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Αρχική σελίδα

Τίτλος αξιολογούμενης ρύθμισης: undefined

Ονοματεπώνυμο συγγραφέα: Συντάκτης Συντάκτης

Αρχική καταχώρηση: undefined

Τελευταία ενημέρωση: undefined

Επισπεύδων φορέας: undefined

Ρύθμιση την οποία αφορά: undefined

Στοιχεία επικοινωνίας: undefined

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A. Αιτολογική έκθεση

1. Ποιο ζήτημα αντιμετωπίζει η αξιολογούμενη ρύθμιση;

undefined

2. Γιατί αποτελεί πρόβλημα;

undefined

3. Ποιους φορείς ή πληθυσμιακές ομάδες αφορά;

undefined

4. Το εν λόγω ζήτημα έχει αντιμετωπιστεί με νομοθετική ρύθμιση στο παρελθόν;

undefined

4.1 Ποιο είναι το ισχύον νομικό πλαίσιο που ρυθμίζει το ζήτημα;

undefined

5. Γιατί δεν είναι δυνατό να αντιμετωπιστεί στο πλαίσιο της υφιστάμενης νομοθεσίας;

5.1 με αλλαγή προεδρικού διατάγματος, υπουργικής απόφασης ή άλλης κανονιστικής πράξης;

undefined

5.2 με αλλαγή διοικητικής πρακτικής συμπεριλαμβανομένης της δυνατότητας νέας ερμηνευτικής προσέγγισης της υφιστάμενης νομοθεσίας;

undefined

5.3 με διάθεση περισσότερων ανθρώπινων και υλικών πόρων;

undefined

6. Έχετε λάβει υπόψη συναφείς πρακτικές;

undefined

6.1 Σε άλλη/ες χώρα/ες της Ε.Ε. ή του ΟΟΣΑ:

undefined

6.2 Σε όργανα της Ε.Ε.:

undefined

6.3 Σε διεθνείς οργανισμούς:

undefined

7. Σημειώστε ποιοι από τους στόχους βιώσιμης ανάπτυξης των Ηνωμένων Εθνών επιδιώκονται με την αξιολογούμενη ρύθμιση:

8. Ποιοι είναι οι στόχοι της αξιολογούμενης ρύθμισης:

8.1 βραχυπρόθεσμοι:

undefined

8.2 μακροπρόθεσμοι:

undefined

9. Ειδικότεροι στόχοι ανάλογα με τον τομέα νομοθέτησης

10. Σε περίπτωση που προβλέπεται η χρήση πληροφοριακού συστήματος, ποια θα είναι η συμβολή αυτού στην επίτευξη των στόχων της αξιολογούμενης ρύθμισης:

Εάν είναι άμεση, εξηγήστε:

undefined

Εάν είναι έμμεση, εξηγήστε:

undefined

11. Το προβλεπόμενο πληροφοριακό σύστημα είναι συμβατό με την εκάστοτε ψηφιακή στρατηγική της χώρας (Βίβλος Ψηφιακού Μετασχηματισμού);

undefined

Εξηγήστε:

undefined

12. Διασφαλίζεται η διαλειτουργικότητα του εν λόγω πληροφοριακού συστήματος με άλλα υφιστάμενα συστήματα;

undefined

Εξηγήστε:

undefined

13. Έχει προηγηθεί μελέτη βιωσιμότητας του προβλεπόμενου πληροφοριακού συστήματος;

undefined

Εξηγήστε:

undefined

14. Σύνοψη στόχων κάθε άρθρου

Άρθρο	Στόχος
-------	--------

Β. Έκθεση Γενικού Λογιστηρίου του Κράτους (άρθρο 75 παρ. 1 ή 2 του Συντάγματος)

Στο σχέδιο νόμου ή στην τροπολογία επί του σχεδίου νόμου

undefined

του Υπουργείου:

undefined

15. Συνοπτική ανάλυση των άρθρων της αξιολογούμενης ρύθμισης

undefined

16. Οικονομικά αποτελέσματα επί του Κρατικού Προϋπολογισμού ή/και επί του προϋπολογισμού του/των αρμόδιου/ων φορέα/ων

Από τις προτεινόμενες διατάξεις προκαλούνται τα ακόλουθα οικονομικά αποτελέσματα:

Επί του Κρατικού Προϋπολογισμού

undefined

Επί του Προϋπολογισμού του/των αρμόδιου/ων φορέα/ων

undefined

Ο/Η ΥΠΟΓΡΑΦΩΝ/ΟΥΣΑ ΓΕΝΙΚΟΣ/Η ΔΙΕΥΘΥΝΤΗΣ/ΡΙΑ (Όνομα Επώνυμο Ημερομηνία)

Όνομα	Επώνυμο	Ιδιότητα
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Γ. Ειδική Έκθεση (άρθρο 75 παρ. 3 του Συντάγματος)

Στο σχέδιο νόμου ή στην τροπολογία επί του σχεδίου νόμου

undefined

του Υπουργείου:

undefined

17. Οικονομικά αποτελέσματα

undefined

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Δ. Έκθεση γενικών συνεπειών

18.18.Οφέλη αξιολογούμενης ρύθμισης

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Ε. Έκθεση διαβούλευσης

22. Διαβούλευση κατά τη διάρκεια της νομοπαρασκευαστικής διαδικασίας από την έναρξη κατάρτισης της αξιολογούμενης ρύθμισης μέχρι την υπογραφή από τους συναρμόδιους Υπουργούς

Συνεργασία με άλλα υπουργεία / υπηρεσίες
undefined

Συνεργασία με κοινωνικούς φορείς / Ανεξάρτητες Αρχές
undefined

Διεθνής διαβούλευση
undefined

23. Σχόλια στο πλαίσιο της διαβούλευσης μέσω της ηλεκτρονικής πλατφόρμας www.opengov.gr (ηλεκτρονική επισύναψη της έκθεσης)

Επί των γενικών αρχών («επί της αρχής») της αξιολογούμενης ρύθμιση

Αριθμός συμμετασχόντων
undefined

Σχόλια που υιοθετήθηκαν
undefined

Σχόλια που δεν υιοθετήθηκαν
undefined

Επί των άρθρων της αξιολογούμενης ρύθμισης
undefined

Αριθμός συμμετασχόντων
undefined

Σχόλια που υιοθετήθηκαν
undefined

undefined

Σχόλια που δεν υιοθετήθηκαν

undefined

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Στ. Έκθεση νομιμότητας

24. Συναφείς συνταγματικές διατάξεις

undefined

25. Ενωσιακό δίκαιο

Πρωτογενές ενωσιακό δίκαιο (συμπεριλαμβανομένου του Χάρτη Θεμελιωδών Δικαιωμάτων)

undefined

Κανονισμός

undefined

Οδηγία

undefined

Απόφαση

undefined

26. Συναφείς διατάξεις διεθνών συνθηκών ή συμφωνιών

Ευρωπαϊκή Σύμβαση των Δικαιωμάτων του Ανθρώπου

undefined

Διεθνείς συμβάσεις

undefined

27. Συναφής νομολογία των ανωτάτων και άλλων εθνικών δικαστηρίων, καθώς και αποφάσεις των Ανεξάρτητων Αρχών

Ανώτατο ή άλλο εθνικό δικαστήριο

undefined

Ανεξάρτητη Αρχή

undefined

28.Συναφής ευρωπαϊκή και διεθνής νομολογία

Νομολογία Δικαστηρίου Ε.Ε.

undefined

Νομολογία Ευρωπαϊκού Δικαστηρίου Δικαιωμάτων του Ανθρώπου

undefined

Άλλα ευρωπαϊκά ή διεθνή δικαστήρια ή διαιτητικά όργανα

undefined

Ζ. Πίνακας τροποποιούμενων ή καταργούμενων διατάξεων
29.Τροποποίηση – αντικατάσταση – συμπλήρωση διατάξεων

Διατάξεις αξιολογούμενης ρύθμισης	Υφιστάμενες διατάξεις
-----------------------------------	-----------------------

30.Κατάργηση διατάξεων

Διατάξεις αξιολογούμενης ρύθμισης που προβλέπουν κατάργηση	Καταργούμενες διατάξεις
--	-------------------------

Η. Έκθεση εφαρμογής της ρύθμισης

31. Συναρμοδιότητα Υπουργείων / υπηρεσιών / φορέων

Σχετική διάταξη αξιολογούμενης ρύθμισης	Συναρμόδια Υπουργεία – Συναρμόδιες υπηρεσίες / φορείς	Αντικείμενο συναρμοδιότητας
---	---	-----------------------------

32. Έκδοση κανονιστικών πράξεων και εγκυκλίων

Εξουσιοδοτική διάταξη	Είδος πράξης	Αρμόδιο ή επισπεύδον Υπουργείο ή υπηρεσία	Αντικείμενο	Χρονοδιάγραμμα (ενδεικτική ή αποκλειστική προθεσμία)
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Ανάγκη σύστασης νέου νομικού προσώπου, ανώνυμης εταιρίας ή δημόσιας υπηρεσίας

33. Ποιες διατάξεις της αξιολογούμενης ρύθμισης προβλέπουν τη σύσταση νέου νομικού προσώπου, ανώνυμης εταιρίας ή δημόσιας υπηρεσίας;

undefined

34. Γιατί προτείνεται η σύσταση αυτού του νέου οργάνου και δεν επαρκούν οι υφιστάμενες διοικητικές δομές για να επιτευχθεί ο στόχος της αξιολογούμενης ρύθμισης;

undefined

35. Χρόνος έναρξης λειτουργίας του νέου οργάνου:

undefined

36. Έχει γίνει η σχετική οικονομοτεχνική μελέτη αναφορικά με τη σύσταση του νέου οργάνου;

undefined

Στοιχεία νέου νομικού προσώπου, ανώνυμης εταιρίας ή δημόσιας υπηρεσίας

37. Επωνυμία ή ονομασία και νομική μορφή

undefined

38. Χώρος λειτουργίας του νέου οργάνου

undefined

39. Διασφάλιση επαρκούς υλικοτεχνικού & ηλεκτρονικού εξοπλισμού

undefined

40. Τρόπος στελέχωσης του νέου οργάνου

undefined

Υπογράφοντες

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WILLIAM FAULKNER

As I Lay Dying

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THE REIVERS (1962)
UNCOLLECTED STORIES OF WILLIAM FAULKNER (1979, POSTHUMOUS)

AS I LAY DYING

The Corrected Text



William Faulkner

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This edition follows the text of *As I Lay Dying* as corrected in 1985. The copy-text for this edition is Faulkner's ribbon setting copy, which—under the direction of Noel Polk—has been compared with the holograph manuscript and carbon typescript. An editors' note on the corrections by Noel Polk follows the text; the line and page notes have been prepared by Joseph Blotner.

To Hal Smith

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DARL



Jewel and I come up from the field, following the path in single file. Although I am fifteen feet ahead of him, anyone watching us from the cottonhouse can see Jewel's frayed and broken straw hat a full head above my own.

The path runs straight as a plumb-line, worn smooth by feet and baked brick-hard by July, between the green rows of laidby cotton, to the cottonhouse in the center of the field, where it turns and circles the cottonhouse at four soft right angles and goes on across the field again, worn so by feet in fading precision.

The cottonhouse is of rough logs, from between which the chinking has long fallen. Square, with a broken roof set at a single pitch, it leans in empty and shimmering dilapidation in the sunlight, a single broad window in two opposite walls giving onto the approaches of the path. When we reach it I turn and follow the path which circles the house. Jewel, fifteen feet behind me, looking straight ahead, steps in a single stride through the window. Still staring straight ahead, his pale eyes like wood set into his wooden face, he crosses the floor in four strides with the rigid gravity of a cigar store Indian dressed in patched overalls and endued with life from the hips down, and steps in a single stride through the opposite window and into the path again just as I come around the corner. In single file and five feet apart and Jewel now in front, we go on up the path toward the foot of the bluff.

Tull's wagon stands beside the spring, hitched to the rail, the reins wrapped about the seat stanchion. In the wagon bed are two chairs. Jewel stops at the spring and takes the gourd from the willow branch and drinks. I pass him and mount the path, beginning to hear Cash's saw.

When I reach the top he has quit sawing. Standing in a litter of chips, he is

fitting two of the boards together. Between the shadow spaces they are yellow as gold, like soft gold, bearing on their flanks in smooth undulations the marks of the adze blade: a good carpenter, Cash is. He holds the two planks on the trestle, fitted along the edges in a quarter of the finished box. He kneels and squints along the edge of them, then he lowers them and takes up the adze. A good carpenter. Addie Bundren could not want a better one, a better box to lie in. It will give her confidence and comfort. I go on to the house, followed by the

Chuck. Chuck. Chuck.

of the adze.

CORA



So I saved out the eggs and baked yesterday. The cakes turned out right well. We depend a lot on our chickens. They are good layers, what few we have left after the possums and such. Snakes too, in the summer. A snake will break up a hen-house quicker than anything. So after they were going to cost so much more than Mr Tull thought, and after I promised that the difference in the number of eggs would make it up, I had to be more careful than ever because it was on my final say-so we took them. We could have stocked cheaper chickens, but I gave my promise as Miss Lawington said when she advised me to get a good breed, because Mr Tull himself admits that a good breed of cows or hogs pays in the long run. So when we lost so many of them we couldn't afford to use the eggs ourselves, because I could not have had Mr Tull chide me when it was on my say-so we took them. So when Miss Lawington told me about the cakes I thought that I could bake them and earn enough at one time to increase the net value of the flock the equivalent of two head. And that by saving the eggs out one at a time, even the eggs wouldn't be costing anything. And that week they laid so well that I not only saved out enough eggs above what we had engaged to sell, to bake the cakes with, I had saved enough so that the flour and the sugar and the stove wood would not be costing anything. So I baked yesterday, more careful than ever I baked in my life, and the cakes turned out right well. But when we got to town this morning Miss Lawington told me the lady had changed her mind and was not going to have the party after all.

“She ought to taken those cakes anyway,” Kate says.

“Well,” I say, “I reckon she never had no use for them now.”

“She ought to taken them,” Kate says. “But those rich town ladies can change

their minds. Poor folks cant."

"Riches is nothing in the face of the Lord, for He can see into the heart. "Maybe I can sell them at the bazaar Saturday," I say. They turned out real well.

"You cant get two dollars a piece for them," Kate says.

"Well, it isn't like they cost me anything," I say. I saved them out and swapped a dozen of them for the sugar and flour. It isn't like the cakes cost me anything, as Mr Tull himself realises that the eggs I saved were over and beyond what we had engaged to sell, so it was like we had found the eggs or they had been given to us.

"She ought to taken those cakes when she same as gave you her word," Kate says. The Lord can see into the heart. If it is His will that some folks has different ideas of honesty from other folks, it is not my place to question His decree.

"I reckon she never had any use for them," I say. They turned out real well, too.

The quilt is drawn up to her chin, hot as it is, with only her two hands and her face outside. She is propped on the pillow, with her head raised so she can see out the window, and we can hear him every time he takes up the adze or the saw. If we were deaf we could almost watch her face and hear him, see him. Her face is wasted away so that the bones draw just under the skin in white lines. Her eyes are like two candles when you watch them gutter down into the sockets of iron candle-sticks. But the eternal and the everlasting salvation and grace is not upon her.

"They turned out real nice," I say. "But not like the cakes Addie used to bake." You can see that girl's washing and ironing in the pillow-slip, if ironed it ever was. Maybe it will reveal her blindness to her, laying there at the mercy and the ministration of four men and a tom-boy girl. "There's not a woman in this section could ever bake with Addie Bundren," I say. "First thing we know she'll be up and baking again, and then we wont have any sale for ours at all." Under the quilt she makes no more of a hump than a rail would, and the only way you can tell she is breathing is by the sound of the mattress shucks. Even the hair at her cheek does not move, even with that girl standing right over her, fanning her with the fan. While we watch she swaps the fan to the other hand without stopping it.

"Is she sleeping?" Kate whispers.

"She's just watching Cash yonder," the girl says. We can hear the saw in the board. It sounds like snoring. Eula turns on the trunk and looks out the window. Her necklace looks real nice with her red hat. You wouldn't think it only cost twenty-five cents.

“She ought to taken those cakes,” Kate says.

I could have used the money real well. But it’s not like they cost me anything except the baking. I can tell him that anybody is likely to make a miscue, but it’s not all of them that can get out of it without loss, I can tell him. It’s not everybody can eat their mistakes, I can tell him.

Someone comes through the hall. It is Darl. He does not look in as he passes the door. Eula watches him as he goes on and passes from sight again toward the back. Her hand rises and touches her beads lightly, and then her hair. When she finds me watching her, her eyes go blank.

DARL



Pa and Vernon are sitting on the back porch. Pa is tilting snuff from the lid of his snuff-box into his lower lip, holding the lip outdrawn between thumb and finger. They look around as I cross the porch and dip the gourd into the water bucket and drink.

“Where’s Jewel?” pa says. When I was a boy I first learned how much better water tastes when it has set a while in a cedar bucket. Warmish-cool, with a faint taste like the hot July wind in cedar trees smells. It has to set at least six hours, and be drunk from a gourd. Water should never be drunk from metal.

And at night it is better still. I used to lie on the pallet in the hall, waiting until I could hear them all asleep, so I could get up and go back to the bucket. It would be black, the shelf black, the still surface of the water a round orifice in nothingness, where before I stirred it awake with the dipper I could see maybe a star or two in the bucket, and maybe in the dipper a star or two before I drank. After that I was bigger, older. Then I would wait until they all went to sleep so I could lie with my shirt-tail up, hearing them asleep, feeling myself without touching myself, feeling the cool silence blowing upon my parts and wondering if Cash was yonder in the darkness doing it too, had been doing it perhaps for the last two years before I could have wanted to or could have.

Pa’s feet are badly splayed, his toes cramped and bent and warped, with no toenail at all on his little toes, from working so hard in the wet in homemade shoes when he was a boy. Beside his chair his brogans sit. They look as though they had been hacked with a blunt axe out of pig-iron. Vernon has been to town. I have never seen him go to town in overalls. His wife, they say. She taught school too, once.

I fling the dipper dregs to the ground and wipe my mouth on my sleeve. It is going to rain before morning. Maybe before dark. "Down to the barn," I say. "Harnessing the team."

Down there fooling with that horse. He will go on through the barn, into the pasture. The horse will not be in sight: he is up there among the pine seedlings, in the cool. Jewel whistles, once and shrill. The horse snorts, then Jewel sees him, glinting for a gaudy instant among the blue shadows. Jewel whistles again; the horse comes dropping down the slope, stiff-legged, his ears cocking and flicking, his mismatched eyes rolling, and fetches up twenty feet away, broadside on, watching Jewel over his shoulder in an attitude kittenish and alert.

"Come here, sir," Jewel says. He moves. Moving that quick his coat, bunching, tongues swirling like so many flames. With tossing mane and tail and rolling eye the horse makes another short curveting rush and stops again, feet bunched, watching Jewel. Jewel walks steadily toward him, his hands at his sides. Save for Jewel's legs they are like two figures carved for a tableau savage in the sun.

When Jewel can almost touch him, the horse stands on his hind legs and slashes down at Jewel. Then Jewel is enclosed by a glittering maze of hooves as by an illusion of wings; among them, beneath the upreared chest, he moves with the flashing limberness of a snake. For an instant before the jerk comes onto his arms he sees his whole body earth-free, horizontal, whipping snake-limber, until he finds the horse's nostrils and touches earth again. Then they are rigid, motionless, terrific, the horse back-thrust on stiffened, quivering legs, with lowered head; Jewel with dug heels, shutting off the horse's wind with one hand, with the other patting the horse's neck in short strokes myriad and caressing, cursing the horse with obscene ferocity.

They stand in rigid terrific hiatus, the horse trembling and groaning. Then Jewel is on the horse's back. He flows upward in a stooping swirl like the lash of a whip, his body in midair shaped to the horse. For another moment the horse stands spraddled, with lowered head, before it bursts into motion. They descend the hill in a series of spine-jolting jumps, Jewel high, leech-like on the withers, to the fence where the horse bunches to a scuttering halt again.

"Well," Jewel says, "you can quit now, if you got a-plenty."

Inside the barn Jewel slides running to the ground before the horse stops. The horse enters the stall, Jewel following. Without looking back the horse kicks at him, slamming a single hoof into the wall with a pistol-like report. Jewel kicks him in the stomach; the horse arches his neck back, crop-toothed; Jewel strikes him across the face with his fist and slides on to the trough and mounts upon it. Clinging to the hay-rack he lowers his head and peers out across the stall tops

and through the doorway. The path is empty; from here he cannot even hear Cash sawing. He reaches up and drags down hay in hurried armsful and crams it into the rack.

“Eat,” he says. “Get the goddamn stuff out of sight while you got a chance, you pussel-gutted bastard. You sweet son of a bitch,” he says.

JEWEL



It's because he stays out there, right under the window, hammering and sawing on that goddamn box. Where she's got to see him. Where every breath she draws is full of his knocking and sawing where she can see him saying See. See what a good one I am making for you. I told him to go somewhere else. I said Good God do you want to see her in it. It's like when he was a little boy and she says if she had some fertilizer she would try to raise some flowers and he taken the bread pan and brought it back from the barn full of dung.

And now them others sitting there, like buzzards. Waiting, fanning themselves. Because I said If you wouldn't keep on sawing and nailing at it until a man cant sleep even and her hands laying on the quilt like two of them roots dug up and tried to wash and you couldn't get them clean. I can see the fan and Dewey Dell's arm. I said if you'd just let her alone. Sawing and knocking, and keeping the air always moving so fast on her face that when you're tired you cant breathe it, and that goddamn adze going One lick less. One lick less. One lick less until everybody that passes in the road will have to stop and see it and say what a fine carpenter he is. If it had just been me when Cash fell off of that church and if it had just been me when pa laid sick with that load of wood fell on him, it would not be happening with every bastard in the county coming in to stare at her because if there is a God what the hell is He for. It would just be me and her on a high hill and me rolling the rocks down the hill at their faces, picking them up and throwing them down the hill faces and teeth and all by God until she was quiet and not that goddamn adze going One lick less. One lick less and we could be quiet.

DARL



We watch him come around the corner and mount the steps. He does not look at us. "You ready?" he says.

"If you're hitched up," I say. I say "Wait." He stops, looking at pa. Vernon spits, without moving. He spits with decorous and deliberate precision into the pocked dust below the porch. Pa rubs his hands slowly on his knees. He is gazing out beyond the crest of the bluff, out across the land. Jewel watches him a moment, then he goes on to the pail and drinks again.

"I mislike undecision as much as ere a man," pa says.

"It means three dollars," I say. The shirt across pa's hump is faded lighter than the rest of it. There is no sweat stain on his shirt. I have never seen a sweat stain on his shirt. He was sick once from working in the sun when he was twenty-two years old, and he tells people that if he ever sweats, he will die. I suppose he believes it.

"But if she dont last until you get back," he says. "She will be disappointed."

Vernon spits into the dust. But it will rain before morning.

"She's counted on it," pa says. "She'll want to start right away. I know her. I promised her I'd keep the team here and ready, and she's counting on it."

"We'll need that three dollars then, sure," I say. He gazes out over the land, rubbing his hands on his knees. Since he lost his teeth his mouth collapses in slow repetition when he dips. The stubble gives his lower face that appearance that old dogs have. "You'd better make up your mind soon, so we can get there and get a load on before dark," I say.

"Ma aint that sick," Jewel says. "Shut up, Darl."

"That's right," Vernon says. "She seems more like herself today than she has

in a week. Time you and Jewel get back, she'll be setting up."

"You ought to know," Jewel says. "You been here often enough looking at her. You or your folks." Vernon looks at him. Jewel's eyes look like pale wood in his high-blooded face. He is a head taller than any of the rest of us, always was. I told them that's why ma always whipped him and petted him more. Because he was peakling around the house more. That's why she named him Jewel I told them.

"Shut up, Jewel," pa says, but as though he is not listening much. He gazes out across the land, rubbing his knees.

"You could borrow the loan of Vernon's team and we could catch up with you," I say. "If she didn't wait for us."

"Ah, shut your goddamn mouth," Jewel says.

"She'll want to go in ourn," pa says. He rubs his knees. "Dont ere a man mislike it more."

"It's laying there, watching Cash whittle on that damn....." Jewel says. He says it harshly, savagely, but he does not say the word. Like a little boy in the dark to flail his courage and suddenly aghast into silence by his own noise.

"She wanted that like she wants to go in our own wagon," pa says. "She'll rest easier for knowing it's a good one, and private. She was ever a private woman. You know it well."

"Then let it be private," Jewel says. "But how the hell can you expect it to be ——" he looks at the back of pa's head, his eyes like pale wooden eyes.

"Sho," Vernon says, "she'll hold on till it's finished. She'll hold on till everything's ready, till her own good time. And with the roads like they are now, it wont take you no time to get her to town."

"It's fixing up to rain," pa says. "I am a luckless man. I have ever been." He rubs his hands on his knees. "It's that durn doctor, liable to come at any time. I couldn't get word to him till so late. If he was to come tomorrow and tell her the time was nigh, she wouldn't wait. I know her. Wagon or no wagon, she wouldn't wait. Then she'd be upset, and I wouldn't upset her for the living world. With that family burying-ground in Jefferson and them of her blood waiting for her there, she'll be impatient. I promised my word me and the boys would get her there quick as mules could walk it, so she could rest quiet." He rubs his hands on his knees. "No man ever misliked it more."

"If everybody wasn't burning hell to get her there," Jewel says in that harsh, savage voice. "With Cash all day long right under the window, hammering and sawing at that——"

"It was her wish," pa says. "You got no affection nor gentleness for her. You never had. We would be beholden to no man," he says, "me and her. We have

never yet been, and she will rest quieter for knowing it and that it was her own blood sawed out the boards and drove the nails. She was ever one to clean up after herself."

"It means three dollars," I say. "Do you want us to go, or not?" Pa rubs his knees. "We'll be back by tomorrow sundown."

"Well....." pa says. He looks out over the land, awry-haired, mouthing the snuff slowly against his gums.

"Come on," Jewel says. He goes down the steps. Vernon spits neatly into the dust.

"By sundown, now," pa says. "I would not keep her waiting."

Jewel glances back, then he goes on around the house. I enter the hall, hearing the voices before I reach the door. Tilting a little down the hill, as our house does, a breeze draws through the hall all the time, upslanting. A feather dropped near the front door will rise and brush along the ceiling, slanting backward, until it reaches the down-turning current at the back door: so with voices. As you enter the hall, they sound as though they were speaking out of the air about your head.

CORA



It was the sweetest thing I ever saw. It was like he knew he would never see her again, that Anse Bundren was driving him from his mother's death bed, never to see her in this world again. I always said Darl was different from those others. I always said he was the only one of them that had his mother's nature, had any natural affection. Not that Jewel, the one she labored so to bear and coddled and petted so and him flinging into tantrums or sulking spells, inventing devilment to devil her until I would have frailed him time and time. Not him to come and tell her goodbye. Not him to miss a chance to make that extra three dollars at the price of his mother's goodbye kiss. A Bundren through and through, loving nobody, caring for nothing except how to get something with the least amount of work. Mr Tull says Darl asked them to wait. He said Darl almost begged them on his knees not to force him to leave her in her condition. But nothing would do but Anse and Jewel must make that three dollars. Nobody that knows Anse could have expected different, but to think of that boy, that Jewel, selling all those years of self-denial and down-right partiality—they couldn't fool me: Mr Tull says Mrs Bundren liked Jewel the least of all, but I knew better. I knew she was partial to him, to the same quality in him that let her put up with Anse Bundren when Mr Tull said she ought to poisoned him—for three dollars, denying his dying mother the goodbye kiss.

Why, for the last three weeks I have been coming over every time I could, coming sometimes when I shouldn't have, neglecting my own family and duties so that somebody would be with her in her last moments and she would not have to face the Great Unknown without one familiar face to give her courage. Not that I deserve credit for it: I will expect the same for myself. But thank God it

will be the faces of my loved kin, my blood and flesh, for in my husband and children I have been more blessed than most, trials though they have been at times.

She lived, a lonely woman, lonely with her pride, trying to make folks believe different, hiding the fact that they just suffered her, because she was not cold in the coffin before they were carting her forty miles away to bury her, flouting the will of God to do it. Refusing to let her lie in the same earth with those Bundrens.

"But she wanted to go," Mr Tull said. "It was her own wish to lie among her own people."

"Then why didn't she go alive?" I said. "Not one of them would have stopped her, with even that little one almost old enough now to be selfish and stone-hearted like the rest of them."

"It was her own wish," Mr Tull said. "I heard Anse say it was."

"And you would believe Anse, of course," I said. "A man like you would. Dont tell me."

"I'd believe him about something he couldn't expect to make anything off of me by not telling," Mr Tull said.

"Dont tell me," I said. "A woman's place is with her husband and children, alive or dead. Would you expect me to want to go back to Alabama and leave you and the girls when my time comes, that I left of my own will to cast my lot with yours for better and worse, until death and after?"

"Well, folks are different," he said.

I should hope so. I have tried to live right in the sight of God and man, for the honor and comfort of my Christian husband and the love and respect of my Christian children. So that when I lay me down in the consciousness of my duty and reward I will be surrounded by loving faces, carrying the farewell kiss of each of my loved ones into my reward. Not like Addie Bundren dying alone, hiding her pride and her broken heart. Glad to go. Lying there with her head propped up so she could watch Cash building the coffin, having to watch him so he would not skimp on it, like as not, with those men not worrying about anything except if there was time to earn another three dollars before the rain come and the river got too high to get across it. Like as not, if they hadn't decided to make that last load, they would have loaded her into the wagon on a quilt and crossed the river first and then stopped and give her time to die what Christian death they would let her.

Except Darl. It was the sweetest thing I ever saw. Sometimes I lose faith in human nature for a time; I am assailed by doubt. But always the Lord restores my faith and reveals to me His bounteous love for His creatures. Not Jewel, the

one she had always cherished, not him. He was after that three extra dollars. It was Darl, the one that folks say is queer, lazy, pottering about the place no better than Anse, with Cash a good carpenter and always more building than he can get around to, and Jewel always doing something that made him some money or got him talked about, and that near-naked girl always standing over Addie with a fan so that every time a body tried to talk to her and cheer her up, would answer for her right quick, like she was trying to keep anybody from coming near her at all.

It was Darl. He come to the door and stood there, looking at his dying mother. He just looked at her, and I felt the bounteous love of the Lord again and His mercy. I saw that with Jewel she had just been pretending, but that it was between her and Darl that the understanding and the true love was. He just looked at her, not even coming in where she could see him and get upset, knowing that Anse was driving him away and he would never see her again. He said nothing, just looking at her.

“What you want, Darl?” Dewey Dell said, not stopping the fan, speaking up quick, keeping even him from her. He didn’t answer. He just stood and looked at his dying mother, his heart too full for words.

DEWEY DELL



The first time me and Lafe picked on down the row. Pa dassent sweat because he will catch his death from the sickness so everybody that comes to help us. And Jewel dont care about anything he is not kin to us in caring, not care-kin. And Cash like sawing the long hot sad yellow days up into planks and nailing them to something. And pa thinks because neighbors will always treat one another that way because he has always been too busy letting neighbors do for him to find out. And I did not think that Darl would, that sits at the supper table with his eyes gone further than the food and the lamp, full of the land dug out of his skull and the holes filled with distance beyond the land.

We picked on down the row, the woods getting closer and closer and the secret shade, picking on into the secret shade with my sack and Lafe's sack. Because I said will I or wont I when the sack was half full because I said if the sack is full when we get to the woods it wont be me. I said if it dont mean for me to do it the sack will not be full and I will turn up the next row but if the sack is full, I cannot help it. It will be that I had to do it all the time and I cannot help it. And we picked on toward the secret shade and our eyes would drown together touching on his hands and my hands and I didn't say anything. I said "What are you doing?" and he said "I am picking into your sack." And so it was full when we came to the end of the row and I could not help it.

And so it was because I could not help it. It was then, and then I saw Darl and he knew. He said he knew without the words like he told me that ma is going to die without words, and I knew he knew because if he had said he knew with the words I would not have believed that he had been there and saw us. But he said he did know and I said "Are you going to tell pa are you going to kill him?"

without the words I said it and he said “Why?” without the words. And that’s why I can talk to him with knowing with hating because he knows.

He stands in the door, looking at her.

“What you want, Darl?” I say.

“She is going to die,” he says. And old turkey-buzzard Tull coming to watch her die but I can fool them.

“When is she going to die?” I say.

“Before we get back,” he says.

“Then why are you taking Jewel?” I say.

“I want him to help me load,” he says.

TULL

■

Anse keeps on rubbing his knees. His overalls are faded; on one knee a serge patch cut out of a pair of Sunday pants, wore iron-slick. "No man mislikes it more than me," he says.

"A fellow's got to guess ahead now and then," I say. "But, come long and short, it wont be no harm done neither way."

"She'll want to get started right off," he says. "It's far enough to Jefferson at best."

"But the roads is good now," I say. It's fixing to rain tonight, too. His folks buries at New Hope, too, not three miles away. But it's just like him to marry a woman born a day's hard ride away and have her die on him.

He looks out over the land, rubbing his knees. "No man so mislikes it," he says.

"They'll get back in plenty of time," I say. "I wouldn't worry none."

"It means three dollars," he says.

"Might be it wont be no need for them to rush back, no ways," I say. "I hope it."

"She's a-going," he says. "Her mind is set on it."

It's a hard life on women, for a fact. Some women. I mind my mammy lived to be seventy and more. Worked every day, rain or shine; never a sick day since her last chap was born until one day she kind of looked around her and then she went and taken that lace-trimmed night gown she had had forty-five years and never wore out of the chest and put it on and laid down on the bed and pulled the covers up and shut her eyes. "You all will have to look out for pa the best you can," she said. "I'm tired."

Anse rubs his hands on his knees. "The Lord giveth," he says. We can hear Cash a-hammering and sawing beyond the corner.

It's true. Never a truer breath was ever breathed. "The Lord giveth," I say.

That boy comes up the hill. He is carrying a fish nigh long as he is. He slings it to the ground and grunts "Hah" and spits over his shoulder like a man. Durn nigh long as he is.

"What's that?" I say. "A hog? Where'd you get it?"

"Down to the bridge," he says. He turns it over, the under side caked over with dust where it is wet, the eye coated over, humped under the dirt.

"Are you aiming to leave it laying there?" Anse says.

"I aim to show it to ma," Vardaman says. He looks toward the door. We can hear the talking, coming out on the draft. Cash too, knocking and hammering at the boards. "There's company in there," he says.

"Just my folks," I say. "They'd enjoy to see it too."

He says nothing, watching the door. Then he looks down at the fish laying in the dust. He turns it over with his foot and prods at the eye-bump with his toe, gouging at it. Anse is looking out over the land. Vardaman looks at Anse's face, then at the door. He turns, going toward the corner of the house, when Anse calls him without looking around.

"You clean that fish," Anse says.

Vardaman stops. "Why cant Dewey Dell clean it?" he says.

"You clean that fish," Anse says.

"Aw, pa," Vardaman says.

"You clean it," Anse says. He dont look around. Vardaman comes back and picks up the fish. It slides out of his hands, smearing wet dirt onto him, and flops down, dirtying itself again, gapmouthing, goggle-eyed, hiding into the dust like it was ashamed of being dead, like it was in a hurry to get back hid again. Vardaman cusses it. He cusses it like a grown man, standing a-straddle of it. Anse dont look around. Vardaman picks it up again. He goes on around the house, toting it in both arms like a armful of wood, it overlapping him on both ends, head and tail. Durn nigh big as he is.

Anse's wrists dangle out of his sleeves: I never see him with a shirt on that looked like it was his in all my life. They all looked like Jewel might have give him his old ones. Not Jewel, though. He's long-armed, even if he is spindling. Except for the lack of sweat. You could tell they aint been nobody else's but Anse's that way without no mistake. His eyes look like pieces of burnt-out cinder fixed in his face, looking out over the land.

When the shadow touches the steps he says "It's five o'clock."

Just as I get up Cora comes to the door and says it's time to get on. Anse

reaches for his shoes. "Now, Mr Bundren," Cora says, "dont you get up now." He puts his shoes on, stomping into them, like he does everything, like he is hoping all the time he really cant do it and can quit trying to. When we go up the hall we can hear them clumping on the floor like they was iron shoes. He comes toward the door where she is, blinking his eyes, kind of looking ahead of hisself before he sees, like he is hoping to find her setting up, in a chair maybe or maybe sweeping, and looks into the door in that surprised way like he looks in and finds her still in bed every time and Dewey Dell still a-fanning her with the fan. He stands there, like he dont aim to move again nor nothing else.

"Well, I reckon we better get on," Cora says. "I got to feed the chickens." It's fixing to rain, too. Clouds like that dont lie, and the cotton making every day the Lord sends. That'll be something else for him. Cash is still trimming at the boards. "If there's ere a thing we can do," Cora says.

"Anse'll let us know," I say.

Anse dont look at us. He looks around, blinking, in that surprised way, like he had wore hisself down being surprised and was even surprised at that. If Cash just works that careful on my barn.

"I told Anse it likely wont be no need," I say. "I so hope it."

"Her mind is set on it," he says. "I reckon she's bound to go."

"It comes to all of us," Cora says. "Let the Lord comfort you."

"About that corn," I say. I tell him again I will help him out if he gets into a tight, with her sick and all. Like most folks around here, I done holp him so much already I cant quit now.

"I aimed to get to it today," he says. "Seems like I cant get my mind on nothing."

"Maybe she'll hold out till you are laid-by," I say.

"If God wills it," he says.

"Let Him comfort you," Cora says.

If Cash just works that careful on my barn. He looks up when we pass. "Dont reckon I'll get to you this week," he says.

"'Taint no rush," I say. "Whenever you get around to it."

We get into the wagon. Cora sets the cake box on her lap. It's fixing to rain, sho.

"I dont know what he'll do," Cora says. "I just dont know."

"Poor Anse," I say. "She kept him at work for thirty-odd years. I reckon she is tired."

"And I reckon she'll be behind him for thirty years more," Kate says. "Or if it aint her, he'll get another one before cotton-picking."

"I reckon Cash and Darl can get married now," Eula says.

"That poor boy," Cora says. "The poor little tyke."

"What about Jewel?" Kate says.

"He can, too," Eula says.

"Hmph," Kate says. "I reckon he will. I reckon so. I reckon there's more gals than one around here that dont want to see Jewel tied down. Well, they needn't to worry."

"Why, Kate!" Cora says. The wagon begins to rattle. "The poor little tyke," Cora says.

It's fixing to rain this night. Yes, sir. A rattling wagon is mighty dry weather, for a Birdsell. But that'll be cured. It will for a fact.

"She ought to taken them cakes after she said she would," Kate says.

ANSE



Durn that road. And it fixing to rain, too. I can stand here and same as see it with second-sight, a-shutting down behind them like a wall, shutting down betwixt them and my given promise. I do the best I can, much as I can get my mind on anything, but durn them boys.

A-laying there, right up to my door, where every bad luck that comes and goes is bound to find it. I told Addie it want any luck living on a road when it come by here, and she said, for the world like a woman, "Get up and move, then." But I told her it want no luck in it, because the Lord put roads for travelling: why He laid them down flat on the earth. When He aims for something to be always a-moving, He makes it long ways, like a road or a horse or a wagon, but when He aims for something to stay put, He makes it up-and-down ways, like a tree or a man. And so He never aimed for folks to live on a road, because which gets there first, I says, the road or the house? Did you ever know Him to set a road down by a house? I says. No you never, I says, because it's always men cant rest till they gets the house set where everybody that passes in a wagon can spit in the doorway, keeping the folks restless and wanting to get up and go somewhere else when He aimed for them to stay put like a tree or a stand of corn. Because if He'd a aimed for man to be always a-moving and going somewhere else, wouldn't He a put him longways on his belly, like a snake? It stands to reason He would.

Putting it where every bad luck prowling can find it and come straight to my door, charging me taxes on top of it. Making me pay for Cash having to get them carpenter notions when if it hadn't been no road come there, he wouldn't a got them; falling off of churches and lifting no hand in six months and me and Addie

slaving and a-slaving, when there's plenty of sawing on this place he could do if he's got to saw.

And Darl too. Talking me out of him, durn them. It aint that I am afraid of work; I always is fed me and mine and kept a roof above us: it's that they would short-hand me just because he tends to his own business, just because he's got his eyes full of the land all the time. I says to them, he was alright at first, with his eyes full of the land, because the land laid up-and-down ways then; it wasn't till that ere road come and switched the land around longways and his eyes still full of the land, that they begun to threaten me out of him, trying to short-hand me with the law.

Making me pay for it. She was well and hale as ere a woman ever were, except for that road. Just laying down, resting herself in her own bed, asking naught of none. "Are you sick, Addie?" I said.

"I am not sick," she said.

"You lay you down and rest you," I said. "I knowed you are not sick. You're just tired. You lay you down and rest."

"I am not sick," she said. "I will get up."

"Lay still and rest," I said. "You are just tired. You can get up tomorrow." And she was laying there, well and hale as ere a woman ever were, except for that road.

"I never sent for you," I said. "I take you to witness I never sent for you."

"I know you didn't," Peabody said. "I bound that. Where is she?"

"She's a-laying down," I said. "She's just a little tired, but she'll——"

"Get outen here, Anse," he said. "Go set on the porch a while."

And now I got to pay for it, me without a tooth in my head, hoping to get ahead enough so I could get my mouth fixed where I could eat God's own victuals as a man should, and her hale and well as ere a woman in the land until that day. Got to pay for being put to the need of that three dollars. Got to pay for the way for them boys to have to go away to earn it. And now I can see same as second sight the rain shutting down betwixt us, a-coming up that road like a durn man, like it want ere a other house to rain on in all the living land.

I have heard men cuss their luck, and right, for they were sinful men. But I do not say it's a curse on me, because I have done no wrong to be cussed by. I am not religious, I reckon. But peace is in my heart: I know it is. I have done things but neither better nor worse than them that pretend otherlike, and I know that Old Marster will care for me as for ere a sparrow that falls. But it seems hard that a man in his need could be so flouted by a road.

Vardaman comes around the house, bloody as a hog to his knees, and that ere fish chopped up with the axe like as not, or maybe throwed away for him to lie

about the dogs et it. Well, I reckon I aint no call to expect no more of him than of his man-growed brothers. He comes along, watching the house, quiet, and sits on the steps. "Whew," he says, "I'm pure tired."

"Go wash them hands," I say. But couldn't no woman strove harder than Addie to make them right, man and boy: I'll say that for her.

"It was full of blood and guts as a hog," he says. But I just cant seem to get no heart into anything, with this here weather sapping me, too. "Pa," he says, "is ma sick some more?"

"Go wash them hands," I say. But I just cant seem to get no heart into it.

DARL



He has been to town this week: the back of his neck is trimmed close, with a white line between hair and sunburn like a joint of white bone. He has not once looked back.

“Jewel,” I say. Back running, tunnelled between the two sets of bobbing mule ears, the road vanishes beneath the wagon as though it were a ribbon and the front axle were a spool. “Do you know she is going to die, Jewel?”

It takes two people to make you, and one people to die. That’s how the world is going to end.

I said to Dewey Dell: “You want her to die so you can get to town: is that it?” She wouldn’t say what we both knew. “The reason you will not say it is, when you say it, even to yourself, you will know it is true: is that it? But you know it is true now. I can almost tell you the day when you knew it is true. Why wont you say it, even to yourself?” She will not say it. She just keeps on saying Are you going to tell pa? Are you going to kill him? “You cannot believe it is true because you cannot believe that Dewey Dell, Dewey Dell Bundren, could have such bad luck: is that it?”

The sun, an hour above the horizon, is poised like a bloody egg upon a crest of thunderheads; the light has turned copper: in the eye portentous, in the nose sulphurous, smelling of lightning. When Peabody comes, they will have to use the rope. He has pussel-gutted himself eating cold greens. With the rope they will haul him up the path, balloon-like up the sulphurous air.

“Jewel,” I say, “do you know that Addie Bundren is going to die? Addie Bundren is going to die?”

PEABODY



When Anse finally sent for me of his own accord, I said "He has wore her out at last." And I said a damn good thing, and at first I would not go because there might be something I could do and I would have to haul her back, by God. I thought maybe they have the same sort of fool ethics in heaven they have in the Medical College and that it was maybe Vernon Tull sending for me again, getting me there in the nick of time, as Vernon always does things, getting the most for Anse's money like he does for his own. But when it got far enough into the day for me to read weather sign I knew it couldn't have been anybody but Anse that sent. I knew that nobody but a luckless man could ever need a doctor in the face of a cyclone. And I knew that if it had finally occurred to Anse himself that he needed one, it was already too late.

When I reach the spring and get down and hitch the team, the sun has gone down behind a bank of black cloud like a topheavy mountain range, like a load of cinders dumped over there, and there is no wind. I could hear Cash sawing for a mile before I got there. Anse is standing at the top of the bluff above the path.

"Where's the horse?" I say.

"Jewel's taken and gone," he says. "Cant nobody else ketch hit. You'll have to walk up, I reckon."

"Me, walk up, weighing two hundred and twenty-five pounds?" I say. "Walk up that durn wall?" He stands there beside a tree. Too bad the Lord made the mistake of giving trees roots and giving the Anse Bundrens He makes feet and legs. If He'd just swapped them, there wouldn't ever be a worry about this country being deforested someday. Or any other country. "What do you aim for me to do?" I say. "Stay here and get blowed clean out of the county when that

cloud breaks?" Even with the horse it would take me fifteen minutes to ride up across the pasture to the top of the ridge and reach the house. The path looks like a crooked limb blown against the bluff. Anse has not been in town in twelve years. And how his mother ever got up there to bear him, he being his mother's son.

"Vardaman's gittin the rope," he says.

After a while Vardaman appears with the plowline. He gives the end of it to Anse and comes down the path, uncoiling it.

"You hold it tight," I say. "I done already wrote this visit onto my books, so I'm going to charge you just the same, whether I get there or not."

"I got hit," Anse says. "You kin come on up."

I'll be damned if I can see why I dont quit. A man seventy years old, weighing two hundred and odd pounds, being hauled up and down a damn mountain on a rope. I reckon it's because I must reach the fifty thousand dollar mark of dead accounts on my books before I can quit. "What the hell does your wife mean," I say, "taking sick on top of a durn mountain?"

"I'm right sorry," he says. He let the rope go, just dropped it, and he has turned toward the house. There is a little daylight up here still, of the color of sulphur matches. The boards look like strips of sulphur. Cash does not look back. Vernon Tull says he brings each board up to the window for her to see it and say it is all right. The boy overtakes us. Anse looks back at him. "Wher's the rope?" he says.

"It's where you left it," I say. "But never you mind that rope. I got to get back down that bluff. I dont aim for that storm to catch me up here. I'd blow too durn far once I got started."

The girl is standing by the bed, fanning her. When we enter she turns her head and looks at us. She has been dead these ten days. I suppose it's having been a part of Anse for so long that she cannot even make that change, if change it be. I can remember how when I was young I believed death to be a phenomenon of the body; now I know it to be merely a function of the mind—and that of the minds of the ones who suffer the bereavement. The nihilists say it is the end; the fundamentalists, the beginning; when in reality it is no more than a single tenant or family moving out of a tenement or a town.

She looks at us. Only her eyes seem to move. It's like they touch us, not with sight or sense, but like the stream from a hose touches you, the stream at the instant of impact as dissociated from the nozzle as though it had never been there. She does not look at Anse at all. She looks at me, then at the boy. Beneath the quilt she is no more than a bundle of rotten sticks.

"Well, Miss Addie," I say. The girl does not stop the fan. "How are you,

sister?" I say. Her head lies gaunt on the pillow, looking at the boy. "You picked out a fine time to get me out here and bring up a storm." Then I send Anse and the boy out. She watches the boy as he leaves the room. She has not moved save her eyes.

He and Anse are on the porch when I come out, the boy sitting on the steps, Anse standing by a post, not even leaning against it, his arms dangling, the hair pushed and matted up on his head like a dipped rooster. He turns his head, blinking at me.

"Why didn't you send for me sooner?" I say.

"Hit was jest one thing and then another," he says. "That ere corn me and the boys was aimin to git up with, and Dewey Dell a-takin good keer of her, and folks comin in, a-offerin to help and sich, till I jest thought....."

"Damn the money," I say. "Did you ever hear of me worrying a fellow before he was ready to pay?"

"Hit aint begrudgin the money," he says. "I jest kept a-thinkin..... She's goin, is she?" The durn little tyke is sitting on the top step, looking smaller than ever in the sulphur-colored light. That's the one trouble with this country: everything, weather, all, hangs on too long. Like our rivers, our land: opaque, slow, violent; shaping and creating the life of man in its implacable and brooding image. "I knowed hit," Anse says. "All the while I made sho. Her mind is sot on hit."

"And a damn good thing, too," I say. "With a trifling——" He sits on the top step, small, motionless in faded overalls. When I came out he looked up at me, then at Anse. But now he has stopped looking at us. He just sits there.

"Have you told her yit?" Anse says.

"What for?" I say. "What the devil for?"

"She'll know hit. I knowed that when she see you she would know hit, same as writing. You wouldn't need to tell her. Her mind——"

Behind us the girl says, "Paw." I look at her, at her face.

"You better go quick," I say.

When we enter the room she is watching the door. She looks at me. Her eyes look like lamps blaring up just before the oil is gone. "She wants you to go out," the girl says.

"Now, Addie," Anse says, "when he come all the way from Jefferson to git you well?" She watches me: I can feel her eyes. It's like she was shoving at me with them. I have seen it before in women. Seen them drive from the room them coming with sympathy and pity, with actual help, and clinging to some trifling animal to whom they never were more than pack-horses. That's what they mean by the love that passeth understanding: that pride, that furious desire to hide that

abject nakedness which we bring here with us, carry with us into operating rooms, carry stubbornly and furiously with us into the earth again. I leave the room. Beyond the porch Cash's saw snores steadily into the board. A minute later she calls his name, her voice harsh and strong.

"Cash," she says; "you, Cash!"

DARL



Pa stands beside the bed. From behind his leg Vardaman peers, with his round head and his eyes round and his mouth beginning to open. She looks at pa; all her failing life appears to drain into her eyes, urgent, irremediable. "It's Jewel she wants," Dewey Dell says.

"Why, Addie," pa says, "him and Darl went to make one more load. They thought there was time. That you would wait for them, and that three dollars and all....." He stoops laying his hand on hers. For a while yet she looks at him, without reproach, without anything at all, as if her eyes alone are listening to the irrevocable cessation of his voice. Then she raises herself, who has not moved in ten days. Dewey Dell leans down, trying to press her back.

"Ma," she says; "ma."

She is looking out the window, at Cash stooping steadily at the board in the failing light, laboring on toward darkness and into it as though the stroking of the saw illumined its own motion, board and saw engendered.

"You, Cash," she shouts, her voice harsh, strong, and unimpaired. "You, Cash!"

He looks up at the gaunt face framed by the window in the twilight. It is a composite picture of all time since he was a child. He drops the saw and lifts the board for her to see, watching the window in which the face has not moved. He drags a second plank into position and slants the two of them into their final juxtaposition, gesturing toward the ones yet on the ground, shaping with his empty hand in pantomime the finished box. For a while still she looks down at him from the composite picture, neither with censure nor approbation. Then the face disappears.

She lies back and turns her head without so much as glancing at pa. She looks at Vardaman; her eyes, the life in them, rushing suddenly upon them; the two flames glare up for a steady instant. Then they go out as though someone had leaned down and blown upon them.

"Ma," Dewey Dell says; "ma!" Leaning above the bed, her hands lifted a little, the fan still moving like it has for ten days, she begins to keen. Her voice is strong, young, tremulous and clear, rapt with its own timbre and volume, the fan still moving steadily up and down, whispering the useless air. Then she flings herself across Addie Bundren's knees, clutching her, shaking her with the furious strength of the young before sprawling suddenly across the handful of rotten bones that Addie Bundren left, jarring the whole bed into a chattering sibilance of mattress shucks, her arms out-flung and the fan in one hand still beating with expiring breath into the quilt.

From behind pa's leg Vardaman peers, his mouth full open and all color draining from his face into his mouth, as though he has by some means fleshed his own teeth in himself, sucking. He begins to move slowly backward from the bed, his eyes round, his pale face fading into the dusk like a piece of paper pasted on a failing wall, and so out of the door.

Pa leans above the bed in the twilight, his humped silhouette partaking of that owl-like quality of awry-feathered, disgruntled outrage within which lurks a wisdom too profound or too inert for even thought.

"Durn them boys," he says.

Jewel, I say. Overhead the day drives level and gray, hiding the sun by a flight of gray spears. In the rain the mules smoke a little, splashed yellow with mud, the off one clinging in sliding lunges to the side of the road above the ditch. The tilted lumber gleams dull yellow, water-soaked and heavy as lead, tilted at a steep angle into the ditch above the broken wheel; about the shattered spokes and about Jewel's ankles a runnel of yellow neither water nor earth swirls, curving with the yellow road neither of earth nor water, down the hill dissolving into a streaming mass of dark green neither of earth nor sky. Jewel, I say

Cash comes to the door, carrying the saw. Pa stands beside the bed, humped, his arms dangling. He turns his head, his shabby profile, his chin collapsing slowly as he works the snuff against his gums.

"She's gone," Cash says.

"She taken and left us," pa says. Cash does not look at him. "How nigh are you done?" pa says. Cash does not answer. He enters, carrying the saw. "I reckon you better get at it," pa says. "You'll have to do the best you can, with them boys gone off that-a-way." Cash looks down at her face. He is not listening to pa at all. He does not approach the bed. He stops in the middle of the floor,

the saw against his leg, his sweating arms powdered lightly with sawdust, his face composed. "If you get in a tight, maybe some of them'll get here tomorrow and help you," pa says. "Vernon could." Cash is not listening. He is looking down at her peaceful, rigid face fading into the dusk as though darkness were a precursor of the ultimate earth, until at last the face seems to float detached upon it, lightly as the reflection of a dead leaf. "There is Christians enough to help you," pa says. Cash is not listening. After a while he turns without looking at pa and leaves the room. Then the saw begins to snore again. "They will help us in our sorrow," pa says.

The sound of the saw is steady, competent, unhurried, stirring the dying light so that at each stroke her face seems to wake a little into an expression of listening and of waiting, as though she were counting the strokes. Pa looks down at the face, at the black sprawl of Dewey Dell's hair, the out-flung arms, the clutched fan now motionless on the fading quilt. "I reckon you better get supper on," he says.

Dewey Dell does not move.

"Git up, now, and put supper on," pa says. "We got to keep our strength up. I reckon Doctor Peabody's right hungry, coming all this way. And Cash'll need to eat quick and get back to work so he can finish it in time."

Dewey Dell rises, heaving to her feet. She looks down at the face. It is like a casting of fading bronze upon the pillow, the hands alone still with any semblance of life: a curled, gnarled inertness; a spent yet alert quality from which weariness, exhaustion, travail has not yet departed, as though they doubted even yet the actuality of rest, guarding with horned and penurious alertness the cessation which they know cannot last.

Dewey Dell stoops and slides the quilt from beneath them and draws it up over them to the chin, smoothing it down, drawing it smooth. Then without looking at pa she goes around the bed and leaves the room.

She will go out where Peabody is, where she can stand in the twilight and look at his back with such an expression that, feeling her eyes and turning, he will say: I would not let it grieve me, now. She was old, and sick too. Suffering more than we knew. She couldn't have got well. Vardaman's getting big now, and with you to take good care of them all. I would try not to let it grieve me. I expect you'd better go and get some supper ready. It dont have to be much. But they'll need to eat, and she looking at him, saying You could do so much for me if you just would. If you just knew. I am I and you are you and I know it and you dont know it and you could do so much for me if you just would and if you just would then I could tell you and then nobody would have to know it except you and me and Darl

Pa stands over the bed, dangle-armed, humped, motionless. He raises his hand to his head, scouring his hair, listening to the saw. He comes nearer and rubs his hand, palm and back, on his thigh and lays it on her face and then on the hump of quilt where her hands are. He touches the quilt as he saw Dewey Dell do, trying to smoothe it up to the chin, but disarranging it instead. He tries to smoothe it again, clumsily, his hand awkward as a claw, smoothing at the wrinkles which he made and which continue to emerge beneath his hand with perverse ubiquity, so that at last he desists, his hand falling to his side and stroking itself again, palm and back, on his thigh. The sound of the saw snores steadily into the room. Pa breathes with a quiet, rasping sound, mouthing the snuff against his gums. "God's will be done," he says. "Now I can get them teeth."

Jewel's hat droops limp about his neck, channelling water onto the soaked towsack tied about his shoulders as, ankle-deep in the running ditch, he pries with a slipping two-by-four, with a piece of rotting log for fulcrum, at the axle. Jewel, I say, she is dead, Jewel. Addie Bundren is dead

VARDAMAN



Then I begin to run. I run toward the back and come to the edge of the porch and stop. Then I begin to cry. I can feel where the fish was in the dust. It is cut up into pieces of not-fish now, not-blood on my hands and overalls. Then it wasn't so. It hadn't happened then. And now she is getting so far ahead I cannot catch her.

The trees look like chickens when they ruffle out into the cool dust on the hot days. If I jump off the porch I will be where the fish was, and it all cut up into not-fish now. I can hear the bed and her face and them and I can feel the floor shake when he walks on it that came and did it. That came and did it when she was all right but he came and did it.

"The fat son of a bitch."

I jump from the porch, running. The top of the barn comes swooping up out of the twilight. If I jump I can go through it like the pink lady in the circus, into the warm smelling, without having to wait. My hands grab at the bushes; beneath my feet the rocks and dirt go bubbling down.

Then I can breathe again, in the warm smelling. I enter the stall, trying to touch him, and then I can cry then I vomit the crying. As soon as he gets through kicking I can and then I can cry, the crying can.

"He kilt her. He kilt her."

The life in him runs under the skin, under my hand, running through the splotches, smelling up into my nose where the sickness is beginning to cry, vomiting the crying, and then I can breathe, vomiting it. It makes a lot of noise. I can smell the life running up from under my hands, up my arms, and then I can leave the stall.

I cannot find it. In the dark, along the dust, the walls I cannot find it. The crying makes a lot of noise. I wish it wouldn't make so much noise. Then I find it in the wagon shed, in the dust, and I run across the lot and into the road, the stick jouncing on my shoulder.

They watch me as I run up, beginning to jerk back, their eyes rolling, snorting, jerking back on the hitch-rein. I strike. I can hear the stick striking; I can see it hitting their heads, the breast-yoke, missing altogether sometimes as they rear and plunge, but I am glad.

"You kilt my maw!"

The stick breaks, they rearing and snorting, their feet popping loud on the ground; loud because it is going to rain and the air is empty for the rain. But it is still long enough. I run this way and that as they rear and jerk at the hitch-rein, striking.

"You kilt her!"

I strike at them, striking, they wheeling in a long lunge, the buggy wheeling onto two wheels and motionless like it is nailed to the ground and the horses motionless like they are nailed by the hind feet to the center of a whirling plate.

I run in the dust. I cannot see, running in the sucking dust where the buggy vanishes tilted on two wheels. I strike, the stick hitting into the ground, bouncing, striking into the dust and then into the air again and the dust sucking on down the road faster than if a car was in it. And then I can cry, looking at the stick. It is broken down to my hand, not longer than stove wood that was a long stick. I throw it away and I can cry. It does not make so much noise now.

The cow is standing in the barn door, chewing. When she sees me come into the lot she lows, her mouth full of flopping green, her tongue flopping.

"I aint a-goin to milk you. I aint a-goin to do nothing for them."

I hear her turn when I pass. When I turn she is just behind me with her sweet, hot, hard breath.

"Didn't I tell you I wouldn't?"

She nudges me, snuffing. She moans deep inside, her mouth closed. I jerk my hand, cursing her like Jewel does.

"Git, now."

I stoop my hand to the ground and run at her. She jumps back and whirls away and stops, watching me. She moans. She goes on to the path and stands there, looking up the path.

It is dark in the barn, warm, smelling, silent. I can cry quietly, watching the top of the hill.

Cash comes to the hill, limping where he fell off of the church. He looks down at the spring, then up the road and back toward the barn. He comes down the

path stiffly and looks at the broken hitch-rein and at the dust in the road and then up the road, where the dust is gone.

“I hope they’ve got clean past Tull’s by now. I so hope hit.”

Cash turns and limps up the path.

“Durn him. I showed him. Durn him.”

I am not crying now. I am not anything. Dewey Dell comes to the hill and calls me. Vardaman. I am not anything. I am quiet. You, Vardaman. I can cry quiet now, feeling and hearing my tears.

“Then hit want. Hit hadn’t happened then. Hit was a-layin right there on the ground. And now she’s gittin ready to cook hit.”

It is dark. I can hear wood, silence: I know them. But not living sounds, not even him. It is as though the dark were resolving him out of his integrity, into an unrelated scattering of components—snuffings and stampings; smells of cooling flesh and ammoniac hair; an illusion of a coordinated whole of splotched hide and strong bones within which, detached and secret and familiar, an *is* different from my *is*. I see him dissolve—legs, a rolling eye, a gaudy splotching like cold flames—and float upon the dark in fading solution; all one yet neither; all either yet none. I can see hearing coil toward him, caressing, shaping his hard shape—fetlock, hip, shoulder and head; smell and sound. I am not afraid.

“Cooked and et. Cooked and et.”

DEWEY DELL



He could do so much for me if he just would. He could do everything for me. It's like everything in the world for me is inside a tub full of guts, so that you wonder how there can be any room in it for anything else very important. He is a big tub of guts and I am a little tub of guts and if there is not any room for anything else important in a big tub of guts, how can it be room in a little tub of guts. But I know it is there because God gave women a sign when something has happened bad.

It's because I am alone. If I could just feel it, it would be different, because I would not be alone. But if I were not alone, everybody would know it. And he could do so much for me, and then I would not be alone. Then I could be all right alone.

I would let him come in between me and Lafe, like Darl came in between me and Lafe, and so Lafe is alone too. He is Lafe and I am Dewey Dell, and when mother died I had to go beyond and outside of me and Lafe and Darl to grieve because he could do so much for me and he dont know it. He dont even know it.

From the back porch I cannot see the barn. Then the sound of Cash's sawing comes in from that way. It is like a dog outside the house, going back and forth around the house to whatever door you come to, waiting to come in. He said I worry more than you do and I said You dont know what worry is so I cant worry. I try to but I cant think long enough to worry.

I light the kitchen lamp. The fish, cut into jagged pieces, bleeds quietly in the pan. I put it into the cupboard quick, listening into the hall, hearing. It took her ten days to die; maybe she dont know it is yet. Maybe she wont go until Cash. Or maybe until Jewel. I take the dish of greens from the cupboard and the bread

pan from the cold stove, and I stop, watching the door.

"Where's Vardaman?" Cash says. In the lamp his saw-dusted arms look like sand.

"I dont know. I aint seen him."

"Peabody's team run away. See if you can find Vardaman. The horse will let him catch him."

"Well. Tell them to come to supper."

I cannot see the barn. I said, I dont know how to worry. I dont know how to cry. I tried, but I cant. After a while the sound of the saw comes around, coming dark along the ground in the dust-dark. Then I can see him, going up and down above the plank.

"You come in to supper," I say. "Tell him." He could do everything for me. And he dont know it. He is his guts and I am my guts. And I am Lafe's guts. That's it. I dont see why he didn't stay in town. We are country people, not as good as town people. I dont see why he didn't. Then I can see the top of the barn. The cow stands at the foot of the path, lowing. When I turn back, Cash is gone.

I carry the buttermilk in. Pa and Cash and he are at the table.

"Where's that big fish Bud caught, sister?" he says.

I set the milk on the table. "I never had no time to cook it."

"Plain turnip greens is mighty spindling eating for a man my size," he says. Cash is eating. About his head the print of his hat is sweated into his hair. His shirt is blotched with sweat. He has not washed his hands and arms.

"You ought to took time," pa says. "Where's Vardaman?"

I go toward the door. "I cant find him."

"Here, sister," he says; "never mind about the fish. It'll save, I reckon. Come on and sit down."

"I aint minding it," I say. "I'm going to milk before it sets in to rain."

Pa helps himself and pushes the dish on. But he does not begin to eat. His hands are halfclosed on either side of his plate, his head bowed a little, his awry hair standing into the lamplight. He looks like right after the maul hits the steer and it no longer alive and dont yet know that it is dead.

But Cash is eating, and he is too. "You better eat something," he says. He is looking at pa. "Like Cash and me. You'll need it."

"Ay," pa says. He rouses up, like a steer that's been kneeling in a pond and you run at it. "She would not begrudge me it."

When I am out of sight of the house, I go fast. The cow lows at the foot of the bluff. She nuzzles at me, snuffing, blowing her breath in a sweet, hot blast, through my dress, against my hot nakedness, moaning. "You got to wait a little

while. Then I'll tend to you." She follows me into the barn where I set the bucket down. She breathes into the bucket, moaning. "I told you. You just got to wait, now. I got more to do than I can tend to." The barn is dark. When I pass, he kicks the wall a single blow. I go on. The broken plank is like a pale plank standing on end. Then I can see the slope, feel the air moving on my face again, slow, pale with lesser dark and with empty seeing, the pine clumps blotched up the tilted slope, secret and waiting.

The cow in silhouette against the door nuzzles at the silhouette of the bucket, moaning.

Then I pass the stall. I have almost passed it. I listen to it saying for a long time before it can say the word and the listening part is afraid that there may not be time to say it. I feel my body, my bones and flesh beginning to part and open upon the alone, and the process of coming unalone is terrible. Lafe. Lafe. "Lafe" Lafe. Lafe. I lean a little forward, one foot advanced with dead walking. I feel the darkness rushing past my breast, past the cow; I begin to rush upon the darkness but the cow stops me and the darkness rushes on upon the sweet blast of her moaning breath, filled with wood and with silence.

"Vardaman. You, Vardaman."

He comes out of the stall. "You durn little sneak! You durn little sneak!"

He does not resist; the last of rushing darkness flees whistling away. "What? I aint done nothing."

"You durn little sneak!" My hands shake him, hard. Maybe I couldn't stop them. I didn't know they could shake so hard. They shake both of us, shaking.

"I never done it," he says. "I never touched them."

My hands stop shaking him, but I still hold him. "What are you doing here? Why didn't you answer when I called you?"

"I aint doing nothing."

"You go on to the house and get your supper."

He draws back. I hold him. "You quit now. You leave me be."

"What were you doing down here? You didn't come down here to sneak after me?"

"I never. I never. You quit, now. I didn't even know you was down here. You leave me be."

I hold him, leaning down to see his face, feel it with my eyes. He is about to cry. "Go on, now. I done put supper on and I'll be there soon as I milk. You better go on before he eats everything up. I hope that team runs clean back to Jefferson."

"He kilt her," he says. He begins to cry.

"Hush."

"She never hurt him and he come and kilt her."

"Hush." He struggles. I hold him. "Hush."

"He kilt her." The cow comes up behind us, moaning. I shake him again.

"You stop it, now. Right this minute. You're fixing to make yourself sick and then you cant go to town. You go on to the house and eat your supper."

"I dont want no supper. I dont want to go to town."

"We'll leave you here, then. Lessen you behave, we will leave you. Go on, now, before that old green-eating tub of guts eats everything up from you." He goes on, disappearing slowly into the hill. The crest, the trees, the roof of the house stand against the sky. The cow nuzzles at me, moaning. "You'll just have to wait. What you got in you aint nothing to what I got in me, even if you are a woman too." She follows me, moaning. Then the dead, hot, pale air breathes on my face again. He could fix it all right, if he just would. And he dont even know it. He could do everything for me if he just knewed it. The cow breathes upon my hips and back, her breath warm, sweet, stertorous, moaning. The sky lies flat down the slope, upon the secret clumps. Beyond the hill sheet-lightning stains upward and fades. The dead air shapes the dead earth in the dead darkness, further away than seeing shapes the dead earth. It lies dead and warm upon me, touching me naked through my clothes. I said You dont know what worry is. I dont know what it is. I dont know whether I am worrying or not. Whether I can or not. I dont know whether I can cry or not. I dont know whether I have tried to or not. I feel like a wet seed wild in the hot blind earth.

VARDAMAN



When they get it finished they are going to put her in it and then for a long time I couldn't say it. I saw the dark stand up and go whirling away and I said "Are you going to nail her up in it, Cash? Cash? Cash?" I got shut up in the crib the new door it was too heavy for me it went shut I couldn't breathe because the rat was breathing up all the air. I said "Are you going to nail it shut, Cash? Nail it? Nail it?"

Pa walks around. His shadow walks around, over Cash going up and down above the saw, at the bleeding plank.

Dewey Dell said we will get some bananas. The train is behind the glass, red on the track. When it runs the track shines on and off. Pa said flour and sugar and coffee costs so much. Because I am a country boy because boys in town. Bicycles. Why do flour and sugar and coffee cost so much when he is a country boy. "Wouldn't you ruther have some bananas instead?" Bananas are gone, eaten. Gone. When it runs on the track shines again. "Why aint I a town boy, pa?" I said. God made me. I did not said to God to made me in the country. If He can make the train, why cant He make them all in the town because flour and sugar and coffee. "Wouldn't you ruther have bananas?"

He walks around. His shadow walks around.

It was not her. I was there, looking. I saw. I thought it was her, but it was not. It was not my mother. She went away when the other one laid down in her bed and drew the quilt up. She went away. "Did she go as far as town?" "She went further than town." "Did all those rabbits and possums go further than town?" God made the rabbits and possums. He made the train. Why must He make a different place for them to go if she is just like the rabbit.

Pa walks around. His shadow does. The saw sounds like it is asleep.

And so if Cash nails the box up, she is not a rabbit. And so if she is not a rabbit I couldn't breathe in the crib and Cash is going to nail it up. And so if she lets him it is not her. I know. I was there. I saw when it did not be her. I saw. They think it is and Cash is going to nail it up.

It was not her because it was laying right yonder in the dirt. And now it's all chopped up. I chopped it up. It's laying in the kitchen in the bleeding pan, waiting to be cooked and et. Then it wasn't and she was, and now it is and she wasn't. And tomorrow it will be cooked and et and she will be him and pa and Cash and Dewey Dell and there wont be anything in the box and so she can breathe. It was laying right yonder on the ground. I can get Vernon. He was there and he seen it, and with both of us it will be and then it will not be.

TULL



It was nigh to midnight and it had set in to rain when he woke us. It had been a misdoubtful night, with the storm making; a night when a fellow looks for most anything to happen before he can get the stock fed and himself to the house and supper et and in bed with the rain starting, and when Peabody's team come up, lathered, with the broke harness dragging and the neck-yoke betwixt the off critter's legs, Cora says "It's Addie Bundren. She's gone at last."

"Peabody mought have been to ere a one of a dozen houses hereabouts," I says. "Besides, how do you know it's Peabody's team?"

"Well, aint it?" she says. "You hitch up, now."

"What for?" I says. "If she is gone, we cant do nothing till morning. And it fixing to storm, too."

"It's my duty," she says. "You put the team in."

But I wouldn't do it. "It stands to reason they'd send for us if they needed us. You dont even know she's gone yet."

"Why, dont you know that's Peabody's team? Do you claim it aint? Well, then." But I wouldn't go. When folks wants a fellow, it's best to wait till they sends for him, I've found. "It's my Christian duty," Cora says. "Will you stand between me and my Christian duty?"

"You can stay there all day tomorrow, if you want," I says.

So when Cora waked me it had set in to rain. Even while I was going to the door with the lamp and it shining on the glass so he could see I am coming, it kept on knocking. Not loud, but steady, like he might have gone to sleep thumping, but I never noticed how low down on the door the knocking was till I opened it and never seen nothing. I held the lamp up, with the rain sparkling

across it and Cora back in the hall saying "Who is it, Vernon?" but I couldn't see nobody a-tall at first until I looked down and around the door, lowering the lamp.

He looked like a drownded puppy, in them overalls, without no hat, splashed up to his knees where he had walked them four miles in the mud. "Well, I'll be durned," I says.

"Who is it, Vernon?" Cora says.

He looked at me, his eyes round and black in the middle like when you throw a light in a owl's face. "You mind that ere fish," he says.

"Come in the house," I says. "What is it? Is your maw——"

"Vernon," Cora says.

He stood kind of around behind the door, in the dark. The rain was blowing onto the lamp, hissing on it so I am scared every minute it'll break. "You was there," he says. "You seen it."

Then Cora come to the door. "You come right in outen the rain," she says, pulling him in and him watching me. He looked just like a drownded puppy. "I told you," Cora says. "I told you it was a-happening. You go and hitch."

"But he aint said——" I says.

He looked at me, dripping onto the floor. "He's a-ruining the rug," Cora says. "You go get the team while I take him to the kitchen."

But he hung back, dripping, watching me with them eyes. "You was there. You seen it laying there. Cash is fixing to nail her up, and it was a-laying right there on the ground. You seen it. You seen the mark in the dirt. The rain never come up till after I was a-coming here. So we can get back in time."

I be durn if it didn't give me the creeps, even when I didn't know yet. But Cora did. "You get that team quick as you can," she says. "He's outen his head with grief and worry."

I be durn if it didn't give me the creeps. Now and then a fellow gets to thinking. About all the sorrow and afflictions in this world; how it's liable to strike anywhere, like lightning. I reckon it does take a powerful trust in the Lord to guard a fellow, though sometimes I think that Cora's a mite over-cautious, like she was trying to crowd the other folks away and get in closer than anybody else. But then, when something like this happens, I reckon she is right and you got to keep after it and I reckon I am blessed in having a wife that ever strives for sanctity and well-doing like she says I am.

Now and then a fellow gets to thinking about it. Not often, though. Which is a good thing. For the Lord aimed for him to do and not to spend too much time thinking, because his brain it's like a piece of machinery: it wont stand a whole lot of racking. It's best when it all runs along the same, doing the day's work and

not no one part used no more than needful. I have said and I say again, that's ever living thing the matter with Darl: he just thinks by himself too much. Cora's right when she says all he needs is a wife to straighten him out. And when I think about that, I think that if nothing but being married will help a man, he's durn nigh hopeless. But I reckon Cora's right when she says the reason the Lord had to create women is because man dont know his own good when he sees it.

When I come back to the house with the team, they was in the kitchen. She was dressed on top of her nightgown, with a shawl over her head and her umbrella and her bible wrapped up in the oilcloth, and him sitting on a up-turned bucket on the stove-zinc where she had put him, dripping onto the floor. "I cant get nothing outen him except about a fish," she says. "It's a judgment on them. I see the hand of the Lord upon this boy for Anse Bundren's judgment and warning."

"The rain never come up till after I left," he says. "I had done left. I was on the way. And so it was there in the dust. You seen it. Cash is fixing to nail her, but you seen it."

When we got there it was raining hard, and him sitting on the seat between us, wrapped up in Cora's shawl. He hadn't said nothing else, just sitting there with Cora holding the umbrella over him. Now and then Cora would stop singing long enough to say "It's a judgment on Anse Bundren. May it show him the path of sin he is a-trodding." Then she would sing again, and him sitting there between us, leaning forward a little like the mules couldn't go fast enough to suit him.

"It was laying right yonder," he says, "but the rain come up after I taken and left. So I can go and open the windows, because Cash aint nailed her yet."

It was long a-past midnight when we drove the last nail, and almost dust-dawn when I got back home and taken the team out and got back in bed, with Cora's nightcap laying on the other pillow. And be durned if even then it wasn't like I could still hear Cora singing and feel that boy leaning forward between us like he was ahead of the mules, and still see Cash going up and down with that saw, and Anse standing there like a scarecrow, like he was a steer standing knee-deep in a pond and somebody come by and set the pond up on edge and he aint missed it yet.

It was nigh toward daybreak when we drove the last nail and toted it into the house, where she was laying on the bed with the window open and the rain blowing on her again. Twice he did it, and him so dead for sleep that Cora says his face looked like one of these here Christmas masts that had done been buried a while and then dug up, until at last they put her into it and nailed it down so he couldn't open the window on her no more. And the next morning they found him

in his shirt tail, laying asleep on the floor like a felled steer, and the top of the box bored clean full of holes and Cash's new auger broke off in the last one. When they taken the lid off they found that two of them had bored on into her face.

If it's a judgment, it aint right. Because the Lord's got more to do than that. He's bound to have. Because the only burden Anse Bundren's ever had is himself. And when folks talks him low, I think to myself he aint that less of a man or he couldn't a bore himself this long.

It aint right. I be durn if it is. Because He said Suffer little children to come unto Me dont make it right, neither. Cora said, "I have bore you what the Lord God sent me. I faced it without fear nor terror because my faith was strong in the Lord, a-bolstering and sustaining me. If you have no son, it's because the Lord has decreed otherwise in His wisdom. And my life is and has ever been a open book to ere a man or woman among His creatures because I trust in my God and my reward."

I reckon she's right. I reckon if there's ere a man or woman anywhere that He could turn it all over to and go away with His mind at rest, it would be Cora. And I reckon she would make a few changes, no matter how He was running it. And I reckon they would be for man's good. Leastways, we would have to like them. Leastways, we might as well go on and make like we did.

DARL



The lantern sits on a stump. Rusted, grease-fouled, its cracked chimney smeared on one side with a soaring smudge of soot, it sheds a feeble and sultry glare upon the trestles and the boards and the adjacent earth. Upon the dark ground the chips look like random smears of soft pale paint on a black canvas. The boards look like long smooth tatters torn from the flat darkness and turned backside out.

Cash labors about the trestles, moving back and forth, lifting and placing the planks with long clattering reverberations in the dead air as though he were lifting and dropping them at the bottom of an invisible well, the sounds ceasing without departing, as if any movement might dislodge them from the immediate air in reverberant repetition. He saws again, his elbow flashing slowly, a thin thread of fire running along the edge of the saw, lost and recovered at the top and bottom of each stroke in unbroken elongation, so that the saw appears to be six feet long, into and out of pa's shabby and aimless silhouette. "Give me that plank," Cash says. "No; the other one." He puts the saw down and comes and picks up the plank he wants, sweeping pa away with the long swinging gleam of the balanced board.

The air smells like sulphur. Upon the impalpable plane of it their shadows form as upon a wall, as though like sound they had not gone very far away in falling but had merely congealed for a moment, immediate and musing. Cash works on, half turned into the feeble light, one thigh and one pole-thin arm braced, his face sloped into the light with a rapt, dynamic immobility above his tireless elbow. Below the sky sheet-lightning slumbers lightly; against it the trees, motionless, are ruffled out to the last twig, swollen, increased as though quick with young.

It begins to rain. The first harsh, sparse, swift drops rush through the leaves and across the ground in a long sigh, as though of relief from intolerable suspense. They are big as buckshot, warm as though fired from a gun; they sweep across the lantern in a vicious hissing. Pa lifts his face, slack-mouthed, the wet black rim of snuff plastered close along the base of his gums; from behind his slack-faced astonishment he muses as though from beyond time, upon the ultimate outrage. Cash looks once at the sky, then at the lantern. The saw has not faltered, the running gleam of its pistonning edge unbroken. "Get something to cover the lantern," he says.

Pa goes to the house. The rain rushes suddenly down, without thunder, without warning of any sort; he is swept onto the porch upon the edge of it and in an instant Cash is wet to the skin. Yet the motion of the saw has not faltered, as though it and the arm functioned in a tranquil conviction that rain was an illusion of the mind. Then he puts down the saw and goes and crouches above the lantern, shielding it with his body, his back shaped lean and scrawny by his wet shirt as though he had been abruptly turned wrong-side out, shirt and all.

Pa returns. He is wearing Jewel's raincoat and carrying Dewey Dell's. Squatting over the lantern, Cash reaches back and picks up four sticks and drives them into the earth and takes Dewey Dell's raincoat from pa and spreads it over the sticks, forming a roof above the lantern. Pa watches him. "I dont know what you'll do," he says. "Darl taken his coat with him."

"Get wet," Cash says. He takes up the saw again; again it moves up and down, in and out of that unhurried imperviousness as a piston moves in the oil; soaked, scrawny, tireless, with the lean light body of a boy or an old man. Pa watches him, blinking, his face streaming; again he looks up at the sky with that expression of dumb and brooding outrage and yet of vindication, as though he had expected no less; now and then he stirs, moves, gaunt and streaming, picking up a board or a tool and then laying it down. Vernon Tull is there now, and Cash is wearing Mrs Tull's raincoat and he and Vernon are hunting the saw. After a while they find it in pa's hand.

"Why dont you go on to the house, out of the rain?" Cash says. Pa looks at him, his face streaming slowly. It is as though upon a face carved by a savage caricaturist a monstrous burlesque of all bereavement flowed. "You go on in," Cash says. "Me and Vernon can finish it."

Pa looks at them. The sleeves of Jewel's coat are too short for him. Upon his face the rain streams, slow as cold glycerin. "I dont begrudge her the wetting," he says. He moves again and falls to shifting the planks, picking them up, laying them down again carefully, as though they are glass. He goes to the lantern and pulls at the propped raincoat until he knocks it down and Cash comes and fixes it

back.

"You get on to the house," Cash says. He leads pa to the house and returns with the raincoat and folds it and places it beneath the shelter where the lantern sits. Vernon has not stopped. He looks up, still sawing.

"You ought to done that at first," he says. "You knowed it was fixing to rain."

"It's his fever," Cash says. He looks at the board.

"Ay," Vernon says. "He'd a come, anyway."

Cash squints at the board. On the long flank of it the rain crashes steadily, myriad, fluctuant. "I'm going to bevel it," he says.

"It'll take more time," Vernon says. Cash sets the plank on edge; a moment longer Vernon watches him, then he hands him the plane.

Vernon holds the board steady while Cash bevels the edge of it with the tedious and minute care of a jeweler. Mrs Tull comes to the edge of the porch and calls Vernon. "How near are you done?" she says.

Vernon does not look up. "Not long. Some, yet."

She watches Cash stooping at the plank, the turgid savage gleam of the lantern slicking on the raincoat as he moves. "You go down and get some planks off the barn and finish it and come in out of the rain," she says. "You'll both catch your death." Vernon does not move. "Vernon," she says.

"We wont be long," he says. "We'll be done after a spell." Mrs Tull watches them a while. Then she reenters the house.

"If we get in a tight, we could take some of them planks," Vernon says. "I'll help you put them back."

Cash ceases the plane and squints along the plank, wiping it with his palm. "Give me the next one," he says.

Some time toward dawn the rain ceases. But it is not yet day when Cash drives the last nail and stands stiffly up and looks down at the finished coffin, the others watching him. In the lantern light his face is calm, musing; slowly he strokes his hands on his raincoated thighs in a gesture deliberate, final and composed. Then the four of them—Cash and pa and Vernon and Peabody—raise the coffin to their shoulders and turn toward the house. It is light, yet they move slowly; empty, yet they carry it carefully; lifeless, yet they move with hushed precautionary words to one another, speaking of it as though, complete, it now slumbered lightly alive, waiting to come awake. On the dark floor their feet clump awkwardly, as though for a long time they have not walked on floors.

They set it down by the bed. Peabody says quietly: "Let's eat a snack. It's almost daylight. Where's Cash?"

He has returned to the trestles, stooped again in the lantern's feeble glare as he gathers up his tools and wipes them on a cloth carefully and puts them into the

box with its leather sling to go over the shoulder. Then he takes up box, lantern and raincoat and returns to the house, mounting the steps into faint silhouette against the paling east.

In a strange room you must empty yourself for sleep. And before you are emptied for sleep, what are you. And when you are emptied for sleep, you are not. And when you are filled with sleep, you never were. I dont know what I am. I dont know if I am or not. Jewel knows he is, because he does not know that he does not know whether he is or not. He cannot empty himself for sleep because he is not what he is and he is what he is not. Beyond the unlamped wall I can hear the rain shaping the wagon that is ours, the load that is no longer theirs that felled and sawed it nor yet theirs that bought it and which is not ours either, lie on our wagon though it does, since only the wind and the rain shape it only to Jewel and me, that are not asleep. And since sleep is is-not and rain and wind are *was*, it is not. Yet the wagon *is*, because when the wagon is *was*, Addie Bundren will not be. And Jewel *is*, so Addie Bundren must be. And then I must be, or I could not empty myself for sleep in a strange room. And so if I am not emptied yet, I am *is*.

How often have I lain beneath rain on a strange roof, thinking of home.

CASH



I made it on the bevel.

1. There is more surface for the nails to grip.
2. There is twice the gripping-surface to each seam.
3. The water will have to seep into it on a slant. Water moves easiest up and down or straight across.
4. In a house people are upright two thirds of the time. So the seams and joints are made up-and-down. Because the stress is up-and-down.
5. In a bed where people lie down all the time, the joints and seams are made sideways, because the stress is sideways.
6. Except.
7. A body is not square like a crosstie.
8. Animal magnetism.
9. The animal magnetism of a dead body makes the stress come slanting, so the seams and joints of a coffin are made on the bevel.
10. You can see by an old grave that the earth sinks down on the bevel.
11. While in a natural hole it sinks by the center, the stress being up-and-down.
12. So I made it on the bevel.
13. It makes a neater job.

VARDAMAN



My mother is a fish.

TULL

■

It was ten o'clock when I got back, with Peabody's team hitched on to the back of the wagon. They had already dragged the buckboard back from where Quick found it upside down straddle of the ditch about a mile from the spring. It was pulled out of the road at the spring, and about a dozen wagons was already there. It was Quick found it. He said the river was up and still rising. He said it had already covered the highest water-mark on the bridge-piling he had ever seen. "That bridge wont stand a whole lot of water," I said. "Has somebody told Anse about it?"

"I told him," Quick said. "He says he reckons them boys has heard and unloaded and are on the way back by now. He says they can load up and get across."

"He better go on and bury her at New Hope," Armstid said. "That bridge is old. I wouldn't monkey with it."

"His mind is set on taking her to Jefferson," Quick said.

"Then he better get at it soon as he can," Armstid said.

Anse meets us at the door. He has shaved, but not good. There is a long cut on his jaw, and he is wearing his Sunday pants and a white shirt with the neckband buttoned. It is drawn smooth over his hump, making it look bigger than ever, like a white shirt will, and his face is different too. He looks folks in the eye now, dignified, his face tragic and composed, shaking us by the hand as we walk up onto the porch and scrape our shoes, a little stiff in our Sunday clothes, our Sunday clothes rustling, not looking full at him as he meets us.

"The Lord giveth," we say.

"The Lord giveth."

That boy is not there. Peabody told about how he come into the kitchen, hollering, swarming and clawing at Cora when he found her cooking that fish, and how Dewey Dell taken him down to the barn. "My team all right?" Peabody says.

"All right," I tell him. "I give them a bait this morning. Your buggy seems all right too. It aint hurt."

"And no fault of somebody's," he says. "I'd give a nickel to know where that boy was when that team broke away."

"If it's broke anywhere, I'll fix it," I say.

The women folks go on into the house. We can hear them, talking and fanning. The fans go whish. whish. whish and them talking, the talking sounding kind of like bees murmuring in a water bucket. The men stop on the porch, talking some, not looking at one another.

"Howdy, Vernon," they say. "Howdy, Tull."

"Looks like more rain."

"It does for a fact."

"Yes, sir. It will rain some more."

"It come up quick."

"And going away slow. It dont fail."

I go around to the back. Cash is filling up the holes he bored in the top of it. He is trimming out plugs for them, one at a time, the wood wet and hard to work. He could cut up a tin can and hide the holes and nobody wouldn't know the difference. Wouldn't mind, anyway. I have seen him spend a hour trimming out a wedge like it was glass he was working, when he could have reached around and picked up a dozen sticks and drove them into the joint and made it do.

When we finished I go back to the front. The men have gone a little piece from the house, sitting on the ends of the boards and on the saw-horses where we made it last night, some sitting and some squatting. Whitfield aint come yet.

They look up at me, their eyes asking.

"It's about," I say. "He's ready to nail."

While they are getting up Anse comes to the door and looks at us and we return to the porch. We scrape our shoes again, careful, waiting for one another to go in first, milling a little at the door. Anse stands inside the door, dignified, composed. He waves us in and leads the way into the room.

They had laid her in it reversed. Cash made it clock-shape, like this



with every joint and seam bevelled and scrubbed with the plane, tight as a drum and neat as a sewing basket, and they had laid her in it head to foot so it wouldn't crush her dress. It was her wedding dress and it had a flare-

out bottom, and they had laid her head to foot in it so the dress could spread out, and they had made her a veil out of a mosquito bar so the auger holes in her face wouldn't show.

When we are going out, Whitfield comes. He is wet and muddy to the waist, coming in. "The Lord comfort this house," he says. "I was late because the bridge has gone. I went down to the old ford and swum my horse over, the Lord protecting me. His grace be upon this house."

We go back to the trestles and plank-ends and sit or squat.

"I knowed it would go," Armstid says.

"It's been there a long time, that ere bridge," Quick says.

"The Lord has kept it there, you mean," Uncle Billy says. "I dont know ere a man that's touched hammer to it in twenty-five years."

"How long has it been there, Uncle Billy?" Quick says.

"It was built in.....let me see..... It was in the year 1888," Uncle Billy says. "I mind it because the first man to cross it was Peabody coming to my house when Jody was born."

"If I'd a crossed it every time your wife littered since, it'd a been wore out long before this, Billy," Peabody says.

We laugh, suddenly loud, then suddenly quiet again. We look a little aside at one another.

"Lots of folks has crossed it that wont cross no more bridges," Houston says.

"It's a fact," Littlejohn says. "It's so."

"One more aint, no ways," Armstid says. "It'd taken them two-three days to got her to town in the wagon. They'd be gone a week, getting her to Jefferson and back."

"What's Anse so itching to take her to Jefferson for, anyway?" Houston says.

"He promised her," I say. "She wanted it. She come from there. Her mind was set on it."

"And Anse is set on it, too," Quick says.

"Ay," Uncle Billy says. "It's like a man that's let everything slide all his life to get set on something that will make the most trouble for everybody he knows."

"Well, it'll take the Lord to get her over that river now," Peabody says. "Anse cant do it."

"And I reckon He will," Quick says. "He's took care of Anse a long time, now."

"It's a fact," Littlejohn says.

"Too long to quit now," Armstid says.

"I reckon He's like everybody else around here," Uncle Billy says. "He's done

it so long now He cant quit."

Cash comes out. He has put on a clean shirt; his hair, wet, is combed smooth down on his brow, smooth and black as if he had painted it onto his head. He squats stiffly among us, we watching him.

"You feeling this weather, aint you?" Armstid says.

Cash says nothing.

"A broke bone always feels it," Littlejohn says. "A fellow with a broke bone can tell it a-coming."

"Lucky Cash got off with just a broke leg," Armstid says. "He might have hurt himself bed-rid. How far'd you fall, Cash?"

"Twenty-eight foot, four and a half inches, about," Cash says. I move over beside him.

"A fellow can sho slip quick on wet planks," Quick says.

"It's too bad," I say. "But you couldn't a holp it."

"It's them durn women," he says. "I made it to balance with her. I made it to her measure and weight."

If it takes wet boards for folks to fall, it's fixing to be lots of falling before this spell is done.

"You couldn't have holp it," I say.

I dont mind the folks falling. It's the cotton and corn I mind.

Neither does Peabody mind the folks falling. How bout it, Doc?

It's a fact. Washed clean outen the ground it will be. Seems like something is always happening to it.

Course it does. That's why it's worth anything. If nothing didn't happen and everybody made a big crop, do you reckon it would be worth the raising?

Well, I be durn if I like to see my work washed outen the ground, work I sweat over.

It's a fact. A fellow wouldn't mind seeing it washed up if he could just turn on the rain himself.

Who is that man can do that? Where is the color of his eyes?

Ay. The Lord made it to grow. It's Hisn to wash up if He sees it fitten so.

"You couldn't have holp it," I say.

"It's them durn women," he says.

In the house the women begin to sing. We hear the first line commence, beginning to swell as they take hold, and we rise and move toward the door, taking off our hats and throwing our chews away. We do not go in. We stop at the steps, clumped, holding our hats between our lax hands in front or behind, standing with one foot advanced and our heads lowered, looking aside, down at our hats in our hands and at the earth or now and then at the sky and at one

another's grave, composed face.

The song ends; the voices quaver away with a rich and dying fall. Whitfield begins. His voice is bigger than him. It's like they are not the same. It's like he is one, and his voice is one, swimming on two horses side by side across the ford and coming into the house, the mud-splashed one and the one that never even got wet, triumphant and sad. Somebody in the house begins to cry. It sounds like her eyes and her voice were turned back inside her, listening; we move, shifting to the other leg, meeting one another's eye and making like they hadn't touched.

Whitfield stops at last. The women sing again. In the thick air it's like their voices come out of the air, flowing together and on in the sad, comforting tunes. When they cease it's like they hadn't gone away. It's like they had just disappeared into the air and when we moved we would loose them again out of the air around us, sad and comforting. Then they finish and we put on our hats, our movements stiff, like we hadn't never wore hats before.

On the way home Cora is still singing. "I am bounding toward my God and my reward," she sings, sitting on the wagon, the shawl around her shoulders and the umbrella open over her, though it is not raining.

"She has hern," I say. "Wherever she went, she has her reward in being free of Anse Bundren." *She laid there three days in that box, waiting for Darl and Jewel to come clean back home and get a new wheel and go back to where the wagon was in the ditch. Take my team, Anse, I said.*

We'll wait for ourn, he said. She'll want it so. She was ever a particular woman.

On the third day they got back and they loaded her into the wagon and started and it already too late. You'll have to go all the way round by Samson's bridge. It'll take you a day to get there. Then you'll be forty miles from Jefferson. Take my team, Anse.

We'll wait for ourn. She'll want it so.

It was about a mile from the house we saw him, sitting on the edge of the slough. It hadn't had a fish in it never that I knowed. He looked around at us, his eyes round and calm, his face dirty, the pole across his knees. Cora was still singing.

"This aint no good day to fish," I said. "You come on home with us and me and you'll go down to the river first thing in the morning and catch some fish."

"It's one in here," he said. "Dewey Dell seen it."

"You come on with us. The river's the best place."

"It's in here," he said. "Dewey Dell seen it."

"I'm bounding toward my God and my reward," Cora sung.

DARL



It's not your horse that's dead, Jewel," I say. He sits erect on the seat, leaning a little forward, wooden-backed. The brim of his hat has soaked free of the crown in two places, drooping across his wooden face so that, head lowered, he looks through it like through the visor of a helmet, looking long across the valley to where the barn leans against the bluff, shaping the invisible horse. "See them?" I say. High above the house, against the quick thick sky, they hang in narrowing circles. From here they are no more than specks, implacable, patient, portentous. "But it's not your horse that's dead."

"Goddamn you," he says. "Goddamn you."

I cannot love my mother because I have no mother. Jewel's mother is a horse.

Motionless, the tall buzzards hang in soaring circles, the clouds giving them an illusion of retrograde.

Motionless, wooden-backed, wooden-faced, he shapes the horse in a rigid stoop like a hawk, hook-winged. They are waiting for us, ready for the moving of it, waiting for him. He enters the stall and waits until it kicks at him so that he can slip past and mount onto the trough and pause, peering out across the intervening stall-tops toward the empty path, before he reaches into the loft.

"Goddamn him. Goddamn him."

CASH



It wont balance. If you want it to tote and ride on a balance, we will have——”

“Pick up. Goddamn you, pick up.”

“I’m telling you it wont tote and it wont ride on a balance unless——”

“Pick up! Pick up, goddamn your thick-nosed soul to hell, pick up!”

It wont balance. If they want it to tote and ride on a balance, they will have

DARL



He stoops among us above it, two of the eight hands. In his face the blood goes in waves. In between them his flesh is greenish looking, about that smooth, thick, pale green of cow's cud; his face suffocated, furious, his lip lifted upon his teeth. "Pick up!" he says. "Pick up, goddamn your thick-nosed soul!"

He heaves, lifting one whole side so suddenly that we all spring into the lift to catch and balance it before he hurls it completely over. For an instant it resists, as though volitional, as though within it her pole-thin body clings furiously, even though dead, to a sort of modesty, as she would have tried to conceal a soiled garment that she could not prevent her body soiling. Then it breaks free, rising suddenly as though the emaciation of her body had added buoyancy to the planks or as though, seeing that the garment was about to be torn from her, she rushes suddenly after it in a passionate reversal that flouts its own desire and need. Jewel's face goes completely green and I can hear teeth in his breath.

We carry it down the hall, our feet harsh and clumsy on the floor, moving with shuffling steps, and through the door.

"Steady it a minute, now," pa says, letting go. He turns back to shut and lock the door, but Jewel will not wait.

"Come on," he says in that suffocating voice. "Come on."

We lower it carefully down the steps. We move, balancing it as though it were something infinitely precious, our faces averted, breathing through our teeth to keep our nostrils closed. We go down the path, toward the slope.

"We better wait," Cash says. "I tell you it aint balanced now. We'll need another hand on that hill."

"Then turn loose," Jewel says. He will not stop. Cash begins to fall behind,

hobbling to keep up, breathing harshly; then he is distanced and Jewel carries the entire front end alone, so that, tilting as the path begins to slant, it begins to rush away from me and slip down the air like a sled upon invisible snow, smoothly evacuating atmosphere in which the sense of it is still shaped.

“Wait, Jewel,” I say. But he will not wait. He is almost running now and Cash is left behind. It seems to me that the end which I now carry alone has no weight, as though it coasts like a rushing straw upon the furious tide of Jewel’s despair. I am not even touching it when, turning, he lets it overshoot him, swinging, and stops it and sloughs it into the wagon bed in the same motion and looks back at me, his face suffused with fury and despair.

“Goddamn you. Goddamn you.”

VARDAMAN



We are going to town. Dewey Dell says it wont be sold because it belongs to Santa Claus and he taken it back with him until next Christmas. Then it will be behind the glass again, shining with waiting.

Pa and Cash are coming down the hill, but Jewel is going to the barn. "Jewel," pa says. Jewel does not stop. "Where you going?" pa says. But Jewel does not stop. "You leave that horse here," pa says. Jewel stops and looks at pa. Jewel's eyes look like marbles. "You leave that horse here," pa says. "We'll all go in the wagon with ma, like she wanted."

But my mother is a fish. Vernon seen it. He was there.

"Jewel's mother is a horse," Darl said.

"Then mine can be a fish, cant it, Darl?" I said.

Jewel is my brother.

"Then mine will have to be a horse, too," I said.

"Why?" Darl said. "If pa is your pa, why does your ma have to be a horse just because Jewel's is?"

"Why does it?" I said. "Why does it, Darl?"

Darl is my brother.

"Then what is your ma, Darl?" I said.

"I haven't got ere one," Darl said. "Because if I had one, it is *was*. And if it is *was*, it cant be *is*. Can it?"

"No," I said.

"Then I am not," Darl said. "Am I?"

"No," I said.

I am. Darl is my brother.

“But you *are*, Darl,” I said.

“I know it,” Darl said. “That’s why I am not *is*. *Are* is too many for one woman to foal.”

Cash is carrying his tool box. Pa looks at him. “I’ll stop at Tull’s on the way back,” Cash says. “Get on that barn roof.”

“It aint respectful,” pa says. “It’s a deliberate flouting of her and of me.”

“Do you want him to come all the way back here and carry them up to Tull’s afoot?” Darl says. Pa looks at Darl, his mouth chewing. Pa shaves every day now because my mother is a fish.

“It aint right,” pa says.

Dewey Dell has the package in her hand. She has the basket with our dinner too.

“What’s that?” pa says.

“Mrs Tull’s cakes,” Dewey Dell says, getting into the wagon. “I’m taking them to town for her.”

“It aint right,” pa says. “It’s a flouting of the dead.”

It’ll be there. It’ll be there come Christmas, she says, shining on the track. She says he wont sell it to no town boys.

DARL



He goes on toward the barn, entering the lot, wooden-backed.

Dewey Dell carries the basket on one arm, in the other hand something wrapped square in a newspaper. Her face is calm and sullen, her eyes brooding and alert; within them I can see Peabody's back like two round peas in two thimbles: perhaps in Peabody's back two of those worms which work surreptitious and steady through you and out the other side and you waking suddenly from sleep or from waking, with on your face an expression sudden, intent, and concerned. She sets the basket into the wagon and climbs in, her leg coming long from beneath her tightening dress: that lever which moves the world; one of that caliper which measures the length and breadth of life. She sits on the seat beside Vardaman and sets the parcel on her lap.

Then he enters the barn. He has not looked back.

"It aint right," pa says. "It's little enough for him to do for her."

"Go on," Cash says. "Leave him stay if he wants. He'll be all right here. Maybe he'll go up to Tull's and stay."

"He'll catch us," I say. "He'll cut across and meet us at Tull's lane."

"He would have rid that horse, too," pa says, "if I hadn't a stopped him. A durn spotted critter wilder than a cattymount. A deliberate flouting of her and of me."

The wagon moves; the mules' ears begin to bob. Behind us, above the house, motionless in tall and soaring circles, they diminish and disappear.

ANSE



I told him not to bring that horse out of respect for his dead ma, because it wouldn't look right, him prancing along on a durn circus animal and her wanting us all to be in the wagon with her that sprung from her flesh and blood, but we hadn't no more than passed Tull's lane when Darl begun to laugh. Setting back there on the plank seat with Cash, with his dead ma laying in her coffin at his feet, laughing. How many times I told him it's doing such things as that that makes folks talk about him, I dont know. I says I got some regard for what folks says about my flesh and blood even if you haven't, even if I have raised such a durn passel of boys, and when you fixes it so folks can say such about you, it's a reflection on your ma, I says, not me: I am a man and I can stand it; it's on your womenfolks, your ma and sister that you should care for, and I turned and looked back at him and him setting there, laughing.

"I dont expect you to have no respect for me," I says. "But with your own ma not cold in her coffin yet."

"Yonder," Cash says, jerking his head toward the lane. The horse is still a right smart piece away, coming up at a good pace, but I dont have to be told who it is. I just looked back at Darl, setting there laughing.

"I done my best," I says. "I tried to do as she would wish it. The Lord will pardon me and excuse the conduct of them He sent me." And Darl setting on the plank seat right above her where she was laying, laughing.

DARL



He comes up the lane fast, yet we are three hundred yards beyond the mouth of it when he turns into the road, the mud flying beneath the flicking drive of the hooves. Then he slows a little, light and erect in the saddle, the horse mincing through the mud.

Tull is in his lot. He looks at us, lifts his hand. We go on, the wagon creaking, the mud whispering on the wheels. Vernon still stands there. He watches Jewel as he passes, the horse moving with a light, high-kneed driving gait, three hundred yards back. We go on, with a motion so soporific, so dreamlike as to be uninferant of progress, as though time and not space were decreasing between us and it.

It turns off at right angles, the wheel-marks of last Sunday healed away now: a smooth, red scoriation curving away into the pines; a white signboard with faded lettering: New Hope Church. 3 mi. It wheels up like a motionless hand lifted above the profound desolation of the ocean; beyond it the red road lies like a spoke of which Addie Bundren is the rim. It wheels past, empty, unscarred, the white signboard turns away its fading and tranquil assertion. Cash looks up the road quietly, his head turning as we pass it like an owl's head, his face composed. Pa looks straight ahead, humped. Dewey Dell looks at the road too, then she looks back at me, her eyes watchful and repudiant, not like that question which was in those of Cash, for a smoldering while. The signboard passes; the unscarred road wheels on. Then Dewey Dell turns her head. The wagon creaks on.

Cash spits over the wheel. "In a couple of days now it'll be smelling," he says. "You might tell Jewel that," I say.

He is motionless now, sitting the horse at the junction, upright, watching us, no less still than the signboard that lifts its fading capitulation opposite him.

"It aint balanced right for no long ride," Cash says.

"Tell him that, too," I say. The wagon creaks on.

A mile further along he passes us, the horse, archnecked, reined back to a swift singlefoot. He sits lightly, poised, upright, wooden-faced in the saddle, the broken hat raked at a swaggering angle. He passes us swiftly, without looking at us, the horse driving, its hooves hissing in the mud. A gout of mud, backflung, plops onto the box. Cash leans forward and takes a tool from his box and removes it carefully. When the road crosses Whiteleaf, the willows leaning near enough, he breaks off a branch and scours at the stain with the wet leaves.

ANSE



It's a hard country on man; it's hard. Eight miles of the sweat of his body washed up outeren the Lord's earth, where the Lord Himself told him to put it. Nowhere in this sinful world can a honest, hardworking man profit. It takes them that runs the stores in the towns, doing no sweating, living off of them that sweats. It aint the hardworking man, the farmer. Sometimes I wonder why we keep at it. It's because there is a reward for us above, where they cant take their autos and such. Every man will be equal there and it will be taken from them that have and give to them that have not by the Lord.

But it's a long wait, seems like. It's bad that a fellow must earn the reward of his right-doing by flouting hisself and his dead. We drove all the rest of the day and got to Samson's at dust-dark and then that bridge was gone, too. They hadn't never see the river so high, and it not done raining yet. There was old men that hadn't never see nor hear of it being so in the memory of man. I am the chosen of the Lord, for who He loveth, so doeth He chastiseth. But I be durn if He dont take some curious ways to show it, seems like.

But now I can get them teeth. That will be a comfort. It will.

SAMSON



It was just before sundown. We were sitting on the porch when the wagon came up the road with the five of them in it and the other one on the horse behind. One of them raised his hand, but they was going on past the store without stopping.

"Who's that?" MacCallum says: I cant think of his name: Rafe's twin; that one it was.

"It's Bundren, from down beyond New Hope," Quick says. "There's one of them Snopes horses Jewel's riding."

"I didn't know there was ere a one of them horses left," MacCallum says. "I thought you folks down there finally contrived to give them all away."

"Try and get that one," Quick says. The wagon went on.

"I bet old man Lon never gave it to him," I says.

"No," Quick says. "He bought it from pappy." The wagon went on. "They must not a heard about the bridge," he says.

"What're they doing up here, anyway?" MacCallum says.

"Taking a holiday since he got his wife buried, I reckon," Quick says. "Heading for town, I reckon, with Tull's bridge gone too. I wonder if they aint heard about the bridge."

"They'll have to fly, then," I says. "I dont reckon there's ere a bridge between here and Mouth of Ishatawa."

They had something in the wagon. But Quick had been to the funeral three days ago and we naturally never thought anything about it except that they were heading away from home mighty late and that they hadn't heard about the bridge. "You better holler at them," MacCallum says. Durn it, the name is right on the tip of my tongue. So Quick hollered and they stopped and he went to the

wagon and told them.

He come back with them. "They're going to Jefferson," he says. "The bridge at Tull's is gone, too." Like we didn't know it, and his face looked funny, around the nostrils, but they just sat there, Bundren and the girl and the chap on the seat, and Cash and the second one, the one folks talks about, on a plank across the tail-gate, and the other one on that spotted horse. But I reckon they was used to it by then, because when I said to Cash that they'd have to pass by New Hope again and what they'd better do, he just says,

"I reckon we can get there."

I aint much for meddling. Let every man run his own business to suit himself, I say. But after I talked to Rachel about them not having a regular man to fix her and it being July and all, I went back down to the barn and tried to talk to Bundren about it.

"I give her my promise," he says. "Her mind was set on it."

I notice how it takes a lazy man, a man that hates moving, to get set on moving once he does get started off, the same as he was set on staying still, like it aint the moving he hates so much as the starting and the stopping. And like he would be kind of proud of whatever come up to make the moving or the setting still look hard. He set there on the wagon, hunched up, blinking, listening to us tell about how quick the bridge went and how high the water was, and I be durn if he didn't act like he was proud of it, like he had made the river rise himself.

"You say it's higher than you ever see it before?" he says. "God's will be done," he says. "I reckon it wont go down much by morning, neither," he says.

"You better stay here tonight," I says, "and get a early start for New Hope tomorrow morning." I was just sorry for them bone-gaunted mules. I told Rachel, I says, "Well, would you have had me turn them away at dark, eight miles from home? What else could I do," I says. "It wont be but one night, and they'll keep it in the barn, and they'll sholy get started by daylight." And so I says, "You stay here tonight and early tomorrow you can go back to New Hope. I got tools enough, and the boys can go on right after supper and have it dug and ready if they want" and then I found that girl watching me. If her eyes had a been pistols, I wouldn't be talking now. I be dog if they didn't blaze at me. And so when I went down to the barn I come on them, her talking so she never noticed when I come up.

"You promised her," she says. "She wouldn't go until you promised. She thought she could depend on you. If you dont do it, it will be a curse on you."

"Cant no man say I dont aim to keep my word," Bundren says. "My heart is open to ere a man."

"I dont care what your heart is," she says. She was whispering, kind of,

talking fast. "You promised her. You've got to. You——" then she seen me and quit, standing there. If they'd been pistols, I wouldn't be talking now. So when I talked to him about it, he says,

"I give her my promise. Her mind is set on it."

"But seems to me she'd rather have her ma buried close by, so she could——"

"It's Addie I give the promise to," he says. "Her mind is set on it."

So I told them to drive it into the barn, because it was threatening rain again, and that supper was about ready. Only they didn't want to come in.

"I thank you," Bundren says. "We wouldn't discommode you. We got a little something in the basket. We can make out."

"Well," I says, "since you are so particular about your womenfolks, I am too. And when folks stops with us at meal time and wont come to the table, my wife takes it as a insult."

So the girl went on to the kitchen to help Rachel. And then Jewel come to me.

"Sho," I says. "Help yourself outen the loft. Feed him when you bait the mules."

"I rather pay you for him," he says.

"What for?" I says. "I wouldn't begrudge no man a bait for his horse."

"I rather pay you," he says; I thought he said extra.

"Extra for what?" I says. "Wont he eat hay and corn?"

"Extra feed," he says. "I feed him a little extra and I dont want him beholden to no man."

"You cant buy no feed from me, boy," I says. "And if he can eat that loft clean, I'll help you load the barn onto the wagon in the morning."

"He aint never been beholden to no man," he says. "I rather pay you for it."

And if I had my rathers, you wouldn't be here a-tall, I wanted to say. But I just says, "Then it's high time he commenced. You cant buy no feed from me."

When Rachel put supper on, her and the girl went and fixed some beds. But wouldn't any of them come in. "She's been dead long enough to get over that sort of foolishness," I says. Because I got just as much respect for the dead as ere a man, but you've got to respect the dead themselves, and a woman that's been dead in a box four days, the best way to respect her is to get her into the ground as quick as you can. But they wouldn't do it.

"It wouldn't be right," Bundren says. "Course, if the boys wants to go to bed, I reckon I can set up with her. I dont begrudge her it."

So when I went back down there they were squatting on the ground around the wagon, all of them. "Let that chap come to the house and get some sleep, anyway," I says. "And you better come too," I says to the girl. I wasn't aiming to interfere with them. And I sholy hadn't done nothing to her that I knowed.

"He's done already asleep," Bundren says. They had done put him to bed in the trough in a empty stall.

"Well, you come on, then," I says to her. But still she never said nothing. They just squatted there. You couldn't hardly see them. "How about you boys?" I says. "You got a full day tomorrow." After a while Cash says,

"I thank you. We can make out."

"We wouldn't be beholden," Bundren says. "I thank you kindly."

So I left them squatting there. I reckon after four days they was used to it. But Rachel wasn't.

"It's a outrage," she says. "A outrage."

"What could he a done?" I says. "He give her his promised word."

"Who's talking about him?" she says. "Who cares about him?" she says, crying. "I just wish that you and him and all the men in the world that torture us alive and flout us dead, dragging us up and down the country——"

"Now, now," I says. "You're upset."

"Dont you touch me!" she says. "Dont you touch me!"

A man cant tell nothing about them. I lived with the same one fifteen years and I be durn if I can. And I imagined a lot of things coming up between us, but I be durn if I ever thought it would be a body four days dead and that a woman. But they make life hard on them, not taking it as it comes up, like a man does.

So I laid there, hearing it commence to rain, thinking about them down there, squatting around the wagon and the rain on the roof, and thinking about Rachel crying there until after a while it was like I could still hear her crying even after she was asleep, and smelling it even when I knowed I couldn't. I couldn't decide even then whether I could or not, or if it wasn't just knowing it was what it was.

So next morning I never went down there. I heard them hitching up and then when I knowed they must be about ready to take out, I went out the front and went down the road toward the bridge until I heard the wagon come out of the lot and go back toward New Hope. And then when I come back to the house, Rachel jumped on me because I wasn't there to make them come in to breakfast. You cant tell about them. Just about when you decide they mean one thing, I be durn if you not only haven't got to change your mind, like as not you got to take a rawhiding for thinking they meant it.

But it was still like I could smell it. And so I decided then that it wasn't smelling it, but it was just knowing it was there, like you will get fooled now and then. But when I went to the barn I knew different. When I walked into the hallway I saw something. It kind of hunkered up when I come in and I thought at first it was one of them got left, then I saw what it was. It was a buzzard. It looked around and saw me and went on down the hall, spraddle-legged, with its

wings kind of hunkered out, watching me first over one shoulder and then over the other, like a old baldheaded man. When it got outdoors it begun to fly. It had to fly a long time before it ever got up into the air, with it thick and heavy and full of rain like it was.

If they was bent on going to Jefferson, I reckon they could have gone around up by Mount Vernon, like MacCallum did. He'll get home about day after tomorrow, horseback. Then they'd be just eighteen miles from town. But maybe this bridge being gone too has learned him the Lord's sense and judgment.

That MacCallum. He's been trading with me off and on for twelve years. I have known him from a boy up; know his name as well as I do my own. But be durn if I can say it.

DEWEY DELL



The signboard comes in sight. It is looking out at the road now, because it can wait. New Hope. 3 mi. it will say. New Hope. 3 mi. New Hope. 3 mi. And then the road will begin, curving away into the trees, empty with waiting, saying New Hope three miles.

I heard that my mother is dead. I wish I had time to let her die. I wish I had time to wish I had. It is because in the wild and outraged earth too soon too soon too soon. It's not that I wouldn't and will not it's that it is too soon too soon too soon.

Now it begins to say it. New Hope three miles. New Hope three miles. *That's what they mean by the womb of time: the agony and the despair of spreading bones, the hard girdle in which lie the outraged entrails of events* Cash's head turns slowly as we approach, his pale empty sad composed and questioning face following the red and empty curve; beside the back wheel Jewel sits the horse, gazing straight ahead.

The land runs out of Darl's eyes; they swim to pin points. They begin at my feet and rise along my body to my face, and then my dress is gone: I sit naked on the seat above the unhurrying mules, above the travail. *Suppose I tell him to turn. He will do what I say. Dont you know he will do what I say?* Once I waked with a black void rushing under me. I could not see. I saw Vardaman rise and go to the window and strike the knife into the fish, the blood gushing, hissing like steam but I could not see. *He'll do as I say. He always does. I can persuade him to anything. You know I can. Suppose I say Turn here.* That was when I died that time. *Suppose I do. We'll go to New Hope. We wont have to go to town.* I rose and took the knife from the streaming fish still hissing and I killed Darl.

When I used to sleep with Vardaman I had a nightmare once I thought I was awake but I couldn't see and couldn't feel I couldn't feel the bed under me and I couldn't think what I was I couldn't think of my name I couldn't even think I am a girl I couldn't even think I nor even think I want to wake up nor remember what was opposite to awake so I could do that I knew that something was passing but I couldn't even think of time then all of a sudden I knew that something was it was wind blowing over me it was like the wind came and blew me back from where it was I was not blowing the room and Vardaman asleep and all of them back under me again and going on like a piece of cool silk dragging across my naked legs

It blows cool out of the pines, a sad steady sound. New Hope. Was 3 mi. Was 3 mi. I believe in God I believe in God.

“Why didn’t we go to New Hope, pa?” Vardaman says. “Mr Samson said we was, but we done passed the road.”

Darl says, “Look, Jewel.” But he is not looking at me. He is looking at the sky. The buzzard is as still as if he were nailed to it.

We turn into Tull’s lane. We pass the barn and go on, the wheels whispering in the mud, passing the green rows of cotton in the wild earth, and Vernon little across the field behind the plow. He lifts his hand as we pass and stands there looking after us for a long while.

“Look, Jewel,” Darl says. Jewel sits on his horse like they were both made out of wood, looking straight ahead.

I believe in God, God. God, I believe in God.

TULL



After they passed I taken the mule out and looped up the trace chains and followed. They was setting in the wagon at the end of the levee. Anse was setting there, looking at the bridge where it was swagged down into the river with just the two ends in sight. He was looking at it like he had believed all the time that folks had been lying to him about it being gone, but like he was hoping all the time it really was. Kind of pleased astonishment he looked, setting on the wagon in his Sunday pants, mumbling his mouth. Looking like a uncurried horse dressed up: I dont know.

The boy was watching the bridge where it was mid-sunk and logs and such drifted up over it and it swagging and shivering like the whole thing would go any minute, big-eyed he was watching it, like he was to a circus. And the gal too. When I come up she looked around at me, her eyes kind of blaring up and going hard like I had made to touch her. Then she looked at Anse again and then back at the water again.

It was nigh up to the levee on both sides, the earth hid except for the tongue of it we was on going out to the bridge and then down into the water, and except for knowing how the road and the bridge used to look, a fellow couldn't tell where was the river and where the land. It was just a tangle of yellow and the levee not less wider than a knife-back kind of, with us setting in the wagon and on the horse and the mule.

Darl was looking at me, and then Cash turned and looked at me with that look in his eyes like when he was figuring on whether the planks would fit her that night, like he was measuring them inside of him and not asking you to say what you thought and not even letting on he was listening if you did say it, but

listening all right. Jewel hadn't moved. He sat there on the horse, leaning a little forward, with that same look on his face when him and Darl passed the house yesterday, coming back to get her.

"If it was just up, we could drive across," Anse says. "We could drive right on across it."

Sometimes a log would get shoved over the jam and float on, rolling and turning, and we could watch it go on to where the ford used to be. It would slow up and whirl crossways and hang out of water for a minute, and you could tell by that that the ford used to be there.

"But that don't show nothing," I say. "It could be a bar of quicksand built up there." We watch the log. Then the gal is looking at me again.

"Mr Whitfield crossed it," she says.

"He was a horse-back," I say. "And three days ago. It's riz five foot since."

"If the bridge was just up," Anse says.

The log bobs up and goes on again. There is a lot of trash and foam, and you can hear the water.

"But it's down," Anse says.

Cash says, "A careful fellow could walk across yonder on the planks and logs."

"But you couldn't tote nothing," I say. "Likely time you set foot on that mess, it'll all go, too. What you think, Darl?"

He is looking at me. He don't say nothing; just looks at me with them queer eyes of hisn that makes folks talk. I always say it aint never been what he done so much or said or anything so much as how he looks at you. It's like he had got into the inside of you, someway. Like somehow you was looking at yourself and your doings outen his eyes. Then I can feel that gal watching me like I had made to touch her. She says something to Anse. "..... Mr Whitfield...." she says.

"I give her my promised word in the presence of the Lord," Anse says. "I reckon it aint no need to worry."

But still he does not start the mules. We set there above the water. Another log bobs up over the jam and goes on; we watch it check up and swing slow for a minute where the ford used to be. Then it goes on.

"It might start falling tonight," I say. "You could lay over one more day."

Then Jewel turns sideways on the horse. He has not moved until then, and he turns and looks at me. His face is kind of green, then it would go red and then green again. "Get to hell on back to your damn plowing," he says. "Who the hell asked you to follow us here?"

"I never meant no harm," I say.

"Shut up, Jewel," Cash says. Jewel looks back at the water, his face gritted,

going red and green and then red. "Well," Cash says after a while, "what you want to do?"

Anse dont say nothing. He sets humped up, mumbling his mouth. "If it was just up, we could drive across it," he says.

"Come on," Jewel says, moving the horse.

"Wait," Cash says. He looks at the bridge. We look at him, except Anse and the gal. They are looking at the water. "Dewey Dell and Vardaman and pa better walk across on the bridge," Cash says.

"Vernon can help them," Jewel says. "And we can hitch his mule ahead of ourn."

"You aint going to take my mule into that water," I say.

Jewel looks at me. His eyes look like pieces of a broken plate. "I'll pay for your damn mule. I'll buy it from you right now."

"My mule aint going into that water," I say.

"Jewel's going to use his horse," Darl says. "Why wont you risk your mule, Vernon?"

"Shut up, Darl," Cash says. "You and Jewel both."

"My mule aint going into that water," I say.

DARL



He sits the horse, glaring at Vernon, his lean face suffused up to and beyond the pale rigidity of his eyes. The summer when he was fifteen, he took a spell of sleeping. One morning when I went to feed the mules the cows were still in the tie-up and then I heard pa go back to the house and call him. When we came on back to the house for breakfast he passed us, carrying the milk buckets, stumbling along like he was drunk, and he was milking when we put the mules in and went on to the field without him. We had been there an hour and still he never showed up. When Dewey Dell came with our lunch, pa sent her back to find Jewel. They found him in the tie-up, sitting on the stool, asleep.

After that, every morning pa would go in and wake him. He would go to sleep at the supper table and soon as supper was finished he would go to bed, and when I came in to bed he would be lying there like a dead man. Yet still pa would have to wake him in the morning. He would get up, but he wouldn't hardly have half sense: he would stand for pa's jawing and complaining without a word and take the milk buckets and go to the barn, and once I found him asleep at the cow, the bucket in place and half full and his hands up to the wrists in the milk and his head against the cow's flank.

After that Dewey Dell had to do the milking. He still got up when pa waked him, going about what we told him to do in that dazed way. It was like he was trying hard to do them; that he was as puzzled as anyone else.

"Are you sick?" ma said. "Dont you feel all right?"

"Yes," Jewel said. "I feel all right."

"He's just lazy, trying me," pa said, and Jewel standing there, asleep on his feet like as not. "Aint you?" he said, waking Jewel up again to answer.

"No," Jewel said.

"You take off and stay in the house today," ma said.

"With that whole bottom piece to be busted out?" pa said. "If you aint sick, what's the matter with you?"

"Nothing," Jewel said. "I'm all right."

"All right?" pa said. "You're asleep on your feet this minute."

"No," Jewel said. "I'm all right."

"I want him to stay at home today," ma said.

"I'll need him," pa said. "It's tight enough, with all of us to do it."

"You'll just have to do the best you can with Cash and Darl," ma said. "I want him to stay in today."

But he wouldn't do it. "I'm all right," he said, going on. But he wasn't all right. Anybody could see it. He was losing flesh, and I have seen him go to sleep chopping; watched the hoe going slower and slower up and down, with less and less of an arc, until it stopped and he leaning on it motionless in the hot shimmer of the sun.

Ma wanted to get the doctor, but pa didn't want to spend the money without it was needful, and Jewel did seem all right except for his thinness and his way of dropping off to sleep at any moment. He ate hearty enough, except for his way of going to sleep in his plate, with a piece of bread half way to his mouth and his jaws still chewing. But he swore he was all right.

It was ma that got Dewey Dell to do his milking, paid her somehow, and the other jobs around the house that Jewel had been doing before supper she found some way for Dewey Dell and Vardaman to do them. And doing them herself when pa wasn't there. She would fix him special things to eat and hide them for him. And that may have been when I first found it out, that Addie Bundren should be hiding anything she did, who had tried to teach us that deceit was such that, in a world where it was, nothing else could be very bad or very important, not even poverty. And at times when I went in to go to bed she would be sitting in the dark by Jewel where he was asleep. And I knew that she was hating herself for that deceit and hating Jewel because she had to love him so that she had to act the deceit.

One night she was taken sick and when I went to the barn to put the team in and drive to Tull's, I couldn't find the lantern. I remembered noticing it on the nail the night before, but it wasn't there now at midnight. So I hitched in the dark and went on and came back with Mrs Tull just after daylight. And there the lantern was, hanging on the nail where I remembered it and couldn't find it before. And then one morning while Dewey Dell was milking just before sunup, Jewel came into the barn from the back, through the hole in the back wall, with

the lantern in his hand.

I told Cash, and Cash and I looked at one another.

"Rutting," Cash said.

"Yes," I said. "But why the lantern? And every night, too. No wonder he's losing flesh. Are you going to say anything to him?"

"Wont do any good," Cash said.

"What he's doing now wont do any good, either."

"I know. But he'll have to learn that himself. Give him time to realise that it'll save, that there'll be just as much more tomorrow, and he'll be all right. I wouldn't tell anybody, I reckon."

"No," I said. "I told Dewey Dell not to. Not ma, anyway."

"No. Not ma."

After that I thought it was right comical: he acting so bewildered and willing and dead for sleep and gaunt as a bean-pole, and thinking he was so smart with it. And I wondered who the girl was. I thought of all I knew that it might be, but I couldn't say for sure.

"'Taint any girl," Cash said. "It's a married woman somewhere. Aint any young girl got that much daring and staying power. That's what I dont like about it."

"Why?" I said. "She'll be safer for him than a girl would. More judgment."

He looked at me, his eyes fumbling, the words fumbling at what he was trying to say. "It aint always the safe things in this world that a fellow....."

"You mean, the safe things are not always the best things?"

"Ay; best," he said, fumbling again. "It aint the best things, the things that are good for him..... A young boy. A fellow kind of hates to see.....wallowing in somebody else's mire....." That's what he was trying to say. When something is new and hard and bright, there ought to be something a little better for it than just being safe, since the safe things are just the things that folks have been doing so long they have worn the edges off and there's nothing to the doing of them that leaves a man to say, That was not done before and it cannot be done again.

So we didn't tell, not even when after a while he'd appear suddenly in the field beside us and go to work, without having had time to get home and make out he had been in bed all night. He would tell ma that he hadn't been hungry at breakfast or that he had eaten a piece of bread while he was hitching up the team. But Cash and I knew that he hadn't been home at all on those nights and he had come up out of the woods when we got to the field. But we didn't tell. Summer was almost over then; we knew that when the nights began to get cool, she would be done if he wasn't.

But when fall came and the nights began to get longer, the only difference was

that he would always be in bed for pa to wake him, getting him up at last in that first state of semi-idiocy like when it first started, worse than when he had stayed out all night.

“She’s sure a stayer,” I told Cash. “I used to admire her, but I downright respect her now.”

“It aint a woman,” he said.

“You know,” I said. But he was watching me. “What is it, then?”

“That’s what I aim to find out,” he said.

“You can trail him through the woods all night if you want to,” I said. “I’m not.”

“I aint trailing him,” he said.

“What do you call it, then?”

“I aint trailing him,” he said. “I dont mean it that way.”

And so a few nights later I heard Jewel get up and climb out the window, and then I heard Cash get up and follow him. The next morning when I went to the barn, Cash was already there, the mules fed, and he was helping Dewey Dell milk. And when I saw him I knew that he knew what it was. Now and then I would catch him watching Jewel with a queer look, like having found out where Jewel went and what he was doing had given him something to really think about at last. But it was not a worried look; it was the kind of look I would see on him when I would find him doing some of Jewel’s work around the house, work that pa still thought Jewel was doing and that ma thought Dewey Dell was doing. So I said nothing to him, believing that when he got done digesting it in his mind, he would tell me. But he never did.

One morning—it was November then, five months since it started—Jewel was not in bed and he didn’t join us in the field. That was the first time ma learned anything about what had been going on. She sent Vardaman down to find where Jewel was, and after a while she came down too. It was as though, so long as the deceit ran along quiet and monotonous, all of us let ourselves be deceived, abetting it unawares or maybe through cowardice, since all people are cowards and naturally prefer any kind of treachery because it has a bland outside. But now it was like we had all—and by a kind of telepathic agreement of admitted fear—flung the whole thing back like covers on the bed and we all sitting bolt upright in our nakedness, staring at one another and saying “Now is the truth. He hasn’t come home. Something has happened to him. We let something happen to him.”

Then we saw him. He came up along the ditch and then turned straight across the field, riding the horse. Its mane and tail were going, as though in motion they were carrying out the splotchy pattern of its coat: he looked like he was riding on

a big pinwheel, barebacked, with a rope bridle, and no hat on his head. It was a descendant of those Texas ponies Flem Snopes brought here twenty-five years ago and auctioned off for two dollars a head and nobody but old Lon Quick ever caught his and still owned some of the blood because he could never give it away.

He galloped up and stopped, his heels in the horse's ribs and it dancing and swirling like the shape of its mane and tail and the splotches of its coat had nothing whatever to do with the flesh-and-bone horse inside them, and he sat there, looking at us.

"Where did you get that horse?" pa said.

"Bought it," Jewel said. "From Mr Quick."

"Bought it?" pa said. "With what? Did you buy that thing on my word?"

"It was my money," Jewel said. "I earned it. You wont need to worry about it."

"Jewel," ma said; "Jewel."

"It's all right," Cash said. "He earned the money. He cleaned up that forty acres of new ground Quick laid out last spring. He did it single handed, working at night by lantern. I saw him. So I dont reckon that horse cost anybody anything except Jewel. I dont reckon we need worry."

"Jewel," ma said. "Jewel——" Then she said: "You come right to the house and go to bed."

"Not yet," Jewel said. "I aint got time. I got to get me a saddle and bridle. Mr Quick says he——"

"Jewel," ma said, looking at him. "I'll give——I'll give——give——" Then she began to cry. She cried hard, not hiding her face, standing there in her faded wrapper, looking at him and him on the horse, looking down at her, his face growing cold and a little sick looking, until he looked away quick and Cash came and touched her.

"You go on to the house," Cash said. "This here ground is too wet for you. You go on, now." She put her hands to her face then and after a while she went on, stumbling a little on the plow-marks. But pretty soon she straightened up and went on. She didn't look back. When she reached the ditch she stopped and called Vardaman. He was looking at the horse, kind of dancing up and down by it.

"Let me ride, Jewel," he said. "Let me ride, Jewel."

Jewel looked at him, then he looked away again, holding the horse reined back. Pa watched him, mumbling his lip.

"So you bought a horse," he said. "You went behind my back and bought a horse. You never consulted me; you know how tight it is for us to make by, yet

you bought a horse for me to feed. Taken the work from your flesh and blood and bought a horse with it.”

Jewel looked at pa, his eyes paler than ever. “He wont never eat a mouthful of yours,” he said. “Not a mouthful. I’ll kill him first. Dont you never think it. Dont you never.”

“Let me ride, Jewel,” Vardaman said. “Let me ride, Jewel.” He sounded like a cricket in the grass, a little one. “Let me ride, Jewel.”

That night I found ma sitting beside the bed where he was sleeping, in the dark. She cried hard, maybe because she had to cry so quiet; maybe because she felt the same way about tears she did about deceit, hating herself for doing it, hating him because she had to. And then I knew that I knew. I knew that as plain on that day as I knew about Dewey Dell on that day.

TULL



So they finally got Anse to say what he wanted to do, and him and the gal and the boy got out of the wagon. But even when we were on the bridge Anse kept on looking back, like he thought maybe, once he was outen the wagon, the whole thing would kind of blow up and he would find himself back yonder in the field again and her laying up there in the house, waiting to die and it to do all over again.

“You ought to let them taken your mule,” he says, and the bridge shaking and swaying under us, going down into the moiling water like it went clean through to the other side of the earth, and the other end coming up outen the water like it wasn’t the same bridge a-tall and that them that would walk up outen the water on that side must come from the bottom of the earth. But it was still whole; you could tell that by the way when this end swagged, it didn’t look like the other end swagged at all: just like the other trees and the bank yonder were swinging back and forth slow like on a big clock. And them logs scraping and bumping at the sunk part and tilting end-up and shooting clean outen the water and tumbling on toward the ford and the waiting, slick, whirling, and foamy.

“What good would that a done?” I says. “If your team cant find the ford and haul it across, what good would three mules or even ten mules do?”

“I aint asking it of you,” he says. “I can always do for me and mine. I aint asking you to risk your mule. It aint your dead; I am not blaming you.”

“They ought to went back and laid over until tomorrow,” I says. The water was cold. It was thick, like slush ice. Only it kind of lived. One part of you knowed it was just water, the same thing that had been running under this same bridge for a long time, yet when them logs would come spewing up outen it, you

were not surprised, like they was a part of water, of the waiting and the threat.

It was like when we was across, up out of the water again and the hard earth under us, that I was surprised. It was like we hadn't expected the bridge to end on the other bank, on something tame like the hard earth again that we had tromped on before this time and knowed well. Like it couldn't be me here, because I'd have had better sense than to done what I just done. And when I looked back and saw the other bank and saw my mule standing there where I used to be and knew that I'd have to get back there someway, I knew it couldn't be, because I just couldn't think of anything that could make me cross that bridge ever even once. Yet here I was, and the fellow that could make himself cross it twice, couldn't be me, not even if Cora told him to.

It was that boy. I said "Here; you better take a holt of my hand" and he waited and held to me. I be durn if it wasn't like he come back and got me; like he was saying They wont nothing hurt you. Like he was saying about a fine place he knowed where Christmas come twice with Thanksgiving and lasts on through the winter and the spring and the summer, and if I just stayed with him I'd be all right too.

When I looked back at my mule it was like he was one of these here spy-glasses and I could look at him standing there and see all the broad land and my house sweated outen it like it was the more the sweat, the broader the land; the more the sweat, the tighter the house because it would take a tight house for Cora, to hold Cora like a jar of milk in the spring: you've got to have a tight jar or you'll need a powerful spring, so if you have a big spring, why then you have the incentive to have tight, wellmade jars, because it is your milk, sour or not, because you would rather have milk that will sour than to have milk that wont, because you are a man.

And him holding to my hand, his hand that hot and confident, so that I was like to say: Look-a-here. Cant you see that mule yonder? He never had no business over here, so he never come, not being nothing but a mule. Because a fellow can see ever now and then that children have more sense than him. But he dont like to admit it to them until they have beards. After they have a beard, they are too busy because they dont know if they'll ever quite make it back to where they were in sense before they was haired, so you dont mind admitting then to folks that are worrying about the same thing that aint worth the worry that you are yourself.

Then we was over and we stood there, looking at Cash turning the wagon around. We watched them drive back down the road to where the trail turned off into the bottom. After a while the wagon was out of sight.

"We better get on down to the ford and git ready to help," I said.

"I give her my word," Anse says. "It is sacred on me. I know you begrudge it, but she will bless you in heaven."

"Well, they got to finish circumventing the land before they can dare the water," I said. "Come on."

"It's the turning back," he said. "It aint no luck in turning back."

He was standing there, humped, mournful, looking at the empty road beyond the swagging and swaying bridge. And that gal, too, with the lunch basket on one arm and that package under the other. Just going to town. Bent on it. They would risk the fire and the earth and the water and all just to eat a sack of bananas. "You ought to laid over a day," I said. "It would a fell some by morning. It mought not a rained tonight. And it cant get no higher."

"I give my promise," he says. "She is counting on it."

DARL



Before us the thick dark current runs. It talks up to us in a murmur become ceaseless and myriad, the yellow surface dimpled monstrously into fading swirls travelling along the surface for an instant, silent, impermanent and profoundly significant, as though just beneath the surface something huge and alive waked for a moment of lazy alertness out of and into light slumber again.

It clucks and murmurs among the spokes and about the mules' knees, yellow, skummed with flotsam and with thick soiled gouts of foam as though it had sweat, lathering, like a driven horse. Through the undergrowth it goes with a plaintive sound, a musing sound; in it the unwinded cane and saplings lean as before a little gale, swaying without reflections as though suspended on invisible wires from the branches overhead. Above the ceaseless surface they stand—trees, cane, vines—rootless, severed from the earth, spectral above a scene of immense yet circumscribed desolation filled with the voice of the waste and mournful water.

Cash and I sit in the wagon; Jewel sits the horse at the off rear wheel. The horse is trembling, its eye rolling wild and baby-blue in its long pink face, its breathing stertorous like groaning. He sits erect, poised, looking quietly and steadily and quickly this way and that, his face calm, a little pale, alert. Cash's face is also gravely composed; he and I look at one another with long probing looks, looks that plunge unimpeded through one another's eyes and into the ultimate secret place where for an instant Cash and Darl crouch flagrant and unabashed in all the old terror and the old foreboding, alert and secret and without shame. When we speak our voices are quiet, detached.

"I reckon we're still in the road, all right."

"Tull taken and cut them two big whiteoaks. I heard tell how at high water in the old days they used to line up the ford by them trees."

"I reckon he did that two years ago when he was logging down here. I reckon he never thought that anybody would ever use this ford again."

"I reckon not. Yes, it must have been then. He cut a sight of timber outen here then. Payed off that mortgage with it, I hear tell."

"Yes. Yes, I reckon so. I reckon Vernon could have done that."

"That's a fact. Most folks that logs in this here country, they need a durn good farm to support the sawmill. Or maybe a store. But I reckon Vernon could."

"I reckon so. He's a sight."

"Ay. Vernon is. Yes, it must still be here. He never would have got that timber out of here if he hadn't cleaned out that old road. I reckon we are still on it." He looks about quietly, at the position of the trees, leaning this way and that, looking back along the floorless road shaped vaguely high in air by the position of the lopped and felled trees, as if the road too had been soaked free of earth and floated upward, to leave in its spectral tracing a monument to a still more profound desolation than this above which we now sit, talking quietly of old security and old trivial things. Jewel looks at him, then at me, then his face turns in in that quiet, constant, questing about the scene, the horse trembling quietly and steadily between his knees.

"He could go on ahead slow and sort of feel it out," I say.

"Yes," Cash says, not looking at me. His face is in profile as he looks forward where Jewel has moved on ahead.

"He cant miss the river," I say. "He couldn't miss seeing it fifty yards ahead."

Cash does not look at me, his face in profile. "If I'd just suspicioned it, I could a come down last week and taken a sight on it."

"The bridge was up then," I say. He does not look at me. "Whitfield crossed it a-horseback."

Jewel looks at us again, his expression sober and alert and subdued. His voice is quiet. "What you want me to do?"

"I ought to come down last week and taken a sight on it," Cash says.

"We couldn't have known," I say. "There wasn't any way for us to know."

"I'll ride on ahead," Jewel says. "You can follow where I am." He lifts the horse. It shrinks, bowed; he leans to it, speaking to it, lifting it forward almost bodily, it setting its feet down with gingerly splashings, trembling, breathing harshly. He speaks to it, murmurs to it. "Go on," he says. "I aint going to let nothing hurt you. Go on, now."

"Jewel," Cash says. Jewel does not look back. He lifts the horse on.

"He can swim," I say. "If he'll just give the horse time, anyhow....." When

he was born, he had a bad time of it. Ma would sit in the lamp-light, holding him on a pillow on her lap. We would wake and find her so. There would be no sound from them.

"That pillow was longer than him," Cash says. He is leaning a little forward. "I ought to come down last week and sighted. I ought to done it."

"That's right," I say. "Neither his feet nor his head would reach the end of it. You couldn't have known," I say.

"I ought to done it," he says. He lifts the reins. The mules move, into the traces; the wheels murmur alive in the water. He looks back and down at Addie. "It aint on a balance," he says.

At last the trees open; against the open river Jewel sits the horse, half turned, it belly deep now. Across the river we can see Vernon and pa and Vardaman and Dewey Dell. Vernon is waving at us, waving us further down stream.

"We are too high up," Cash says. Vernon is shouting too, but we cannot make out what he says for the noise of the water. It runs steady and deep now, unbroken, without sense of motion until a log comes along, turning slowly. "Watch it," Cash says. We watch it and see it falter and hang for a moment, the current building up behind it in a thick wave, submerging it for an instant before it shoots up and tumbles on.

"There it is," I say.

"Ay," Cash says. "It's there." We look at Vernon again. He is now flapping his arms up and down. We move on down stream, slowly and carefully, watching Vernon. He drops his hands. "This is the place," Cash says.

"Well, goddamn it, let's get across, then," Jewel says. He moves the horse on.

"You wait," Cash says. Jewel stops again.

"Well, by God——" he says. Cash looks at the water, then he looks back at Addie. "It aint on a balance," he says.

"Then go on back to the goddamn bridge and walk across," Jewel says. "You and Darl both. Let me on that wagon."

Cash does not pay him any attention. "It aint on a balance," he says. "Yes, sir. We got to watch it."

"Watch it, hell," Jewel says. "You get out of that wagon and let me have it. By God, if you're afraid to drive it over....." His eyes are pale as two bleached chips in his face. Cash is looking at him.

"We'll get it over," he says. "I tell you what you do. You ride on back and walk across the bridge and come down the other bank and meet us with the rope. Vernon'll take your horse home with him and keep it till we get back."

"You go to hell," Jewel says.

"You take the rope and come down the bank and be ready with it," Cash says.

"Three cant do no more than two can—one to drive and one to steady it."

"Goddamn you," Jewel says.

"Let Jewel take the end of the rope and cross upstream of us and brace it," I say. "Will you do that, Jewel?"

Jewel watches me, hard. He looks quick at Cash, then back at me, his eyes alert and hard. "I dont give a damn. Just so we do something. Setting here, not lifting a goddamn hand...."

"Let's do that, Cash," I say.

"I reckon we'll have to," Cash says.

The river itself is not a hundred yards across, and pa and Vernon and Vardaman and Dewey Dell are the only things in sight not of that single monotony of desolation leaning with that terrific quality a little from right to left, as though we had reached the place where the motion of the wasted world accelerates just before the final precipice. Yet they appear dwarfed. It is as though the space between us were time: an irrevocable quality. It is as though time, no longer running straight before us in a diminishing line, now runs parallel between us like a looping string, the distance being the doubling accretion of the thread and not the interval between. The mules stand, their fore quarters already sloped a little, their rumps high. They too are breathing now with a deep groaning sound; looking back once, their gaze sweeps across us with in their eyes a wild, sad, profound and despairing quality as though they had already seen in the thick water the shape of the disaster which they could not speak and we could not see.

Cash turns back into the wagon. He lays his hands flat on Addie, rocking her a little. His face is calm, down-sloped, calculant, concerned. He lifts his box of tools and wedges it forward under the seat; together we shove Addie forward, wedging her between the tools and the wagon bed. Then he looks at me.

"No," I say. "I reckon I'll stay. Might take both of us."

From the tool box he takes his coiled rope and carries the end twice around the seat stanchion and passes the end to me without tying it. The other end he pays out to Jewel, who takes a turn about his saddle horn.

He must force the horse down into the current. It moves, highkneed, archnecked, boring and chafing. Jewel sits lightly forward, his knees lifted a little; again his swift alert calm gaze sweeps upon us and on. He lowers the horse into the stream, speaking to it in a soothing murmur. The horse slips, goes under to the saddle, surges to its feet again, the current building up against Jewel's thighs.

"Watch yourself," Cash says.

"I'm on it now," Jewel says. "You can come ahead now."

Cash takes the reins and lowers the team carefully and skillfully into the stream.

I felt the current take us and I knew we were on the ford by that reason, since it was only by means of that slipping contact that we could tell that we were in motion at all. What had once been a flat surface was now a succession of troughs and hillocks lifting and falling about us, shoving at us, teasing at us with light lazy touches in the vain instants of solidity underfoot. Cash looked back at me, and then I knew that we were gone. But I did not realise the reason for the rope until I saw the log. It surged up out of the water and stood for an instant upright upon that surging and heaving desolation like Christ. Get out and let the current take you down to the bend, Cash said, You can make it all right. No, I said, I'd get just as wet that way as this

The log appears suddenly between two hills, as if it had rocketed suddenly from the bottom of the river. Upon the end of it a long gout of foam hangs like the beard of an old man or a goat. When Cash speaks to me I know that he has been watching it all the time, watching it and watching Jewel ten feet ahead of us. "Let the rope go," he says. With his other hand he reaches down and reeves the two turns from the stanchion. "Ride on, Jewel," he says; "see if you can pull us ahead of the log."

Jewel shouts at the horse; again he appears to lift it bodily between his knees. He is just above the top of the ford and the horse has a purchase of some sort for it surges forward, shining wetly half out of water, crashing on in a succession of lunges. It moves unbelievably fast; by that token Jewel realises at last that the rope is free, for I can see him sawing back on the reins, his head turned, as the log rears in a long sluggish lunge between us, bearing down upon the team. They see it too; for a moment they also shine black out of water. Then the downstream one vanishes, dragging the other with him; the wagon sheers crosswise, poised on the crest of the ford as the log strikes it, tilting it up and on. Cash is half turned, the reins running taut from his hand and disappearing into the water, the other hand reached back upon Addie, holding her jammed over against the high side of the wagon. "Jump clear," he says quietly. "Stay away from the team and dont try to fight it. It'll swing you into the bend all right."

"You come too," I say. Vernon and Vardaman are running along the bank, pa and Dewey Dell stand watching us, Dewey Dell with the basket and the package in her arms. Jewel is trying to fight the horse back. The head of one mule appears, its eyes wide; it looks back at us for an instant, making a sound almost human. The head vanishes again.

"Back, Jewel," Cash shouts. "Back, Jewel." For another instant I see him leaning to the tilting wagon, his arm braced back against Addie and his tools; I

see the bearded head of the rearing log strike up again, and beyond it Jewel holding the horse upreared, its head wrenched around, hammering its head with his fist. I jump from the wagon on the downstream side. Between two hills I see the mules once more. They roll up out of the water in succession, turning completely over, their legs stiffly extended as when they had lost contact with the earth.

VARDAMAN



Cash tried but she fell off and Darl jumped going under he went under and Cash hollering to catch her and I hollering running and hollering and Dewey Dell hollering at me Vardaman you vardaman you vardaman and Vernon passed me because he was seeing her come up and she jumped into the water again and Darl hadn't caught her yet

He came up to see and I hollering catch her Darl catch her and he didn't come back because she was too heavy he had to go on catching at her and I hollering catch her darl catch her darl because in the water she could go faster than a man and Darl had to grapple for her so I knew he could catch her because he is the best grabbler even with the mules in the way again they dived up rolling their feet stiff rolling down again and their backs up now and Darl had to again because in the water she could go faster than a man or a woman and I passed Vernon and he wouldn't get in the water and help Darl he wouldn't grapple for her with Darl he knew but he wouldn't help

The mules dived up again diving their legs stiff their stiff legs rolling slow and then Darl again and I hollering catch her darl catch her head her into the bank darl and Vernon wouldn't help and then Darl dodged past the mules where he could he had her under the water coming in to the bank coming in slow because in the water she fought to stay under the water but Darl is strong and he was coming in slow and so I knew he had her because he came slow and I ran down into the water to help and I couldn't stop hollering because Darl was strong and steady holding her under the water even if she did fight he would not let her go he was seeing me and he would hold her and it was all right now it was all right now it was all right

Then he comes up out of the water. He comes a long way up slow before his hands do but he's got to have her got to so I can bear it. Then his hands come up and all of him above the water. I cant stop. I have not got time to try. I will try to when I can but his hands came empty out of the water emptying the water emptying away

“Where is ma, Darl?” I said. “You never got her. You knew she is a fish but you let her get away. You never got her. Darl. Darl. Darl.” I began to run along the bank, watching the mules dive up slow again and then down again.

TULL



When I told Cora how Darl jumped out of the wagon and left Cash sitting there trying to save it and the wagon turning over, and Jewel that was almost to the bank fighting that horse back where it had more sense than to go, she says "And you're one of the folks that says Darl is the queer one, the one that aint bright, and him the only one of them that had sense enough to get off that wagon. I notice Anse was too smart to been on it a-tall."

"He couldn't a done no good, if he'd been there," I said. "They was going about it right and they would have made it if it hadn't a been for that log."

"Log, fiddlesticks," Cora said. "It was the hand of God."

"Then how can you say it was foolish?" I said. "Nobody cant guard against the hand of God. It would be sacrilege to try to."

"Then why dare it?" Cora says. "Tell me that."

"Anse didn't," I said. "That's just what you faulted him for."

"His place was there," Cora said. "If he had been a man, he would a been there instead of making his sons do what he dursn't."

"I dont know what you want, then," I said. "One breath you say they was daring the hand of God to try it, and the next breath you jump on Anse because he wasn't with them." Then she begun to sing again, working at the washtub, with that singing look in her face like she had done give up folks and all their foolishness and had done went on ahead of them, marching up the sky, singing.

The wagon hung for a long time while the current built up under it, shoving it off the ford, and Cash leaning more and more, trying to keep the coffin braced so it wouldn't slip down and finish tilting the wagon over. Soon as the wagon got tilted good, to where the current could finish it, the log went on. It headed

around the wagon and went on good as a swimming man could have done. It was like it had been sent there to do a job and done it and went on.

When the mules finally kicked loose, it looked for a minute like maybe Cash would get the wagon back. It looked like him and the wagon wasn't moving at all, and just Jewel fighting that horse back to the wagon. Then that boy passed me, running and hollering at Darl and the gal trying to catch him, and then I see the mules come rolling slow up out of the water, their legs spraddled stiff like they had balked upside down, and roll on into the water again.

Then the wagon tilted over and then it and Jewel and the horse was all mixed up together. Cash went outen sight, still holding the coffin braced, and then I couldn't tell anything for the horse lunging and splashing. I thought that Cash had give up then and was swimming for it and I was yelling at Jewel to come on back and then all of a sudden him and the horse went under too and I thought they was all going. I knew that the horse had got dragged off the ford too, and with that wild drowning horse and that wagon and that loose box, it was going to be pretty bad, and there I was, standing knee deep in the water, yelling at Anse behind me: "See what you done now? See what you done now?"

The horse come up again. It was headed for the bank now, throwing its head up, and then I saw one of them holding to the saddle on the downstream side, so I started running along the bank, trying to catch sight of Cash because he couldn't swim, yelling at Jewel where Cash was like a durn fool, bad as that boy that was on down the bank still hollering at Darl.

So I went down into the water so I could still keep some kind of a grip in the mud, when I saw Jewel. He was middle deep, so I knew he was on the ford, anyway, leaning hard upstream, and then I see the rope, and then I see the water building up where he was holding the wagon snubbed just below the ford.

So it was Cash holding to the horse when it come splashing and scrambling up the bank, moaning and groaning like a natural man. When I come to it it was just kicking Cash loose from his holt on the saddle. His face turned up a second when he was sliding back into the water. It was gray, with his eyes closed and a long swipe of mud across his face. Then he let go and turned over in the water. He looked just like a old bundle of clothes kind of washing up and down against the bank. He looked like he was laying there in the water on his face, rocking up and down a little, looking at something on the bottom.

We could watch the rope cutting down into the water, and we could feel the weight of the wagon kind of blump and lunge lazy like, like it just as soon as not, and that rope cutting down into the water hard as a iron bar. We could hear the water hissing on it like it was red hot. Like it was a straight iron bar stuck into the bottom and us holding the end of it, and the wagon lazing up and down,

kind of pushing and prodding at us like it had come around and got behind us, lazy like, like it just as soon as not when it made up its mind. There was a shoat come by, blowed up like a balloon: one of them spotted shoats of Lon Quick's. It bumped against the rope like it was a iron bar and bumped off and went on, and us watching that rope slanting down into the water. We watched it.

DARL



Cash lies on his back on the earth, his head raised on a rolled garment. His eyes are closed, his face is gray, his hair plastered in a smooth smear across his forehead as though done with a paint brush. His face appears sunken a little, sagging from the bony ridges of eye sockets, nose, gums, as though the wetting had slacked the firmness which had held the skin full; his teeth, set in pale gums, are parted a little as if he had been laughing quietly. He lies pole-thin in his wet clothes, a little pool of vomit at his head and a thread of it running from the corner of his mouth and down his cheek where he couldn't turn his head quick or far enough, until Dewey Dell stoops and wipes it away with the hem of her dress.

Jewel approaches. He has the plane. "Vernon just found the square," he says. He looks down at Cash, dripping too. "Aint he talked none yet?"

"He had his saw and hammer and chalk-line and rule," I say. "I know that."

Jewel lays the square down. Pa watches him. "They cant be far away," pa says. "It all went together. Was there ere a such misfortunate man."

Jewel does not look at pa. "You better call Vardaman back here," he says. He looks at Cash. Then he turns and goes away. "Get him to talk soon as he can," he says, "so he can tell us what else there was."

We return to the river. The wagon is hauled clear, the wheels chocked (carefully: we all helped; it is as though upon the shabby, familiar, inert shape of the wagon there lingered somehow, latent yet still immediate, that violence which had slain the mules that drew it not an hour since) above the edge of the flood. In the wagon bed it lies profoundly, the long pale planks hushed a little with wetting yet still yellow, like gold seen through water, save for two long

muddy smears. We pass it and go on to the bank.

One end of the rope is made fast to a tree. At the edge of the stream, knee-deep, Vardaman stands, bent forward a little, watching Vernon with rapt absorption. He has stopped yelling and he is wet to the armpits. Vernon is at the other end of the rope, shoulder-deep in the river, looking back at Vardaman. "Further back than that," he says. "You git back by the tree and hold the rope for me, so it cant slip."

Vardaman backs along the rope, to the tree, moving blindly, watching Vernon. When we come up he looks at us once, his eyes round and a little dazed. Then he looks at Vernon again in that posture of rapt alertness.

"I got the hammer too," Vernon says. "Looks like we ought to done already got that chalk-line. It ought to floated."

"Floated clean away," Jewel says. "We wont get it. We ought to find the saw, though."

"I reckon so," Vernon says. He looks at the water. "That chalk-line, too. What else did he have?"

"He aint talked yet," Jewel says, entering the water. He looks back at me. "You go back and get him roused up to talk," he says.

"Pa's there," I say. I follow Jewel into the water, along the rope. It feels alive in my hand, bellied faintly in a prolonged and resonant arc. Vernon is watching me.

"You better go," he says. "You better be there."

"Let's see what else we can get before it washes on down," I say.

We hold to the rope, the current curling and dimpling about our shoulders. But beneath that false blandness the true force of it leans against us lazily. I had not thought that water in July could be so cold. It is like hands molding and prodding at the very bones. Vernon is still looking back toward the bank.

"Reckon it'll hold us all?" he says. We too look back, following the rigid bar of the rope as it rises from the water to the tree and Vardaman crouched a little beside it, watching us. "Wish my mule wouldn't strike out for home," Vernon says.

"Come on," Jewel says. "Let's get outen here."

We submerge in turn, holding to the rope, being clutched by one another while the cold wall of the water sucks the slanting mud backward and upstream from beneath our feet and we are suspended so, groping along the cold bottom. Even the mud there is not still. It has a chill, scouring quality, as though the earth under us were in motion too. We touch and fumble at one another's extended arms, letting ourselves go cautiously against the rope; or, erect in turn, watch the water suck and boil where one of the other two gropes beneath the surface. Pa

has come down to the shore, watching us.

Vernon comes up, streaming, his face sloped down into his pursed blowing mouth. His mouth is bluish, like a circle of weathered rubber. He has the rule.

"He'll be glad of that," I say. "It's right new. He bought it just last month out of the catalogue."

"If we just knowed for sho what else," Vernon says, looking over his shoulder and then turning to face where Jewel had disappeared. "Didn't he go down fore me?" Vernon says.

"I dont know," I say. "I think so. Yes. Yes, he did."

We watch the thick curling surface, streaming away from us in slow whorls.

"Give him a pull on the rope," Vernon says.

"He's on your end of it," I say.

"Aint nobody on my end of it," he says.

"Pull it in," I say. But he has already done that, holding the end above the water; and then we see Jewel. He is ten yards away; he comes up, blowing, and looks at us, tossing his long hair back with a jerk of his head, then he looks toward the bank; we can see him filling his lungs.

"Jewel," Vernon says, not loud, but his voice going full and clear along the water, peremptory yet tactful. "It'll be back here. Better come back."

Jewel dives again. We stand there, leaning back against the current, watching the water where he disappeared, holding the dead rope between us like two men holding the nozzle of a fire hose, waiting for the water. Suddenly Dewey Dell is behind us in the water. "You make him come back," she says. "Jewel!" she says. He comes up again, tossing his hair back from his eyes. He is swimming now, toward the bank, the current sweeping him downstream quartering. "You, Jewel!" Dewey Dell says. We stand holding the rope and see him gain the bank and climb out. As he rises from the water, he stoops and picks up something. He comes back along the bank. He has found the chalk-line. He comes opposite us and stands there, looking about as if he were seeking something. Pa goes on down the bank. He is going back to look at the mules again where their round bodies float and rub quietly together in the slack water within the bend.

"What did you do with the hammer, Vernon?" Jewel says.

"I give it to him," Vernon says, jerking his head at Vardaman. Vardaman is looking after pa. Then he looks at Jewel. "With the square." Vernon is watching Jewel. He moves toward the bank, passing Dewey Dell and me.

"You get on out of here," I say. She says nothing, looking at Jewel and Vernon.

"Where's the hammer?" Jewel says. Vardaman scuttles up the bank and fetches it.

"It's heavier than the saw," Vernon says. Jewel is tying the end of the chalk-line about the hammer shaft.

"Hammer's got the most wood in it," Jewel says. He and Vernon face one another, watching Jewel's hands.

"And flatter, too," Vernon says. "It'd float three to one, almost. Try the plane."

Jewel looks at Vernon. Vernon is tall, too; long and lean, eye to eye they stand in their close wet clothes. Lon Quick could look even at a cloudy sky and tell the time to ten minutes. Big Lon I mean, not little Lon.

"Why dont you get out of the water?" I say.

"It wont float like a saw," Jewel says.

"It'll float nigher to a saw than a hammer will," Vernon says.

"Bet you," Jewel says.

"I wont bet," Vernon says.

They stand there, watching Jewel's still hands.

"Hell," Jewel says. "Get the plane, then."

So they get the plane and tie it to the chalk-line and enter the water again. Pa comes back along the bank. He stops for a while and looks at us, hunched, mournful, like a failing steer or an old tall bird.

Vernon and Jewel return, leaning against the current. "Get out of the way," Jewel says to Dewey Dell. "Get out of the water."

She crowds against me a little so they can pass, Jewel holding the plane high as though it were perishable, the blue string trailing back over his shoulder. They pass us and stop; they fall to arguing quietly about just where the wagon went over.

"Darl ought to know," Vernon says. They look at me.

"I dont know," I says. "I wasn't there that long."

"Hell," Jewel says. They move on, gingerly, leaning against the current, reading the ford with their feet.

"Have you got a holt of the rope?" Vernon says. Jewel does not answer. He glances back at the shore, calculant, then at the water. He flings the plane outward, letting the string run through his fingers, his fingers turning blue where it runs over them. When the line stops, he hands it back to Vernon.

"Better let me go this time," Vernon says. Again Jewel does not answer; we watch him duck beneath the surface.

"Jewel," Dewey Dell whimpers.

"It aint so deep there," Vernon says. He does not look back. He is watching the water where Jewel went under.

When Jewel comes up he has the saw.

When we pass the wagon pa is standing beside it, scrubbing at the two mud smears with a handful of leaves. Against the jungle Jewel's horse looks like a patchwork quilt hung on a line.

Cash has not moved. We stand above him, holding the plane, the saw, the hammer, the square, the rule, the chalk-line, while Dewey Dell squats and lifts Cash's head. "Cash," she says; "Cash."

He opens his eyes, staring profoundly up at our inverted faces.

"If ever was such a misfortunate man," pa says.

"Look, Cash," we say, holding the tools up so he can see; "what else did you have?"

He tries to speak, rolling his head, shutting his eyes.

"Cash," we say; "Cash."

It is to vomit he is turning his head. Dewey Dell wipes his mouth on the wet hem of her dress; then he can speak.

"It's his saw-set," Jewel says. "The new one he bought when he bought the rule." He moves, turning away. Vernon looks up after him, still squatting. Then he rises and follows Jewel down to the water.

"If ever was such a misfortunate man," pa says. He looms tall above us as we squat; he looks like a figure carved clumsily from tough wood by a drunken caricaturist. "It's a trial," he says. "But I dont begrudge her it. No man can say I begrudge her it." Dewey Dell has laid Cash's head back on the folded coat, twisting his head a little to avoid the vomit. Beside him his tools lie. "A fellow might call it lucky it was the same leg he broke when he fell offen that church," pa says. "But I dont begrudge her it."

Jewel and Vernon are in the river again. From here they do not appear to violate the surface at all; it is as though it had severed them both at a single blow, the two torsos moving with infinitesimal and ludicrous care upon the surface. It looks peaceful, like machinery does after you have watched it and listened to it for a long time. As though the clotting which is you had dissolved into the myriad original motion, and seeing and hearing in themselves blind and deaf; fury in itself quiet with stagnation. Squatting, Dewey Dell's wet dress shapes for the dead eyes of three blind men those mammalian ludicrousities which are the horizons and the valleys of the earth.

CASH



It wasn't on a balance. I told them that if they wanted it to tote and ride on a balance, they would have to

CORA



One day we were talking. She had never been pure religious, not even after that summer at the camp meeting when Brother Whitfield wrestled with her spirit, singled her out and strove with the vanity in her mortal heart, and I said to her many a time, "God gave you children to comfort your hard human lot and for a token of His own suffering and love, for in love you conceived and bore them." I said that because she took God's love and her duty to Him too much as a matter of course, and such conduct is not pleasing to Him. I said, "He gave us the gift to raise our voices in His undying praise" because I said there is more rejoicing in heaven over one sinner than over a hundred that never sinned. And she said "My daily life is an acknowledgment and expiation of my sin" and I said "Who are you, to say what is sin and what is not sin? It is the Lord's part to judge; ours to praise His mercy and His holy name in the hearing of our fellow mortals" because He alone can see into the heart, and just because a woman's life is right in the sight of man, she cant know if there is no sin in her heart without she opens her heart to the Lord and receives His grace. I said, "Just because you have been a faithful wife is no sign that there is no sin in your heart, and just because your life is hard is no sign that the Lord's grace is absolving you." And she said, "I know my own sin. I know that I deserve my punishment. I do not begrudge it." And I said, "It is out of your vanity that you would judge sin and salvation in the Lord's place. It is our mortal lot to suffer and to raise our voices in praise of Him who judges the sin and offers the salvation through our trials and tribulations time out of mind amen. Not even after Brother Whitfield, a godly man if ever one breathed God's breath, prayed for you and strove as never a man could except him," I said.

Because it is not us that can judge our sins or know what is sin in the Lord's eyes. She has had a hard life, but so does every woman. But you'd think from the way she talked that she knew more about sin and salvation than the Lord God Himself, than them who have strove and labored with the sin in this human world. When the only sin she ever committed was being partial to Jewel that never loved her and was its own punishment, in preference to Darl that was touched by God Himself and considered queer by us mortals and that did love her. I said, "There is your sin. And your punishment too. Jewel is your punishment. But where is your salvation? And life is short enough," I said, "to win eternal grace in. And God is a jealous God. It is His to judge and to mete; not yours."

"I know," she said. "I——" Then she stopped, and I said,
"Know what?"

"Nothing," she said. "He is my cross and he will be my salvation. He will save me from the water and from the fire. Even though I have laid down my life, he will save me."

"How do you know, without you open your heart to Him and lift your voice in His praise?" I said. Then I realised that she did not mean God. I realised that out of the vanity of her heart she had spoken sacrilege. And I went down on my knees right there. I begged her to kneel and open her heart and cast from it the devil of vanity and cast herself upon the mercy of the Lord. But she wouldn't. She just sat there, lost in her vanity and her pride, that had closed her heart to God and set that selfish mortal boy in His place. Kneeling there I prayed for her. I prayed for that poor blind woman as I had never prayed for me and mine.

ADDIE



In the afternoon when school was out and the last one had left with his little dirty snuffling nose, instead of going home I would go down the hill to the spring where I could be quiet and hate them. It would be quiet there then, with the water bubbling up and away and the sun slanting quiet in the trees and the quiet smelling of damp and rotting leaves and new earth; especially in the early spring, for it was worst then.

I could just remember how my father used to say that the reason for living was to get ready to stay dead a long time. And when I would have to look at them day after day, each with his and her secret and selfish thought, and blood strange to each other blood and strange to mine, and think that this seemed to be the only way I could get ready to stay dead, I would hate my father for having ever planted me. I would look forward to the times when they faulted, so I could whip them. When the switch fell I could feel it upon my flesh; when it welted and ridged it was my blood that ran, and I would think with each blow of the switch: Now you are aware of me! Now I am something in your secret and selfish life, who have marked your blood with my own for ever and ever.

And so I took Anse. I saw him pass the school house three or four times before I learned that he was driving four miles out of his way to do it. I noticed then how he was beginning to hump—a tall man and young—so that he looked already like a tall bird hunched in the cold weather, on the wagon seat. He would pass the school house, the wagon creaking slow, his head turning slow to watch the door of the school house as the wagon passed, until he went on around the curve and out of sight. One day I went to the door and stood there when he passed. When he saw me he looked quickly away and did not look back again.

In the early spring it was worst. Sometimes I thought that I could not bear it, lying in bed at night, with the wild geese going north and their honking coming faint and high and wild out of the wild darkness, and during the day it would seem as though I couldn't wait for the last one to go so I could go down to the spring. And so when I looked up that day and saw Anse standing there in his Sunday clothes, turning his hat round and round in his hands, I said:

"If you've got any womenfolks, why in the world dont they make you get your hair cut?"

"I aint got none," he said. Then he said suddenly, driving his eyes at me like two hounds in a strange yard: "That's what I come to see you about."

"And make you hold your shoulders up," I said. "You haven't got any? But you've got a house. They tell me you've got a house and a good farm. And you live there alone, doing for yourself, do you?" He just looked at me, turning the hat in his hands. "A new house," I said. "Are you going to get married?"

And he said again, holding his eyes to mine: "That's what I come to see you about."

Later he told me, "I aint got no people. So that wont be no worry to you. I dont reckon you can say the same."

"No. I have people. In Jefferson."

His face fell a little. "Well, I got a little property. I'm forehanded; I got a good honest name. I know how town folks are, but maybe when they talk to me....."

"They might listen," I said. "But they'll be hard to talk to." He was watching my face. "They're in the cemetery."

"But your living kin," he said. "They'll be different."

"Will they?" I said. "I dont know. I never had any other kind."

So I took Anse. And when I knew that I had Cash, I knew that living was terrible and that this was the answer to it. That was when I learned that words are no good; that words dont ever fit even what they are trying to say at. When he was born I knew that motherhood was invented by someone who had to have a word for it because the ones that had the children didn't care whether there was a word for it or not. I knew that fear was invented by someone that had never had the fear; pride, who never had the pride. I knew that it had been, not that they had dirty noses, but that we had had to use one another by words like spiders dangling by their mouths from a beam, swinging and twisting and never touching, and that only through the blows of the switch could my blood and their blood flow as one stream. I knew that it had been, not that my aloneness had to be violated over and over each day, but that it had never been violated until Cash came. Not even by Anse in the nights.

He had a word, too. Love, he called it. But I had been used to words for a long

time. I knew that that word was like the others: just a shape to fill a lack; that when the right time came, you wouldn't need a word for that anymore than for pride or fear. Cash did not need to say it to me nor I to him, and I would say, Let Anse use it, if he wants to. So that it was Anse or love; love or Anse: it didn't matter.

I would think that even while I lay with him in the dark and Cash asleep in the cradle within the swing of my hand. I would think that if he were to wake and cry, I would suckle him, too. Anse or love: it didn't matter. My aloneness had been violated and then made whole again by the violation: time, Anse, love, what you will, outside the circle.

Then I found that I had Darl. At first I would not believe it. Then I believed that I would kill Anse. It was as though he had tricked me, hidden within a word like within a paper screen and struck me in the back through it. But then I realised that I had been tricked by words older than Anse or love, and that the same word had tricked Anse too, and that my revenge would be that he would never know I was taking revenge. And when Darl was born I asked Anse to promise to take me back to Jefferson when I died, because I knew that father had been right, even when he couldn't have known he was right anymore than I could have known I was wrong.

"Nonsense," Anse said; "you and me aint nigh done chapping yet, with just two."

He did not know that he was dead, then. Sometimes I would lie by him in the dark, hearing the land that was now of my blood and flesh, and I would think: Anse. Why Anse. Why are you Anse. I would think about his name until after a while I could see the word as a shape, a vessel, and I would watch him liquify and flow into it like cold molasses flowing out of the darkness into the vessel, until the jar stood full and motionless: a significant shape profoundly without life like an empty door frame; and then I would find that I had forgotten the name of the jar. I would think: The shape of my body where I used to be a virgin is in the shape of a and I couldn't think *Anse*, couldn't remember *Anse*. It was not that I could think of myself as no longer unvirgin, because I was three now. And when I would think *Cash* and *Darl* that way until their names would die and solidify into a shape and then fade away, I would say, All right. It doesn't matter. It doesn't matter what they call them.

And so when Cora Tull would tell me I was not a true mother, I would think how words go straight up in a thin line, quick and harmless, and how terribly doing goes along the earth, clinging to it, so that after a while the two lines are too far apart for the same person to straddle from one to the other; and that sin and love and fear are just sounds that people who never sinned nor loved nor

feared have for what they never had and cannot have until they forget the words. Like Cora, who could never even cook.

She would tell me what I owed to my children and to Anse and to God. I gave Anse the children. I did not ask for them. I did not even ask him for what he could have given me: not-Anse. That was my duty to him, to not ask that, and that duty I fulfilled. I would be I; I would let him be the shape and echo of his word. That was more than he asked, because he could not have asked for that and been Anse, using himself so with a word.

And then he died. He did not know he was dead. I would lie by him in the dark, hearing the dark land talking of God's love and His beauty and His sin; hearing the dark voicelessness in which the words are the deeds, and the other words that are not deeds, that are just the gaps in people's lacks, coming down like the cries of the geese out of the wild darkness in the old terrible nights, fumbling at the deeds like orphans to whom are pointed out in a crowd two faces and told, That is your father, your mother.

I believed that I had found it. I believed that the reason was the duty to the alive, to the terrible blood, the red bitter flood boiling through the land. I would think of sin as I would think of the clothes we both wore in the world's face, of the circumspection necessary because he was he and I was I; the sin the more utter and terrible since he was the instrument ordained by God who created the sin, to sanctify that sin He had created. While I waited for him in the woods, waiting for him before he saw me, I would think of him as dressed in sin. I would think of him as thinking of me as dressed also in sin, he the more beautiful since the garment which he had exchanged for sin was sanctified. I would think of the sin as garments which we would remove in order to shape and coerce the terrible blood to the forlorn echo of the dead word high in the air. Then I would lay with Anse again—I did not lie to him: I just refused, just as I refused my breast to Cash and Darl after their time was up—hearing the dark land talking the voiceless speech.

I hid nothing. I tried to deceive no one. I would not have cared. I merely took the precautions that he thought necessary for his sake, not for my safety, but just as I wore clothes in the world's face. And I would think then when Cora talked to me, of how the high dead words in time seemed to lose even the significance of their dead sound.

Then it was over. Over in the sense that he was gone and I knew that, see him again though I would, I would never again see him coming swift and secret to me in the woods dressed in sin like a gallant garment already blowing aside with the speed of his secret coming.

But for me it was not over. I mean, over in the sense of beginning and ending,

because to me there was no beginning nor ending to anything then. I even held Anse refraining still, not that I was holding him recessional, but as though nothing else had ever been. My children were of me alone, of the wild blood boiling along the earth, of me and of all that lived; of none and of all. Then I found that I had Jewel. When I waked to remember to discover it, he was two months gone.

My father said that the reason for living is getting ready to stay dead. I knew at last what he meant and that he could not have known what he meant himself, because a man cannot know anything about cleaning up the house afterward. And so I have cleaned my house. With Jewel—I lay by the lamp, holding up my own head, watching him cap and suture it before he breathed—the wild blood boiled away and the sound of it ceased. Then there was only the milk, warm and calm, and I lying calm in the slow silence, getting ready to clean my house.

I gave Anse Dewey Dell to negative Jewel. Then I gave him Vardaman to replace the child I had robbed him of. And now he has three children that are his and not mine. And then I could get ready to die.

One day I was talking to Cora. She prayed for me because she believed I was blind to sin, wanting me to kneel and pray too, because people to whom sin is just a matter of words, to them salvation is just words too.

WHITFIELD



When they told me she was dying, all that night I wrestled with Satan, and I emerged victorious. I woke to the enormity of my sin; I saw the true light at last, and I fell on my knees and confessed to God and asked His guidance and received it. "Rise," He said; "repair to that home in which you have put a living lie, among those people with whom you have outraged My Word; confess your sin aloud. It is for them, for that deceived husband, to forgive you: not I." So I went. I heard that Tull's bridge was gone; I said "Thanks, O Lord, O Mighty Ruler of all;" for by those dangers and difficulties which I should have to surmount I saw that He had not abandoned me; that my reception again into His holy peace and love would be the sweeter for it. "Just let me not perish before I have begged the forgiveness of the man whom I betrayed," I prayed; "let me not be too late; let not the tale of mine and her transgression come from her lips instead of mine. She had sworn then that she would never tell it, but eternity is a fearsome thing to face: have I not wrestled thigh to thigh with Satan myself? let me not have also the sin of her broken vow upon my soul. Let not the waters of Thy Mighty Wrath encompass me until I have cleansed my soul in the presence of them whom I injured."

It was His hand that bore me safely above the flood, that fended from me the dangers of the waters. My horse was frightened, and my own heart failed me as the logs and the uprooted trees bore down upon my littleness. But not my soul: time after time I saw them averted at destruction's final instant, and I lifted my voice above the noise of the flood: "Praise to Thee, O Mighty Lord and King. By this token shall I cleanse my soul and gain again into the fold of Thy undying love."

I knew then that forgiveness was mine. The flood, the danger, behind, and as I rode on across the firm earth again and the scene of my Gethsemane drew closer and closer, I framed the words which I should use. I would enter the house; I would stop her before she had spoken; I would say to her husband: "Anse, I have sinned. Do with me as you will."

It was already as though it were done. My soul felt freer, quieter than it had in years; already I seemed to dwell in abiding peace again as I rode on. To either side I saw His hand; in my heart I could hear His voice: "Courage. I am with thee."

Then I reached Tull's house. His youngest girl came out and called to me as I was passing. She told me that she was already dead.

I have sinned, O Lord. Thou knowest the extent of my remorse and the will of my spirit. But He is merciful; He will accept the will for the deed, Who knew that when I framed the words of my confession it was to Anse I spoke them, even though he was not there. It was He in His infinite wisdom that restrained the tale from her dying lips as she lay surrounded by those who loved and trusted her; mine the travail by water which I sustained by the strength of His hand. Praise to Thee in Thy bounteous and omnipotent love; O praise.

I entered the house of bereavement, the lowly dwelling where another erring mortal lay while her soul faced the awful and irrevocable judgment, peace to her ashes.

"God's grace upon this house," I said.

DARL



On the horse he rode up to Armstid's and came back on the horse, leading Armstid's team. We hitched up and laid Cash on top of Addie. When we laid him down he vomited again, but he got his head over the wagon bed in time.

"He taken a lick in the stomach, too," Vernon said.

"The horse may have kicked him in the stomach too," I said. "Did he kick you in the stomach, Cash?"

He tried to say something. Dewey Dell wiped his mouth again.

"What's he say?" Vernon said.

"What is it, Cash?" Dewey Dell said. She leaned down. "His tools," she said. Vernon got them and put them into the wagon. Dewey Dell lifted Cash's head so he could see. We drove on, Dewey Dell and I sitting beside Cash to steady him *and he riding on ahead on the horse*. Vernon stood watching us for a while. Then he turned and went back toward the bridge. He walked gingerly, beginning to flap the wet sleeves of his shirt as though he had just got wet.

He was sitting the horse before the gate. Armstid was waiting at the gate. We stopped *and he got down* and we lifted Cash down and carried him into the house, where Mrs Armstid had the bed ready. We left her and Dewey Dell undressing him.

We followed pa out to the wagon. He went back and got into the wagon and drove on, we following on foot, into the lot. The wetting had helped, because Armstid said, "You're welcome to the house. You can put it there." *He followed, leading the horse, and stood beside the wagon, the reins in his hand.*

"I thank you," pa said. "We'll use in the shed yonder. I know it's a imposition on you."

“You’re welcome to the house,” Armstid said. *He had that wooden look on his face again; that bold, surly, high-colored rigid look like his face and eyes were two colors of wood, the wrong one pale and the wrong one dark. His shirt was beginning to dry, but it still clung close upon him when he moved.*

“She would appreciate it,” pa said.

We took the team out and rolled the wagon back under the shed. One side of the shed was open.

“It wont rain under,” Armstid said. “But if you’d rather.....”

Back of the barn was some rusted sheets of tin roofing. We took two of them and propped them against the open side.

“You’re welcome to the house,” Armstid said.

“I thank you,” pa said. “I’d take it right kind if you’d give them a little snack.”

“Sho,” Armstid said. “Lula’ll have supper ready soon as she gets Cash comfortable.” *He had gone back to the horse and he was taking the saddle off, his damp shirt lapping flat to him when he moved.*

Pa wouldn’t come in the house.

“Come in and eat,” Armstid said. “It’s nigh ready.”

“I wouldn’t crave nothing,” pa said. “I thank you.”

“You come in and dry and eat,” Armstid said. “It’ll be all right here.”

“It’s for her,” pa said. “It’s for her sake I am taking the food. I got no team, no nothing. But she will be grateful to ere a one of you.”

“Sho,” Armstid said. “You folks come in and dry.”

But after Armstid gave pa a drink, he felt better, and when we went in to see about Cash *he hadn’t come in with us. When I looked back he was leading the horse into the barn* he was already talking about getting another team, and by supper time he had good as bought it. *He is down there in the barn, sliding fluidly past the gaudy lunging swirl, into the stall with it. He climbs onto the manger and drags the hay down and leaves the stall and seeks and finds the curry-comb. Then he returns and slips quickly past the single crashing thump and up against the horse, where it cannot overreach. He applies the curry-comb, holding himself within the horse’s striking radius with the agility of an acrobat, cursing the horse in a whisper of obscene caress. Its head flashes back, tooth-cropped; its eyes roll in the dusk like marbles on a gaudy velvet cloth as he strikes it upon the face with the back of the curry-comb.*

ARMSTID



But time I give him another sup of whisky and supper was about ready, he had done already bought a team from somebody, on a credit. Picking and choosing he were by then, saying how he didn't like this span and wouldn't put his money in nothing so-and-so owned, not even a hen coop.

"You might try Snopes," I said. "He's got three-four span. Maybe one of them would suit you."

Then he begun to mumble his mouth, looking at me like it was me that owned the only span of mules in the county and wouldn't sell them to him, when I knew that like as not it would be my team that would ever get them out of the lot at all. Only I dont know what they would do with them, if they had a team. Littlejohn had told me that the levee through Haley bottom had done gone for two miles and that the only way to get to Jefferson would be to go around by Mottson. But that was Anse's business.

"He's a close man to trade with," he says, mumbling his mouth. But when I give him another sup after supper, he cheered up some. He was aiming to go back to the barn and set up with her. Maybe he thought that if he just stayed down there ready to take out, Santa Claus would maybe bring him a span of mules. "But I reckon I can talk him around," he says. "A man'll always help a fellow in a tight, if he's got ere a drop of Christian blood in him."

"Of course you're welcome to the use of mine," I said, me knowing how much he believed that was the reason.

"I thank you," he said. "She'll want to go in ourn," and him knowing how much I believed that was the reason.

After supper Jewel rode over to the Bend to get Peabody. I heard he was to be

there today at Varner's. Jewel come back about midnight. Peabody had gone down below Inverness somewhere, but Uncle Billy come back with him, with his satchel of horse-physic. Like he says, a man aint so different from a horse or a mule, come long come short, except a mule or a horse has got a little more sense. "What you been into now, boy?" he says, looking at Cash. "Get me a mattress and a chair and a glass of whisky," he says.

He made Cash drink the whisky, then he run Anse out of the room. "Lucky it was the same leg he broke last summer," Anse says, mournful, mumbling and blinking. "That's something."

We folded the mattress across Cash's legs and set the chair on the mattress and me and Jewel set on the chair and the gal held the lamp and Uncle Billy taken a chew of tobacco and went to work. Cash fought pretty hard for a while, until he fainted. Then he laid still, with big balls of sweat standing on his face like they had started to roll down and then stopped to wait for him.

When he waked up, Uncle Billy had done packed up and left. He kept on trying to say something until the gal leaned down and wiped his mouth. "It's his tools," she said.

"I brought them in," Darl said. "I got them."

He tried to talk again; she leaned down. "He wants to see them," she said. So Darl brought them in where he could see them. They shoved them under the side of the bed, where he could reach his hand and touch them when he felt better. Next morning Anse taken that horse and rode over to the Bend to see Snopes. Him and Jewel stood in the lot talking a while, then Anse got on the horse and rode off. I reckon that was the first time Jewel ever let anybody ride that horse, and until Anse come back he hung around in that swole-up way, watching the road like he was half a mind to take out after Anse and get the horse back.

Along toward nine o'clock it begun to get hot. That was when I see the first buzzard. Because of the wetting, I reckon. Anyway it wasn't until well into the day that I see them. Lucky the breeze was setting away from the house, so it wasn't until well into the morning. But soon as I see them it was like I could smell it in the field a mile away from just watching them, and them circling and circling for everybody in the county to see what was in my barn.

I was still a good half a mile from the house when I heard that boy yelling. I thought maybe he might have fell into the well or something, so I whipped up and come into the lot on the lope.

There must have been a dozen of them setting along the ridge-pole of the barn, and that boy was chasing another one around the lot like it was a turkey and it just lifting enough to dodge him and go flopping back to the roof of the shed again where he had found it setting on the coffin. It had got hot then, right,

and the breeze had dropped or changed or something, so I went and found Jewel, but Lula come out.

"You got to do something," she said. "It's a outrage."

"That's what I aim to do," I said.

"It's a outrage," she said. "He should be lawed for treating her so."

"He's getting her into the ground the best he can," I said. So I found Jewel and asked him if he didn't want to take one of the mules and go over to the Bend and see about Anse. He didn't say nothing. He just looked at me with his jaws going bone-white and them bone-white eyes of hisn, then he went and begun to call Darl.

"What you fixing to do?" I said.

He didn't answer. Darl come out. "Come on," Jewel said.

"What you aim to do?" Darl said.

"Going to move the wagon," Jewel said over his shoulder.

"Dont be a fool," I said. "I never meant nothing. You couldn't help it." And Darl hung back too, but nothing wouldn't suit Jewel.

"Shut your goddamn mouth," he says.

"It's got to be somewhere," Darl said. "We'll take out soon as pa gets back."

"You wont help me?" Jewel says, them white eyes of hisn kind of blaring and his face shaking like he had a aguer.

"No," Darl said. "I wont. Wait till pa gets back."

So I stood in the door and watched him push and haul at that wagon. It was on a downhill, and once I thought he was fixing to beat out the back end of the shed. Then the dinner bell rung. I called him, but he didn't look around. "Come on to dinner," I said. "Tell that boy." But he didn't answer, so I went on to dinner. The gal went down to get that boy, but she come back without him. About half through dinner we heard him yelling again, running that buzzard out.

"It's a outrage," Lula said; "a outrage."

"He's doing the best he can," I said. "A fellow dont trade with Snopes in thirty minutes. They'll set in the shade all afternoon to dicker."

"Do?" she says. "Do? He's done too much, already."

And I reckon he had. Trouble is, his quitting was just about to start our doing. He couldn't buy no team from nobody, let alone Snopes, withouten he had something to mortgage he didn't know would mortgage yet. And so when I went back to the field I looked at my mules and same as told them goodbye for a spell. And when I come back that evening and the sun shining all day on that shed, I wasn't so sho I would regret it.

He come riding up just as I went out to the porch, where they all was. He looked kind of funny: kind of more hangdog than common, and kind of proud

too. Like he had done something he thought was cute but wasn't so sho now how other folks would take it.

"I got a team," he said.

"You bought a team from Snopes?" I said.

"I reckon Snopes aint the only man in this country that can drive a trade," he said.

"Sho," I said. He was looking at Jewel, with that funny look, but Jewel had done got down from the porch and was going toward the horse. To see what Anse had done to it, I reckon.

"Jewel," Anse says. Jewel looked back. "Come here," Anse says. Jewel come back a little and stopped again.

"What you want?" he said.

"So you got a team from Snopes," I said. "He'll send them over tonight, I reckon? You'll want a early start tomorrow, long as you'll have to go by Mottson."

Then he quit looking like he had been for a while. He got that badgered look like he used to have, mumbling his mouth.

"I do the best I can," he said. "Fore God, if there were ere a man in the living world suffered the trials and floutings I have suffered."

"A fellow that just beat Snopes in a trade ought to feel pretty good," I said. "What did you give him, Anse?"

He didn't look at me. "I give a chattel mortgage on my cultivator and seeder," he said.

"But they aint worth forty dollars. How far do you aim to get with a forty dollar team?"

They were all watching him now, quiet and steady. Jewel was stopped, halfway back, waiting to go on to the horse. "I give other things," Anse said. He begun to mumble his mouth again, standing there like he was waiting for somebody to hit him and him with his mind already made up not to do nothing about it.

"What other things?" Darl said.

"Hell," I said. "You take my team. You can bring them back. I'll get along someway."

"So that's what you were doing in Cash's clothes last night," Darl said. He said it just like he was reading it outen the paper. Like he never give a durn himself one way or the other. Jewel had come back now, standing there, looking at Anse with them marble eyes of hisn. "Cash aimed to buy that talking machine from Suratt with that money," Darl said.

Anse stood there, mumbling his mouth. Jewel watched him. He aint never

blinked yet.

"But that's just eight dollars more," Darl said, in that voice like he was just listening and never give a durn himself. "That still wont buy a team."

Anse looked at Jewel, quick, kind of sliding his eyes that way, then he looked down again. "God knows, if there were ere a man," he says. Still they didn't say nothing. They just watched him, waiting, and him sliding his eyes toward their feet and up their legs but no higher. "And the horse," he says.

"What horse?" Jewel said. Anse just stood there. I be durn, if a man cant keep the upper hand of his sons, he ought to run them away from home, no matter how big they are. And if he cant do that, I be durn if he oughtn't to leave himself. I be durn if I wouldn't. "You mean, you tried to swap my horse?" Jewel says.

Anse stands there, dangle-armed. "For fifteen years I aint had a tooth in my head," he says. "God knows it. He knows in fifteen years I aint et the victuals He aimed for man to eat to keep his strength up, and me saving a nickel here and a nickel there so my family wouldn't suffer it, to buy them teeth so I could eat God's appointed food. I give that money. I thought that if I could do without eating, my sons could do without riding. God knows I did."

Jewel stands with his hands on his hips, looking at Anse. Then he looks away. He looked out across the field, his face still as a rock, like it was somebody else talking about somebody else's horse and him not even listening. Then he spit, slow, and said "Hell" and he turned and went on to the gate and unhitched the horse and got on it. It was moving when he come into the saddle and by the time he was on it they was tearing down the road like the Law might have been behind them. They went out of sight that way, the two of them looking like some kind of a spotted cyclone.

"Well," I says. "You take my team," I said. But he wouldn't do it. And they wouldn't even stay, and that boy chasing them buzzards all day in the hot sun until he was nigh as crazy as the rest of them. "Leave Cash here, anyway," I said. But they wouldn't do that. They made a pallet for him with quilts on top of the coffin and laid him on it and set his tools by him, and we put my team in and hauled the wagon about a mile down the road.

"If we'll bother you here," Anse says, "just say so."

"Sho," I said. "It'll be fine here. Safe, too. Now let's go back and eat supper."

"I thank you," Anse said. "We got a little something in the basket. We can make out."

"Where'd you get it?" I said.

"We brought it from home."

"But it'll be stale now," I said. "Come and get some hot victuals."

But they wouldn't come. "I reckon we can make out," Anse said. So I went home and et and taken a basket back to them and tried again to make them come back to the house.

"I thank you," he said. "I reckon we can make out." So I left them there, squatting around a little fire, waiting; God knows what for.

I come on home. I kept thinking about them there, and about that fellow tearing away on that horse. And that would be the last they would see of him. And I be durn if I could blame him. Not for wanting to not give up his horse, but for getting shut of such a durn fool as Anse.

Or that's what I thought then. Because be durn if there aint something about a durn fellow like Anse that seems to make a man have to help him, even when he knows he'll be wanting to kick himself next minute. Because about a hour after breakfast next morning Eustace Grimm that works Snopes' place come up with a span of mules, hunting Anse.

"I thought him and Anse never traded," I said.

"Sho," Eustace said. "All they liked was the horse. Like I said to Mr Snopes, he was letting this team go for fifty dollars, because if his uncle Flem had a just kept them Texas horses when he owned them, Anse wouldn't a never——"

"The horse?" I said. "Anse's boy taken that horse and cleared out last night, probably half way to Texas by now, and Anse——"

"I didn't know who brung it," Eustace said. "I never see them. I just found the horse in the barn this morning when I went to feed, and I told Mr Snopes and he said to bring the team on over here."

Well, that'll be the last they'll ever see of him now, sho enough. Come Christmas time they'll maybe get a postal card from him in Texas, I reckon. And if it hadn't a been Jewel, I reckon it'd a been me; I owe him that much, myself. I be durn if Anse dont conjure a man, some way. I be durn if he aint a sight.

VARDAMAN



Now there are seven of them, in little tall black circles.

“Look, Darl,” I say; “see?”

He looks up. We watch them in little tall black circles of not-moving.

“Yesterday there were just four,” I say.

There were more than four on the barn.

“Do you know what I would do if he tries to light on the wagon again?” I say.

“What would you do?” Darl says.

“I wouldn’t let him light on her,” I say. “I wouldn’t let him light on Cash, either.”

Cash is sick. He is sick on the box. But my mother is a fish.

“We got to get some medicine in Mottson,” pa says. “I reckon we’ll just have to.”

“How do you feel, Cash?” Darl says.

“It dont bother none,” Cash says.

“Do you want it propped a little higher?” Darl says.

Cash has a broken leg. He has had two broken legs. He lies on the box with a quilt rolled under his head and a piece of wood under his knee.

“I reckon we ought to left him at Armstid’s,” pa says.

I haven’t got a broken leg and pa hasn’t and Darl hasn’t and “It’s just the bumps,” Cash says. “It kind of grinds together a little on a bump. It dont bother none.” Jewel *has gone away. He and his horse went away one supper time*

“It’s because she wouldn’t have us beholden,” pa says. “Fore God, I do the best that ere a man” *Is it because Jewel’s mother is a horse Darl? I said.*

“Maybe I can draw the ropes a little tighter,” Darl says. *That’s why Jewel and*

I were both in the shed and she was in the wagon because the horse lives in the barn and I had to keep on running the buzzard away from

“If you just would,” Cash says. And Dewey Dell hasn’t got a broken leg and I haven’t. Cash is my brother.

We stop. When Darl loosens the rope Cash begins to sweat again. His teeth look out.

“Hurt?” Darl says.

“I reckon you better put it back,” Cash says.

Darl puts the rope back, pulling hard. Cash’s teeth look out.

“Hurt?” Darl says.

“It dont bother none,” Cash says.

“Do you want pa to drive slower?” Darl says.

“No,” Cash says. “Aint no time to hang back. It dont bother none.”

“We’ll have to get some medicine at Mottson,” pa says. “I reckon we’ll have to.”

“Tell him to go on,” Cash says. We go on. Dewey Dell leans back and wipes Cash’s face. Cash is my brother. *But Jewel’s mother is a horse. My mother is a fish. Darl says that when we come to the water again I might see her and Dewey Dell said, She’s in the box; how could she have got out? She got out through the holes I bored, into the water I said, and when we come to the water again I am going to see her. My mother is not in the box. My mother does not smell like that. My mother is a fish*

“Those cakes will be in fine shape by the time we get to Jefferson,” Darl says.

Dewey Dell does not look around.

“You better try to sell them in Mottson,” Darl says.

“When will we get to Mottson, Darl?” I say.

“Tomorrow,” Darl says. “If this team dont rack to pieces. Snopes must have fed them on sawdust.”

“Why did he feed them on sawdust, Darl?” I say.

“Look,” Darl says. “See?”

Now there are nine of them, tall in little tall black circles.

When we come to the foot of the hill pa stops and Darl and Dewey Dell and I get out. Cash cant walk because he has a broken leg. “Come up, mules,” pa says. The mules walk hard; the wagon creaks. Darl and Dewey Dell and I walk behind the wagon, up the hill. When we come to the top of the hill pa stops and we get back into the wagon.

Now there are ten of them, tall in little tall black circles on the sky.

MOSELEY



I happened to look up, and saw her outside the window, looking in. Not close to the glass, and not looking at anything in particular; just standing there with her head turned this way and her eyes full on me and kind of blank too, like she was waiting for a sign. When I looked up again she was moving toward the door.

She kind of bumbled at the screen door a minute, like they do, and came in. She had on a stiff-brimmed straw hat setting on the top of her head and she was carrying a package wrapped in newspaper: I thought that she had a quarter or a dollar at the most, and that after she stood around a while she would maybe buy a cheap comb or a bottle of nigger toilet water, so I never disturbed her for a minute or so except to notice that she was pretty in a kind of sullen, awkward way, and that she looked a sight better in her gingham dress and her own complexion than she would after she bought whatever she would finally decide on. Or tell that she wanted. I knew that she had already decided before she came in. But you have to let them take their time. So I went on with what I was doing, figuring to let Albert wait on her when he caught up at the fountain, when he came back to me.

“That woman,” he said. “You better see what she wants.”

“What does she want?” I said.

“I dont know. I cant get anything out of her. You better wait on her.”

So I went around the counter. I saw that she was barefooted, standing with her feet flat and easy on the floor, like she was used to it. She was looking at me, hard, holding the package; I saw she had about as black a pair of eyes as ever I saw, and she was a stranger. I never remembered seeing her in Mottson before.

“What can I do for you?” I said.

Still she didn't say anything. She stared at me without winking. Then she looked back at the folks at the fountain. Then she looked past me, toward the back of the store.

"Do you want to look at some toilet things?" I said. "Or is it medicine you want?"

"That's it," she said. She looked quick back at the fountain again. So I thought maybe her ma or somebody had sent her in for some of this female dope and she was ashamed to ask for it. I knew she couldn't have a complexion like hers and use it herself, let alone not being much more than old enough to barely know what it was for. It's a shame, the way they poison themselves with it. But a man's got to stock it or go out of business in this country.

"Oh," I said. "What do you use? We have——" She looked at me again, almost like she had said hush, and looked toward the back of the store again.

"I'd liefer go back there," she said.

"All right," I said. You have to humor them. You save time by it. I followed her to the back. She put her hand on the gate. "There's nothing back there but the prescription case," I said. "What do you want?" She stopped and looked at me. It was like she had taken some kind of a lid off her face, her eyes. It was her eyes: kind of dumb and hopeful and sullenly willing to be disappointed all at the same time. But she was in trouble of some sort; I could see that. "What's your trouble?" I said. "Tell me what it is you want. I'm pretty busy." I wasn't meaning to hurry her, but a man just hasn't got the time they have out there.

"It's the female trouble," she said.

"Oh," I said. "Is that all?" I thought maybe she was younger than she looked, and her first one had scared her, or maybe one had been a little abnormal as it will in young women. "Where's your ma?" I said. "Haven't you got one?"

"She's out yonder in the wagon," she said.

"Why not talk to her about it before you take any medicine," I said. "Any woman would have told you about it." She looked at me, and I looked at her again and said, "How old are you?"

"Seventeen," she said.

"Oh," I said. "I thought maybe you were....." She was watching me. But then, in the eyes all of them look like they had no age and knew everything in the world, anyhow. "Are you too regular, or not regular enough?"

She quit looking at me but she didn't move. "Yes," she said. "I reckon so. Yes."

"Well, which?" I said. "Dont you know?" It's a crime and a shame; but after all, they'll buy it from somebody. She stood there, not looking at me. "You want something to stop it?" I said. "Is that it?"

"No," she said. "That's it. It's already stopped."

"Well, what——" Her face was lowered a little, still, like they do in all their dealings with a man so he dont ever know just where the lightning will strike next. "You are not married, are you?" I said.

"No."

"Oh," I said. "And how long has it been since it stopped? about five months maybe?"

"It aint been but two," she said.

"Well, I haven't got anything in my store you want to buy," I said, "unless it's a nipple. And I'd advise you to buy that and go back home and tell your pa, if you have one, and let him make somebody buy you a wedding license. Was that all you wanted?"

But she just stood there, not looking at me.

"I got the money to pay you," she said.

"Is it your own, or did he act enough of a man to give you the money?"

"He give it to me. Ten dollars. He said that would be enough."

"A thousand dollars wouldn't be enough in my store and ten cents wouldn't be enough," I said. "You take my advice and go home and tell your pa or your brothers if you have any or the first man you come to in the road."

But she didn't move. "Lafe said I could get it at the drugstore. He said to tell you me and him wouldn't never tell nobody you sold it to us."

"And I just wish your precious Lafe had come for it himself; that's what I wish. I dont know: I'd have had a little respect for him then. And you can go back and tell him I said so—if he aint halfway to Texas by now, which I dont doubt. Me, a respectable druggist, that's kept store and raised a family and been a church-member for fifty-six years in this town. I'm a good mind to tell your folks myself, if I can just find who they are."

She looked at me now, her eyes and face kind of blank again like when I first saw her through the window. "I didn't know," she said. "He told me I could get something at the drug store. He said they might not want to sell it to me, but if I had ten dollars and told them I wouldn't never tell nobody...."

"He never said this drugstore," I said. "If he did or mentioned my name, I defy him to prove it. I defy him to repeat it or I'll prosecute him to the full extent of the law, and you can tell him so."

"But maybe another drug store would," she said.

"Then I dont want to know it. Me, that's——" Then I looked at her. But it's a hard life they have; sometimes a man.....if there can ever be any excuse for sin, which it cant be. And then, life wasn't made to be easy on folks: they wouldn't ever have any reason to be good and die. "Look here," I said. "You get

that notion out of your head. The Lord gave you what you have, even if He did use the devil to do it; you let Him take it away from you if it's His will to do so. You go on back to Lafe and you and him take that ten dollars and get married with it."

"Lafe said I could get something at the drugstore," she said.

"Then go and get it," I said. "You wont get it here."

She went out, carrying the package, her feet making a little hissing on the floor. She bumbled again at the door and went out. I could see her through the glass going on down the street.

It was Albert told me about the rest of it. He said the wagon was stopped in front of Grummet's hardware store, with the ladies all scattering up and down the street with handkerchiefs to their noses, and a crowd of hard-nosed men and boys standing around the wagon, listening to the marshal arguing with the man. He was a kind of tall, gaunted man sitting on the wagon, saying it was a public street and he reckoned he had as much right there as anybody, and the marshal telling him he would have to move on; folks couldn't stand it. It had been dead eight days, Albert said. They came from some place out in Yoknapatawpha county, trying to get to Jefferson with it. It must have been like a piece of rotten cheese coming into an ant-hill, in that ramshackle wagon that Albert said folks were scared would fall all to pieces before they could get it out of town, with that home-made box and another fellow with a broken leg lying on a quilt on top of it, and the father and a little boy sitting on the seat and the marshal trying to make them get out of town.

"It's a public street," the man says. "I reckon we can stop to buy something same as airy other man. We got the money to pay for hit, and hit aint airy law that says a man cant spend his money where he wants."

They had stopped to buy some cement. The other son was in Grummet's, trying to make Grummet break a sack and let him have ten cents' worth, and finally Grummet broke the sack to get him out. They wanted the cement to fix the fellow's broken leg, someway.

"Why, you'll kill him," the marshal said. "You'll cause him to lose his leg. You take him on to a doctor, and you get this thing buried soon as you can. Dont you know you're liable to jail for endangering the public health?"

"We're doing the best we can," the father said. Then he told a long tale about how they had to wait for the wagon to come back and how the bridge was washed away and how they went eight miles to another bridge and it was gone too so they came back and swum the ford and the mules got drowned and how they got another team and found that the road was washed out and they had to come clean around by Mottson, and then the one with the cement came back and

told him to shut up.

“We’ll be gone in a minute,” he told the marshal.

“We never aimed to bother nobody,” the father said.

“You take that fellow to a doctor,” the marshal told the one with the cement.

“I reckon he’s all right,” he said.

“It aint that we’re hard-hearted,” the marshal said. “But I reckon you can tell yourself how it is.”

“Sho,” the other said. “We’ll take out soon as Dewey Dell comes back. She went to deliver a package.”

So they stood there with the folks backed off with handkerchiefs to their faces, until in a minute the girl came up with that newspaper package.

“Come on,” the one with the cement said, “we’ve lost too much time.” So they got in the wagon and went on. And when I went to supper it still seemed like I could smell it. And the next day I met the marshal and I began to sniff and said,

“Smell anything?”

“I reckon they’re in Jefferson by now,” he said.

“Or in jail. Well, thank the Lord it’s not our jail.”

“That’s a fact,” he said.

DARL



"Here's a place," pa says. He pulls the team up and sits looking at the house. "We could get some water over yonder."

"All right," I say. "You'll have to borrow a bucket from them, Dewey Dell."

"God knows," pa says. "I wouldn't be beholden, God knows."

"If you see a good-sized can, you might bring it," I say. Dewey Dell gets down from the wagon, carrying the package. "You had more trouble than you expected, selling those cakes in Mottson," I say. How do our lives ravel out into the no-wind, no-sound, the weary gestures wearily recapitulant: echoes of old compulsions with no-hand on no-strings: in sunset we fall into furious attitudes, dead gestures of dolls. Cash broke his leg and now the sawdust is running out. He is bleeding to death is Cash.

"I wouldn't be beholden," pa says. "God knows."

"Then make some water yourself," I say. "We can use Cash's hat."

When Dewey Dell comes back the man comes with her. Then he stops and she comes on and he stands there and after a while he goes back to the house and stands on the porch, watching us.

"We better not try to lift him down," pa says. "We can fix it here."

"Do you want to be lifted down, Cash?" I say.

"Wont we get to Jefferson tomorrow?" he says. He is watching us, his eyes interrogatory, intent, and sad. "I can last it out."

"It'll be easier on you," pa says. "It'll keep it from rubbing together."

"I can last it," Cash says. "We'll lose time stopping."

"We done bought the cement, now," pa says.

"I could last it," Cash says. "It aint but one more day. It dont bother to speak

of." He looks at us, his eyes wide in his thin gray face, questioning. "It sets up so," he says.

"We done bought it now," pa says.

I mix the cement in the can, stirring the slow water into the pale green thick coils. I bring the can to the wagon where Cash can see. He lies on his back, his thin profile in silhouette, ascetic and profound against the sky. "Does that look about right?" I say.

"You dont want too much water, or it wont work right," he says.

"Is this too much?"

"Maybe if you could get a little sand," he says. "It aint but one more day," he says. "It dont bother me none."

Vardaman goes back down the road to where we crossed the branch and returns with sand. He pours it slowly into the thick coiling in the can. I go to the wagon again.

"Does that look all right?"

"Yes," Cash says. "I could have lasted. It dont bother me none."

We loosen the splints and pour the cement over his leg slow.

"Watch out for it," Cash says. "Dont get none on it if you can help."

"Yes," I say. Dewey Dell tears a piece of paper from the package and wipes the cement from the top of it as it drips from Cash's leg.

"How does that feel?"

"It feels fine," he says. "It's cold. It feels fine."

"If it'll just help you," pa says. "I asks your forgiveness. I never foreseen it no more than you."

"It feels fine," Cash says.

If you could just ravel out into time. That would be nice. It would be nice if you could just ravel out into time.

We replace the splints, the cords, drawing them tight, the cement in thick pale green slow surges among the cords, Cash watching us quietly with that profound questioning look.

"That'll steady it," I say.

"Ay," Cash says. "I'm obliged."

Then we all turn on the wagon and watch him. He is coming up the road behind us, wooden-backed, wooden-faced, moving only from his hips down. He comes up without a word, with his pale rigid eyes in his high sullen face, and gets into the wagon.

"Here's a hill," pa says. "I reckon you'll have to get out and walk."

VARDAMAN



Darl and Jewel and Dewey Dell and I are walking up the hill, behind the wagon. Jewel came back. He came up the road and got into the wagon. He was walking. Jewel hasn't got a horse anymore. Jewel is my brother. Cash is my brother. Cash has a broken leg. We fixed Cash's leg so it doesn't hurt. Cash is my brother. Jewel is my brother too, but he hasn't got a broken leg.

Now there are five of them, tall in little tall black circles.

"Where do they stay at night, Darl?" I say. "When we stop at night in the barn, where do they stay?"

The hill goes off into the sky. Then the sun comes up from behind the hill and the mules and the wagon and pa walk on the sun. You cannot watch them, walking slow on the sun. In Jefferson it is red on the track behind the glass. The track goes shining round and round. Dewey Dell says so.

Tonight I am going to see where they stay while we are in the barn.

DARL



“Jewel,” I say, “whose son are you?”

The breeze was setting up from the barn, so we put her under the apple tree, where the moonlight can dapple the apple tree upon the long slumbering flanks within which now and then she talks in little trickling bursts of secret and murmurous bubbling. I took Vardaman to listen. When we came up the cat leaped down from it and flicked away with silver claw and silver eye into the shadow.

“Your mother was a horse, but who was your father, Jewel?”

“You goddamn lying son of a bitch.”

“Dont call me that,” I say.

“You goddamn lying son of a bitch.”

“Dont you call me that, Jewel.” In the tall moonlight his eyes look like spots of white paper pasted on a high small football.

After supper Cash began to sweat a little. “It’s getting a little hot,” he said. “It was the sun shining on it all day, I reckon.”

“You want some water poured on it?” we say. “Maybe that will ease it some.”

“I’d be obliged,” Cash said. “It was the sun shining on it, I reckon. I ought to thought and kept it covered.”

“We ought to thought,” we said. “You couldn’t have suspicioned.”

“I never noticed it getting hot,” Cash said. “I ought to minded it.”

So we poured the water over it. His leg and foot below the cement looked like they had been boiled. “Does that feel better?” we said.

“I’m obliged,” Cash said. “It feels fine.”

Dewey Dell wipes his face with the hem of her dress.

“See if you can get some sleep,” we say.

“Sho,” Cash says. “I’m right obliged. It feels fine now.”

Jewel, I say, Who was your father, Jewel?

Goddamn you. Goddamn you.

VARDAMAN



She was under the apple tree and Darl and I go across the moon and the cat jumps down and runs and we can hear her inside the wood.

“Hear?” Darl says. “Put your ear close.”

I put my ear close and I can hear her. Only I cant tell what she is saying.

“What is she saying, Darl?” I say. “Who is she talking to?”

“She’s talking to God,” Darl says. “She is calling on Him to help her.”

“What does she want Him to do?” I say.

“She wants Him to hide her away from the sight of man,” Darl says.

“Why does she want to hide her away from the sight of man, Darl?”

“So she can lay down her life,” Darl says.

“Why does she want to lay down her life, Darl?”

“Listen,” Darl says. We hear her. We hear her turn over on her side. “Listen,” Darl says.

“She’s turned over,” I say. “She’s looking at me through the wood.”

“Yes,” Darl says.

“How can she see through the wood, Darl?”

“Come,” Darl says. “We must let her be quiet. Come.”

“She cant see out there, because the holes are in the top,” I say. “How can she see, Darl?”

“Let’s go see about Cash,” Darl says.

And I saw something Dewey Dell told me not to tell nobody

Cash is sick in his leg. We fixed his leg this afternoon, but he is sick in it again, lying on the bed. We pour water on his leg and then he feels fine.

“I feel fine,” Cash says. “I’m obliged to you.”

"Try to get some sleep," we say.

"I feel fine," Cash says. "I'm obliged to you."

And I saw something Dewey Dell told me not to tell nobody. It is not about pa and it is not about Cash and it is not about Jewel and it is not about Dewey Dell and it is not about me

Dewey Dell and I are going to sleep on the pallet. It is on the back porch, where we can see the barn, and the moon shines on half of the pallet and we will lie half in the white and half in the black, with the moonlight on our legs. And then I am going to see where they stay at night while we are in the barn. We are not in the barn tonight but I can see the barn and so I am going to find where they stay at night.

We lie on the pallet, with our legs in the moon.

"Look," I say, "my legs look black. Your legs look black, too."

"Go to sleep," Dewey Dell says.

Jefferson is a far piece.

"Dewey Dell."

"What."

"If it's not Christmas now, how will it be there?"

It goes round and round on the shining track. Then the track goes shining round and round.

"Will what be there?"

"That train. In the window."

"You go to sleep. You can see tomorrow if it's there."

Maybe Santa Claus wont know they are town boys.

"Dewey Dell."

"You go to sleep. He aint going to let none of them town boys have it."

It was behind the window, red on the track, the track shining round and round. It made my heart hurt. And then it was pa and Jewel and Darl and Mr. Gillespie's boy. Mr Gillespie's boy's legs come down under his nightshirt. When he goes into the moon, his legs fuzz. They go on around the house toward the apple tree.

"What are they going to do, Dewey Dell?"

They went around the house toward the apple tree.

"I can smell her," I say. "Can you smell her, too?"

"Hush," Dewey Dell says. "The wind's changed. Go to sleep."

And so I am going to know where they stay at night soon. They come around the house, going across the yard in the moon, carrying her on their shoulders. They carry her down to the barn, the moon shining flat and quiet on her. Then they come back and go into the house again. While they were in the moon, Mr

Gillespie's boy's leg fuzzed. And then I waited and I said Dewey Dell? and then I waited and then I went to find where they stay at night and I saw something that Dewey Dell told me not to tell nobody.

DARL



Against the dark doorway he seems to materialise out of darkness, lean as a race horse in his underclothes in the beginning of the glare. He leaps to the ground with on his face an expression of furious disbelief. He has seen me without even turning his head or his eyes in which the glare swims like two small torches. "Come on," he says, leaping down the slope toward the barn.

For an instant longer he runs silver in the moonlight, then he springs out like a flat figure cut leanly from tin against an abrupt and soundless explosion as the whole loft of the barn takes fire at once, as though it had been stuffed with powder. The front, the conical façade with the square orifice of doorway broken only by the square squat shape of the coffin on the sawhorses like a cubistic bug, comes into relief. Behind me pa and Gillespie and Mack and Dewey Dell and Vardaman emerge from the house.

He pauses at the coffin, stooping, looking at me, his face furious. Overhead the flames sound like thunder; across us rushes a cool draft: there is no heat in it at all yet, and a handful of chaff lifts suddenly and sucks swiftly along the stalls where a horse is screaming. "Quick," I say; "the horses."

He glares a moment longer at me, then at the roof overhead, then he leaps toward the stall where the horse screams. It plunges and kicks, the sound of the crashing blows sucking up into the sound of the flames. They sound like an interminable train crossing an endless trestle. Gillespie and Mack pass me, in knee-length nightshirts, shouting, their voices thin and high and meaningless and at the same time profoundly wild and sad: ".....cow.....stall....." Gillespie's nightshirt rushes ahead of him on the draft, ballooning about his hairy thighs.

The stall door has swung shut. Jewel thrusts it back with his buttocks and he appears, his back arched, the muscles ridged through his garment as he drags the horse out by its head. In the glare its eyes roll with soft, fleet, wild opaline fire; its muscles bunch and run as it flings its head about, lifting Jewel clear of the ground. He drags it on, slowly, terrifically; again he gives me across his shoulder a single glare furious and brief. Even when they are clear of the barn the horse continues to fight and lash backward toward the doorway until Gillespie passes me, stark-naked, his nightshirt wrapped about the mule's head, and beats the maddened horse on out of the door.

Jewel returns, running; again he looks down at the coffin. But he comes on. "Where's cow?" he cries, passing me. I follow him. In the stall Mack is struggling with the other mule. When its head turns into the glare I can see the wild rolling of its eye too, but it makes no sound. It just stands there, watching Mack over its shoulder, swinging its hind quarters toward him whenever he approaches. He looks back at us, his eyes and mouth three round holes in his face on which the freckles look like english peas on a plate. His voice is thin, high, faraway.

"I cant do nothing....." It is as though the sound had been swept from his lips and up and away, speaking back to us from an immense distance of exhaustion. Jewel slides past us; the mule whirls and lashes out, but he has already gained its head. I lean to Mack's ear:

"Nightshirt. Around his head."

Mack stares at me. Then he rips the nightshirt off and flings it over the mule's head, and it becomes docile at once. Jewel is yelling at him: "Cow? Cow?"

"Back," Mack cries. "Last stall."

The cow watches us as we enter. She is backed into the corner, head lowered, still chewing though rapidly. But she makes no move. Jewel has paused, looking up, and suddenly we watch the entire floor to the loft dissolve. It just turns to fire; a faint litter of sparks rains down. He glances about. Back under the trough is a three legged milking stool. He catches it up and swings it into the planking of the rear wall. He splinters a plank, then another, a third; we tear the fragments away. While we are stooping to the opening something charges into us from behind. It is the cow; with a single whistling breath she rushes between us and through the gap and into the outer glare, her tail erect and rigid as a broom nailed upright to the end of her spine.

Jewel turns back into the barn. "Here," I say; "Jewel!" I grasp at him; he strikes my hand down. "You fool," I say, "dont you see you cant make it back yonder?" The hallway looks like a searchlight turned into rain. "Come on," I say, "around this way."

When we are through the gap he begins to run. "Jewel," I say, running. He darts around the corner. When I reach it he has almost reached the next one, running against the glare like that figure cut from tin. Pa and Gillespie and Mack are some distance away, watching the barn, pink against the darkness where for the time the moonlight has been vanquished. "Catch him!" I cry; "stop him!"

When I reach the front, he is struggling with Gillespie; the one lean in underclothes, the other stark naked. They are like two figures in a Greek frieze, isolated out of all reality by the red glare. Before I can reach them he has struck Gillespie to the ground and turned and run back into the barn.

The sound of it has become quite peaceful now, like the sound of the river did. We watch through the dissolving proscenium of the doorway as Jewel runs crouching to the far end of the coffin and stoops to it. For an instant he looks up and out at us through the rain of burning hay like a portière of flaming beads, and I can see his mouth shape as he calls my name.

"Jewel!" Dewey Dell cries; "Jewel!" It seems to me that I now hear the accumulation of her voice through the last five minutes, and I hear her scuffling and struggling as pa and Mack hold her, screaming "Jewel! Jewel!" But he is no longer looking at us. We see his shoulders strain as he upends the coffin and slides it single-handed from the sawhorses. It looms unbelievably tall, hiding him: I would not have believed that Addie Bundren would have needed that much room to lie comfortable in; for another instant it stands upright while the sparks rain on it in scattering bursts as though they engendered other sparks from the contact. Then it topples forward, gaining momentum, revealing Jewel and the sparks raining on him too in engendering gusts, so that he appears to be enclosed in a thin nimbus of fire. Without stopping it overends and rears again, pauses, then crashes slowly forward and through the curtain. This time Jewel is riding upon it, clinging to it, until it crashes down and flings him forward and clear and Mack leaps forward into a thin smell of scorching meat and slaps at the widening crimson-edged holes that bloom like flowers in his undershirt.

VARDAMAN



When I went to find where they stay at night, I saw something They said, “Where is Darl? Where did Darl go?”

They carried her back under the apple tree.

The barn was still red, but it wasn’t a barn now. It was sunk down, and the red went swirling up. The barn went swirling up in little red pieces, against the sky and the stars so that the stars moved backward.

And then Cash was still awake. He turned his head from side to side, with sweat on his face.

“Do you want some more water on it, Cash?” Dewey Dell said.

Cash’s leg and foot turned black. We held the lamp and looked at Cash’s foot and leg where it was black.

“Your foot looks like a nigger’s foot, Cash,” I said.

“I reckon we’ll have to bust it off,” pa said.

“What in the tarnation you put it on there for,” Mr Gillespie said.

“I thought it would steady it some,” pa said. “I just aimed to help him.”

They got the flat iron and the hammer. Dewey Dell held the lamp. They had to hit it hard. And then Cash went to sleep.

“He’s asleep now,” I said. “It cant hurt him while he’s asleep.”

It just cracked. It wouldn’t come off.

“It’ll take the hide, too,” Mr Gillespie said. “Why in the tarnation you put it on there. Didn’t none of you think to grease his leg first?”

“I just aimed to help him,” pa said. “It was Darl put it on.”

“Where is Darl?” they said.

“Didn’t none of you have more sense than that?” Mr Gillespie said. “I’d a

thought he would, anyway."

Jewel was lying on his face. His back was red. Dewey Dell put the medicine on it. The medicine was made out of butter and soot, to draw out the fire. Then his back was black.

"Does it hurt, Jewel?" I said. "Your back looks like a nigger's, Jewel," I said. Cash's foot and leg looked like a nigger's. Then they broke it off. Cash's leg bled.

"You go on back and lay down," Dewey Dell said. "You ought to be asleep."

"Where is Darl?" they said.

He is out there under the apple tree with her, lying on her. He is there so the cat wont come back. I said, "Are you going to keep the cat away, Darl?"

The moonlight dappled on him too. On her it was still, but on Darl it dappled up and down.

"You needn't to cry," I said. "Jewel got her out. You needn't to cry, Darl."

The barn is still red. It used to be redder than this. Then it went swirling, making the stars run backward without falling. It hurt my heart like the train did.

When I went to find where they stay at night, I saw something that Dewey Dell says I mustn't tell nobody

DARL



We have been passing the signs for sometime now: the drug stores, the clothing stores, the patent medicine and the garages and cafés, and the mile-boards diminishing, becoming more starkly reaccruent: 3 mi. 2 mi. From the crest of a hill, as we get into the wagon again, we can see the smoke low and flat, seemingly unmoving in the unwinded afternoon.

“Is that it, Darl?” Vardaman says. “Is that Jefferson?” He too has lost flesh; like ours, his face has an expression strained, dreamy, and gaunt.

“Yes,” I say. He lifts his head and looks at the sky. High against it they hang in narrowing circles, like the smoke, with an outward semblance of form and purpose, but with no inference of motion, progress or retrograde. We mount the wagon again where Cash lies on the box, the jagged shards of cement cracked about his leg. The shabby mules droop rattling and clanking down the hill.

“We’ll have to take him to the doctor,” pa says. “I reckon it aint no way around it.” The back of Jewel’s shirt, where it touches him, stains slow and black with grease. Life was created in the valleys. It blew up onto the hills on the old terrors, the old lusts, the old despairs. That’s why you must walk up the hills so you can ride down.

Dewey Dell sits on the seat, the newspaper package on her lap. When we reach the foot of the hill where the road flattens between close walls of trees, she begins to look about quietly from one side of the road to the other. At last she says, “I got to stop.”

Pa looks at her, his shabby profile that of anticipant and disgruntled annoyance. He does not check the team. “What for?”

“I got to go to the bushes,” Dewey Dell says.

Pa does not check the team. "Cant you wait till we get to town? It aint over a mile now."

"Stop," Dewey Dell says. "I got to go to the bushes."

Pa stops in the middle of the road and we watch Dewey Dell descend, carrying the package. She does not look back.

"Why not leave your cakes here?" I say. "We'll watch them."

She descends steadily, not looking at us.

"How would she know where to go if she waited till we get to town?" Vardaman says. "Where would you go to do it in town, Dewey Dell?"

She lifts the package down and turns and disappears among the trees and undergrowth.

"Dont be no longer than you can help," pa says. "We aint got no time to waste." She does not answer. After a while we cannot hear her even. "We ought to done like Armstid and Gillespie said and sent word to town and had it dug and ready," he says.

"Why didn't you?" I say. "You could have telephoned."

"What for?" Jewel says. "Who the hell cant dig a hole in the ground?"

A car comes over the hill. It begins to sound the horn, slowing. It runs along the roadside in low gear, the outside wheels in the ditch, and passes us and goes on. Vardaman watches it until it is out of sight.

"How far is it now, Darl?" he says.

"Not far," I say.

"We ought to done it," pa says. "I just never wanted to be beholden to none except her flesh and blood."

"Who the hell cant dig a damn hole in the ground?" Jewel says.

"It aint respectful, talking that way about her grave," pa says. "You all dont know what it is. You never pure loved her, none of you." Jewel does not answer. He sits a little stiffly erect, his body arched away from his shirt. His high-colored jaw juts.

Dewey Dell returns. We watch her emerge from the bushes, carrying the package, and climb into the wagon. She now wears her Sunday dress, her beads, her shoes and stockings.

"I thought I told you to leave them clothes to home," pa says. She does not answer, does not look at us. She sets the package in the wagon and gets in. The wagon moves on.

"How many more hills now, Darl?" Vardaman says.

"Just one," I say. "The next one goes right up into town."

This hill is red sand, bordered on either hand by negro cabins; against the sky ahead the massed telephone lines run, and the clock on the courthouse lifts

among the trees. In the sand the wheels whisper, as though the very earth would hush our entry. We descend as the hill commences to rise.

We follow the wagon, the whispering wheels, passing the cabins where faces come suddenly to the doors, white-eyed. We hear sudden voices, ejaculant. Jewel has been looking from side to side; now his head turns forward and I can see his ears taking on a still deeper tone of furious red. Three negroes walk beside the road ahead of us; ten feet ahead of them a white man walks. When we pass the negroes their heads turn suddenly with that expression of shock and instinctive outrage. "Great God," one says; "what they got in that wagon?"

Jewel whirls. "Son of a bitches," he says. As he does so he is abreast of the white man, who has paused. It is as though Jewel had gone blind for the moment, for it is the white man toward whom he whirls.

"Darl!" Cash says from the wagon. I grasp at Jewel. The white man has fallen back a pace, his face still slack-jawed; then his jaw tightens, claps to. Jewel leans above him, his jaw muscles gone white.

"What did you say?" he says.

"Here," I say. "He dont mean anything, mister. Jewel," I say. When I touch him he swings at the man. I grasp his arm; we struggle. Jewel has never looked at me. He is trying to free his arm. When I see the man again he has an open knife in his hand.

"Hold up, mister," I say; "I've got him. Jewel," I say.

"Thinks because he's a goddamn town fellow," Jewel says, panting, wrenching at me. "Son of a bitch," he says.

The man moves. He begins to edge around me, watching Jewel, the knife low against his flank. "Cant no man call me that," he says. Pa has got down, and Dewey Dell is holding Jewel, pushing at him. I release him and face the man.

"Wait," I say. "He dont mean nothing. He's sick; got burned in a fire last night, and he aint himself."

"Fire or no fire," the man says, "cant no man call me that."

"He thought you said something to him," I say.

"I never said nothing to him. I never see him before."

"Fore God," pa says; "fore God."

"I know," I say. "He never meant anything. He'll take it back."

"Let him take it back then."

"Put up your knife, and he will."

The man looks at me. He looks at Jewel. Jewel is quiet now.

"Put up your knife." I say.

The man shuts the knife.

"Fore God," pa says. "Fore God."

"Tell him you didn't mean anything, Jewel," I say.

"I thought he said something," Jewel says. "Just because he's——"

"Hush," I say. "Tell him you didn't mean it."

"I didn't mean it," Jewel says.

"He better not," the man says. "Calling me a——"

"Do you think he's afraid to call you that?" I say.

The man looks at me. "I never said that," he said.

"Dont think it, neither," Jewel says.

"Shut up," I say. "Come on. Drive on, pa."

The wagon moves. The man stands watching us. Jewel does not look back.

"Jewel would a whipped him," Vardaman says.

We approach the crest, where the street runs, where cars go back and forth; the mules haul the wagon up and onto the crest and the street. Pa stops them. The street runs on ahead, where the square opens and the monument stands before the courthouse. We mount again while the heads turn with that expression which we know; save Jewel. He does not get on, even though the wagon has started again. "Get in, Jewel," I say. "Come on. Let's get away from here." But he does not get in. Instead he sets his foot on the turning hub of the rear wheel, one hand grasping the stanchion, and with the hub turning smoothly under his sole he lifts the other foot and squats there, staring straight ahead, motionless, lean, wooden-backed, as though carved squatting out of the lean wood.

CASH



It wasn't nothing else to do. It was either send him to Jackson, or have Gillespie sue us, because he knowed some way that Darl set fire to it. I dont know how he knowed, but he did. Vardaman seen him do it, but he swore he never told nobody but Dewey Dell and that she told him not to tell nobody. But Gillespie knowed it. But he would a suspicioned it sooner or later. He could have done it that night just watching the way Darl acted.

And so pa said, "I reckon there aint nothing else to do," and Jewel said, "You want to fix him now?"

"Fix him?" pa said.

"Catch him and tie him up," Jewel said. "Goddamn it, do you want to wait until he sets fire to the goddamn team and wagon?"

But there wasn't no use in that. "There aint no use in that," I said. "We can wait till she is underground." A fellow that's going to spend the rest of his life locked up, he ought to be let to have what pleasure he can have before he goes.

"I reckon he ought to be there," pa says. "God knows, it's a trial on me. Seems like it aint no end to bad luck when once it starts."

Sometimes I aint so sho who's got ere a right to say when a man is crazy and when he aint. Sometimes I think it aint none of us pure crazy and aint none of us pure sane until the balance of us talks him that-a-way. It's like it aint so much what a fellow does, but it's the way the majority of folks is looking at him when he does it.

Because Jewel is too hard on him. Of course it was Jewel's horse was traded to get her that nigh to town, and in a sense it was the value of the horse Darl tried to burn up. But I thought more than once before we crossed the river and after,

how it would be God's blessing if He did take her outen our hands and get shut of her in some clean way, and it seemed to me that when Jewel worked so to get her outen the river, he was going against God in a way, and then when Darl seen that it looked like one of us would have to do something, I can almost believe he done right in a way. But I dont reckon nothing excuses setting fire to a man's barn and endangering his stock and destroying his property. That's how I reckon a man is crazy. That's how he cant see eye to eye with other folks. And I reckon they aint nothing else to do with him but what the most folks say is right.

But it's a shame, in a way. Folks seem to get away from the olden right teaching that says to drive the nails down and trim the edges well always like it was for your own use and comfort you were making it. It's like some folks has the smooth, pretty boards to build a courthouse with and others dont have no more than rough lumber fitten to build a chicken coop. But it's better to build a tight chicken coop than a shoddy courthouse, and when they both build shoddy or build well, neither because it's one or tother is going to make a man feel the better nor the worse.

So we went up the street, toward the square, and he said, "We better take Cash to the doctor first. We can leave him there and come back for him." That's it. It's because me and him was born close together, and it nigh ten years before Jewel and Dewey Dell and Vardaman begun to come along. I feel kin to them, all right, but I dont know. And me being the oldest, and thinking already the very thing that he done: I dont know.

Pa was looking at me, then at him, mumbling his mouth.

"Go on," I said. "We'll get it done first."

"She would want us all there," pa says.

"Let's take Cash to the doctor first," Darl said. "She'll wait. She's already waited nine days."

"You all dont know," pa says. "The somebody you was young with and you growed old in her and she growed old in you, seeing the old coming on and it was the one somebody you could hear say it dont matter and know it was the truth outen the hard world and all a man's grief and trials. You all dont know."

"We got the digging to do, too," I said.

"Armstid and Gillespie both told you to send word ahead," Darl said. "Dont you want to go to Peabody's now, Cash?"

"Go on," I said. "It feels right easy now. It's best to get things done in the right place."

"If it was just dug," pa says. "We forgot our spade, too."

"Yes," Darl said. "I'll go to the hardware store. We'll have to buy one."

"It'll cost money," pa says.

"Do you begrudge her it?" Darl says.

"Go on and get a spade," Jewel said. "Here. Give me the money."

But pa didn't stop. "I reckon we can get a spade," he said. "I reckon there are Christians here." So Darl set still and we went on, with Jewel squatting on the tail-gate, watching the back of Darl's head. He looked like one of these bulldogs, one of these dogs that dont bark none, squatting against the rope, watching the thing he was waiting to jump at.

He set that way all the time we was in front of Mrs Bundren's house, hearing the music, watching the back of Darl's head with them hard white eyes of hisn.

The music was playing in the house. It was one of them graphophones. It was natural as a music-band.

"Do you want to go to Peabody's?" Darl said. "They can wait here and tell pa, and I'll drive you to Peabody's and come back for them."

"No," I said. It was better to get her underground, now we was this close, just waiting until pa borrowed the shovel. He drove along the street until we could hear the music.

"Maybe they got one here," he said. He pulled up at Mrs Bundren's. It was like he knowed. Sometimes I think that if a working man could see work as far ahead as a lazy man can see laziness. So he stopped there like he knowed, before that little new house, where the music was. We waited there, hearing it. I believe I could have dickered Suratt down to five dollars on that one of his. It's a comfortable thing, music is. "Maybe they got one here," pa says.

"You want Jewel to go," Darl says, "or do you reckon I better?"

"I reckon I better," pa says. He got down and went up the path and around the house to the back. The music stopped, then it started again.

"He'll get it, too," Darl said.

"Ay," I said. It was just like he knowed, like he could see through the walls and into the next ten minutes.

Only it was more than ten minutes. The music stopped and never commenced again for a good spell, where her and pa was talking at the back. We waited in the wagon.

"You let me take you back to Peabody's," Darl said.

"No," I said. "We'll get her underground."

"If he ever gets back," Jewel said. He begun to cuss. He started to get down from the wagon. "I'm going," he said.

Then we saw pa coming back. He had two spades, coming around the house. He laid them in the wagon and got in and we went on. The music never started again. Pa was looking back at the house. He kind of lifted his hand a little and I saw the shade pulled back a little at the window and her face in it.

But the curiouseth thing was Dewey Dell. It surprised me. I see all the while how folks could say he was queer, but that was the very reason couldn't nobody hold it personal. It was like he was outside of it too, same as you, and getting mad at it would be kind of like getting mad at a mud-puddle that splashed you when you stepped in it. And then I always kind of had a idea that him and Dewey Dell kind of knowed things betwixt them. If I'd a said it was ere a one of us she liked better than ere a other, I'd a said it was Darl. But when we got it filled and covered and drove out the gate and turned into the lane where them fellows was waiting, when they come out and come on him and he jerked back, it was Dewey Dell that was on him before even Jewel could get at him. And then I believed I knowed how Gillespie knowed about how his barn taken fire.

She hadn't said a word, hadn't even looked at him, but when them fellows told him what they wanted and that they had come to get him and he throwed back, she jumped on him like a wild cat so that one of the fellows had to quit and hold her and her scratching and clawing at him like a wild cat, while the other one and pa and Jewel throwed Darl down and held him lying on his back, looking up at me.

"I thought you would have told me," he said. "I never thought you wouldn't have."

"Darl," I said. But he fought again, him and Jewel and the fellow, and the other one holding Dewey Dell and Vardaman yelling and Jewel saying, "Kill him. Kill the son of a bitch."

It was bad so. It was bad. A fellow cant get away from a shoddy job. He cant do it. I tried to tell him, but he just said, "I thought you'd a told me. It's not that I," he said, then he begun to laugh. The other fellow pulled Jewel off of him and he sat there on the ground, laughing.

I tried to tell him. If I could have just moved, even set up. But I tried to tell him and he quit laughing, looking up at me.

"Do you want me to go?" he said.

"It'll be better for you," I said. "Down there it'll be quiet, with none of the bothering and such. It'll be better for you, Darl," I said.

"Better," he said. He begun to laugh again. "Better," he said. He couldn't hardly say it for laughing. He sat on the ground and us watching him, laughing and laughing. It was bad. It was bad so. I be durn if I could see anything to laugh at. Because there just aint nothing justifies the deliberate destruction of what a man has built with his own sweat and stored the fruit of his sweat into.

But I aint so sho that ere a man has the right to say what is crazy and what aint. It's like there was a fellow in every man that's done a-past the sanity or the insanity, that watches the sane and the insane doings of that man with the same

horror and the same astonishment.

PEABODY



I said, "I reckon a man in a tight might let Bill Varner patch him up like a damn mule, but I be damned if the man that'd let Anse Bundren treat him with raw cement aint got more spare legs than I have."

"They just aimed to ease hit some," he said.

"Aimed, hell," I said. "What in hell did Armstid mean by even letting them put you on that wagon again?"

"Hit was gittin right noticeable," he said. "We never had time to wait." I just looked at him. "Hit never bothered me none," he said.

"Dont you lie there and try to tell me you rode six days on a wagon without springs, with a broken leg and it never bothered you."

"It never bothered me much," he said.

"You mean, it never bothered Anse much," I said. "No more than it bothered him to throw that poor devil down in the public street and handcuff him like a damn murderer. Dont tell me. And dont tell me it aint going to bother you to lose sixty-odd square inches of skin to get that concrete off. And dont tell me it aint going to bother you to have to limp around on one short leg for the balance of your life—if you walk at all again. Concrete," I said. "God Almighty, why didn't Anse carry you to the nearest sawmill and stick your leg in the saw? That would have cured it. Then you all could have stuck his head into the saw and cured a whole family..... Where is Anse, anyway? What's he up to now?"

"He's taking back them spades he borrowed," he said.

"That's right," I said. "Of course he'd have to borrow a spade to bury his wife with. Unless he could borrow a hole in the ground. Too bad you all didn't put him in it too..... Does that hurt?"

"Not to speak of," he said, and the sweat big as marbles running down his face and his face about the color of blotting paper.

"Course not," I said. "About next summer you can hobble around fine on this leg. Then it wont bother you, not to speak of..... If you had anything you could call luck, you might say it was lucky this is the same leg you broke before," I said.

"Hit's what paw says," he said.

MacGOWAN



It happened I am back of the prescription case, pouring up some chocolate sauce, when Jody comes back and says, "Say, Skeet, there's a woman up front that wants to see the doctor and when I said What doctor you want to see, she said she wants to see the doctor that works here and when I said There aint any doctor works here, she just stood there, looking back this way."

"What kind of a woman is it?" I says. "Tell her to go upstairs to Alford's office."

"Country woman," he says.

"Send her to the courthouse," I says. "Tell her all the doctors have gone to Memphis to a Barbers' Convention."

"All right," he says, going away. "She looks pretty good for a country girl," he says.

"Wait," I says. He waited and I went and peeped through the crack. But I couldn't tell nothing except she had a good leg against the light. "Is she young, you say?" I says.

"She looks like a pretty hot mamma, for a country girl," he says.

"Take this," I says, giving him the chocolate. I took off my apron and went up there. She looked pretty good. One of them black eyed ones that look like she'd as soon put a knife in you as not if you two-timed her. She looked pretty good. There wasn't nobody else in the store; it was dinner time.

"What can I do for you?" I says.

"Are you the doctor?" she says.

"Sure," I says. She quit looking at me and was kind of looking around.

"Can we go back yonder?" she says.

It was just a quarter past twelve, but I went and told Jody to kind of watch out and whistle if the old man come in sight, because he never got back before one.

"You better lay off of that," Jody says. "He'll fire your stern out of here so quick you cant wink."

"He dont never get back before one," I says. "You can see him go into the postoffice. You keep your eye peeled, now, and give me a whistle."

"What you going to do?" he says.

"You keep your eye out. I'll tell you later."

"Aint you going to give me no seconds on it?" he says.

"What the hell do you think this is?" I says; "a stud-farm? You watch out for him. I'm going into conference."

So I go on to the back. I stopped at the glass and smoothed my hair, then I went behind the prescription case, where she was waiting. She is looking at the medicine cabinet, then she looks at me.

"Now, madam," I says; "what is your trouble?"

"It's the female trouble," she says, watching me. "I got the money," she says.

"Ah," I says. "Have you got female troubles or do you want female troubles? If so, you come to the right doctor." Them country people. Half the time they dont know what they want, and the balance of the time they cant tell it to you. The clock said twenty past twelve.

"No," she says.

"No which?" I says.

"I aint had it," she says. "That's it." She looked at me. "I got the money," she says.

So I knew what she was talking about.

"Oh," I says. "You got something in your belly you wish you didn't have." She looks at me. "You wish you had a little more or a little less, huh?"

"I got the money," she says. "He said I could git something at the drugstore for hit."

"Who said so?" I says.

"He did," she says, looking at me.

"You dont want to call no names," I says. "The one that put the acorn in your belly? He the one that told you?" She dont say nothing. "You aint married, are you?" I says. I never saw no ring. But like as not, they aint heard yet out there that they use rings.

"I got the money," she says. She showed it to me, tied up in her handkerchief: a ten spot.

"I'll swear you have," I says. "He give it to you?"

"Yes," she says.

"Which one?" I says. She looks at me. "Which one of them give it to you?"

"It aint but one," she says. She looks at me.

"Go on," I says. She dont say nothing. The trouble about the cellar is, it aint but one way out and that's back up the inside stairs. The clock says twenty-five to one. "A pretty girl like you," I says.

She looks at me. She begins to tie the money back up in the handkerchief. "Excuse me a minute," I says. I go around the prescription case. "Did you hear about that fellow sprained his ear?" I says. "After that he couldn't even hear a belch."

"You better get her out from back there before the old man comes," Jody says.

"If you'll stay up there in front where he pays you to stay, he wont catch nobody but me," I says.

He goes on, slow, toward the front. "What you doing to her, Skeet?" he says.

"I cant tell you," I says. "It wouldn't be ethical. You go on up there and watch."

"Say, Skeet," he says.

"Ah, go on," I says. "I aint doing nothing but filling a prescription."

"He may not do nothing about that woman back there, but if he finds you monkeying with that prescription case, he'll kick your stern clean down them cellar stairs."

"My stern has been kicked by bigger bastards than him," I says. "Go back and watch out for him, now."

So I come back. The clock said fifteen to one. She is tying the money in the handkerchief. "You aint the doctor," she says.

"Sure I am," I says. She watches me. "Is it because I look too young, or am I too handsome?" I says. "We used to have a bunch of old water-jointed doctors here," I says; "Jefferson used to be a kind of Old Doctors' Home for them. But business started falling off and folks stayed so well until one day they found out that the women wouldn't never get sick at all. So they run all the old doctors out and got us young good-looking ones that the women would like and then the women begun to get sick again and so business picked up. They're doing that all over the country. Hadn't you heard about it? Maybe it's because you aint never needed a doctor."

"I need one now," she says.

"And you come to the right one," I says. "I already told you that."

"Have you got something for it?" she says. "I got the money."

"Well," I says, "of course a doctor has to learn all sorts of things while he's learning to roll calomel; he cant help himself. But I dont know about your trouble."

"He told me I could get something. He told me I could get it at the drugstore."

"Did he tell you the name of it?" I says. "You better go back and ask him."

She quit looking at me, kind of turning the handkerchief in her hands. "I got to do something," she says.

"How bad do you want to do something?" I says. She looks at me. "Of course, a doctor learns all sorts of things folks dont think he knows. But he aint supposed to tell all he knows. It's against the law."

Up front Jody says, "Skeet."

"Excuse me a minute," I says. I went up front. "Do you see him?" I says.

"Aint you done yet?" he says. "Maybe you better come up here and watch and let me do that consulting."

"Maybe you'll lay a egg," I says. I come back. She is looking at me. "Of course you realise that I could be put in the penitentiary for doing what you want," I says. "I would lose my license and then I'd have to go to work. You realise that?"

"I aint got but ten dollars," she says. "I could bring the rest next month, maybe."

"Pooh," I says, "ten dollars? You see, I cant put no price on my knowledge and skill. Certainly not for no little paltry sawbuck."

She looks at me. She dont even blink. "What you want, then?"

The clock said four to one. So I decided I better get her out. "You guess three times and then I'll show you," I says.

She dont even blink her eyes. "I got to do something," she says. She looks behind her and around, then she looks toward the front. "Gimme the medicine first," she says.

"You mean, you're ready to right now?" I says. "Here?"

"Gimme the medicine first," she says.

So I took a graduated glass and kind of turned my back to her and picked out a bottle that looked all right, because a man that would keep poison setting around in a unlabelled bottle ought to be in jail, anyway. It smelled like turpentine. I poured some into the glass and give it to her. She smelled it, looking at me across the glass.

"Hit smells like turpentine," she says.

"Sure," I says. "That's just the beginning of the treatment. You come back at ten o'clock tonight and I'll give you the rest of it and perform the operation."

"Operation?" she says.

"It wont hurt you. You've had the same operation before. Ever hear about the hair of the dog?"

She looks at me. "Will it work?" she says.

“Sure it’ll work. If you come back and get it.”

So she drunk whatever it was without batting a eye, and went out. I went up front.

“Didn’t you get it?” Jody says.

“Get what?” I says.

“Ah, come on,” he says. “I aint going to try to beat your time.”

“Oh, her,” I says. “She just wanted a little medicine. She’s got a bad case of dysentery and she’s a little ashamed about mentioning it with a stranger there.”

It was my night, anyway, so I helped the old bastard check up and I got his hat on him and got him out of the store by eight-thirty. I went as far as the corner with him and watched him until he passed under two street lamps and went on out of sight. Then I came back to the store and waited until nine-thirty and turned out the front lights and locked the door and left just one light burning at the back, and I went back and put some talcum powder into six capsules and kind of cleared up the cellar and then I was all ready.

She come in just at ten, before the clock had done striking. I let her in and she come in, walking fast. I looked out the door, but there wasn’t nobody but a boy in overalls sitting on the curb. “You want something?” I says. He never said nothing, just looking at me. I locked the door and turned off the light and went on back. She was waiting. She didn’t look at me now.

“Where is it?” she said.

I gave her the box of capsules. She held the box in her hand, looking at the capsules.

“Are you sure it’ll work?” she says.

“Sure,” I says. “When you take the rest of the treatment.”

“Where do I take it?” she says.

“Down in the cellar,” I says.

VARDAMAN



Now it is wider and lighter, but the stores are dark because they have all gone home. The stores are dark, but the lights pass on the windows when we pass. The lights are in the trees around the courthouse. They roost in the trees, but the courthouse is dark. The clock on it looks four ways, because it is not dark. The moon is not dark too. Not very dark. *Darl he went to Jackson is my brother Darl is my brother* Only it was over that way, shining on the track.

“Let’s go that way, Dewey Dell,” I say.

“What for?” Dewey Dell says. The track went shining around the window, it red on the track. But she said he would not sell it to the town boys. “But it will be there Christmas,” Dewey Dell says. “You’ll have to wait till then, when he brings it back.”

Darl went to Jackson. Lots of people didn’t go to Jackson. Darl is my brother. My brother is going to Jackson

While we walk the lights go around, roosting in the trees. On all sides it is the same. They go around the courthouse and then you cannot see them. But you can see them in the black windows beyond. They have all gone home to bed except me and Dewey Dell.

Going on the train to Jackson. My brother

There is a light in the store, far back. In the window are two big glasses of soda water, red and green. Two men could not drink them. Two mules could not. Two cows could not. *Darl*

A man comes to the door. He looks at Dewey Dell.

“You wait out here,” Dewey Dell says.

“Why cant I come in?” I say. “I want to come in, too.”

“You wait out here,” she says.

“All right,” I say.

Dewey Dell goes in.

Darl is my brother. Darl went crazy

The walk is harder than sitting on the ground. He is in the open door. He looks at me. “You want something?” he says. His head is slick. Jewel’s head is slick sometimes. Cash’s head is not slick. *Darl he went to Jackson my brother Darl In the street he ate a banana. Wouldn’t you rather have bananas? Dewey Dell said. You wait till Christmas. It’ll be there then. Then you can see it. So we are going to have some bananas. We are going to have a bag full, me and Dewey Dell.* He locks the door. Dewey Dell is inside. Then the light winks out.

He went to Jackson. He went crazy and went to Jackson both. Lots of people didn’t go crazy. Pa and Cash and Jewel and Dewey Dell and me didn’t go crazy. We never did go crazy. We didn’t go to Jackson either. Darl

I hear the cow a long time, clopping on the street. Then she comes into the square. She goes across the square, her head down clopping . She lows. There was nothing in the square before she lowed, but it wasn’t empty. Now it is empty after she lowed. She goes on, clopping . She lows. *My brother is Darl. He went to Jackson on the train. He didn’t go on the train to go crazy. He went crazy in our wagon. Darl* She has been in there a long time. And the cow is gone too. A long time. She has been in there longer than the cow was. But not as long as empty. *Darl is my brother. My brother Darl*

Dewey Dell comes out. She looks at me.

“Let’s go around that way now,” I say.

She looks at me. “It aint going to work,” she says. “That son of a bitch.”

“What aint going to work, Dewey Dell?”

“I just know it wont,” she says. She is not looking at anything. “I just know it.”

“Let’s go that way,” I say.

“We got to go back to the hotel. It’s late. We got to slip back in.”

“Cant we go by and see, anyway?”

“Hadn’t you rather have bananas? Hadn’t you rather?”

“All right.” *My brother he went crazy and he went to Jackson too. Jackson is further away than crazy*

“It wont work,” Dewey Dell says. “I just know it wont.”

“What wont work?” I say. *He had to get on the train to go to Jackson. I have not been on the train, but Darl has been on the train. Darl. Darl is my brother. Darl. Darl*

DARL



Darl has gone to Jackson. They put him on the train, laughing, down the long car laughing, the heads turning like the heads of owls when he passed. "What are you laughing at?" I said.

"Yes yes yes yes yes."

Two men put him on the train. They wore mismatched coats, bulging behind over their right hip pockets. Their necks were shaved to a hairline, as though the recent and simultaneous barbers had had a chalk-line like Cash's. "Is it the pistols you're laughing at?" I said. "Why do you laugh?" I said. "Is it because you hate the sound of laughing?"

They pulled two seats together so Darl could sit by the window to laugh. One of them sat beside him, the other sat on the seat facing him, riding backward. One of them had to ride backward because the state's money has a face to each backside and a backside to each face, and they are riding on the state's money which is incest. A nickel has a woman on one side and a buffalo on the other; two faces and no back. I dont know what that is. Darl had a little spy-glass he got in France at the war. In it it had a woman and a pig with two backs and no face. I know what that is. "Is that why you are laughing, Darl?"

"Yes yes yes yes yes."

The wagon stands on the square, hitched, the mules motionless, the reins wrapped about the seat-spring, the back of the wagon toward the courthouse. It looks no different from a hundred other wagons there; Jewel standing beside it and looking up the street like any other man in town that day, yet there is something different, distinctive. There is about it that unmistakable air of definite and imminent departure that trains have, perhaps due to the fact that

Dewey Dell and Vardaman on the seat and Cash on a pallet in the wagon bed are eating bananas from a paper bag. "Is that why you are laughing, Darl?"

Darl is our brother, our brother Darl. Our brother Darl in a cage in Jackson where, his grimed hands lying light in the quiet interstices, looking out he foams.

"Yes yes yes yes yes yes yes."

DEWEY DELL



When he saw the money I said, "It's not my money, it doesn't belong to me."

"Whose is it, then?"

"It's Cora Tull's money. It's Mrs Tull's. I sold the cakes for it."

"Ten dollars for two cakes?"

"Dont you touch it. It's not mine."

"You never had them cakes. It's a lie. It was them Sunday clothes you had in that package."

"Dont you touch it! If you take it you are a thief."

"My own daughter accuses me of being a thief. My own daughter."

"Pa. Pa."

"I have fed you and sheltered you. I give you love and care, yet my own daughter, the daughter of my dead wife, calls me a thief over her mother's grave."

"It's not mine, I tell you. If it was, God knows you could have it."

"Where did you get ten dollars?"

"Pa. Pa."

"You wont tell me. Did you come by it so shameful you dare not?"

"It's not mine, I tell you. Cant you understand it's not mine?"

"It's not like I wouldn't pay it back. But she calls her own father a thief."

"I cant, I tell you. I tell you it's not my money. God knows you could have it."

"I wouldn't take it. My own born daughter that has et my food for seventeen years, begrudges me the loan of ten dollars."

"It's not mine, I cant."

"Whose is it, then?"

“It was give to me. To buy something with.”

“To buy what with?”

“Pa. Pa.”

“It’s just a loan. God knows, I hate for my blooden children to reproach me. But I give them what was mine without stint. Cheerful I give them, without stint. And now they deny me. Addie. It was lucky for you you died, Addie.”

“Pa. Pa.”

“God knows it is.”

He took the money and went out.

CASH



So when we stopped there to borrow the shovels we heard the graphophone playing in the house, and so when we got done with the shovels pa says, "I reckon I better take them back."

So we went back to the house. "We better take Cash on to Peabody's," Jewel said.

"It wont take but a minute," pa said. He got down from the wagon. The music was not playing now.

"Let Vardaman do it," Jewel said. "He can do it in half the time you can. Or here, you let me——"

"I reckon I better do it," pa says. "Long as it was me that borrowed them."

So we set in the wagon, but the music wasn't playing now. I reckon it's a good thing we aint got ere a one of them. I reckon I wouldn't never get no work done a-tall for listening to it. I dont know if a little music aint about the nicest thing a fellow can have. Seems like when he comes in tired of a night, it aint nothing could rest him like having a little music played and him resting. I have seen them that shuts up like a hand-grip, with a handle and all, so a fellow can carry it with him wherever he wants.

"What you reckon he's doing?" Jewel says. "I could a toted them shovels back and forth ten times by now."

"Let him take his time," I said. "He aint as spry as you, remember."

"Why didn't he let me take them back, then? We got to get your leg fixed up so we can start home tomorrow."

"We got plenty of time," I said. "I wonder what them machines costs on the installment."

"Installment of what?" Jewel said. "What you got to buy it with?"

"A fellow cant tell," I said. "I could a bought that one from Suratt for five dollars, I believe."

And so pa come back and we went to Peabody's. While we was there pa said he was going to the barbershop and get a shave. And so that night he said he had some business to tend to, kind of looking away from us while he said it, with his hair combed wet and slick and smelling sweet with perfume, but I said leave him be; I wouldn't mind hearing a little more of that music myself.

And so next morning he was gone again, then he come back and told us to get hitched up and ready to take out and he would meet us and when they was gone he said,

"I dont reckon you got no more money."

"Peabody just give me enough to pay the hotel with," I said. "We dont need nothing else, do we?"

"No," pa said; "no. We dont need nothing." He stood there, not looking at me.

"If it is something we got to have, I reckon maybe Peabody," I said.

"No," he said; "it aint nothing else. You all wait for me at the corner."

So Jewel got the team and come for me and they fixed me a pallet in the wagon and we drove across the square to the corner where pa said, and we was waiting there in the wagon, with Dewey Dell and Vardaman eating bananas, when we see them coming up the street. Pa was coming along with that kind of daresome and hangdog look all at once like when he has been up to something he knows ma aint going to like, carrying a grip in his hand, and Jewel says,

"Who's that?"

Then we see it wasn't the grip that made him look different; it was his face, and Jewel says, "He got them teeth."

It was a fact. It made him look a foot taller, kind of holding his head up, hangdog and proud too, and then we see her behind him, carrying the other grip —a kind of duck-shaped woman all dressed up, with them kind of hardlooking pop eyes like she was daring ere a man to say nothing. And there we set watching them, with Dewey Dell's and Vardaman's mouth half open and half-et bananas in their hands and her coming around from behind pa, looking at us like she dared ere a man. And then I see that the grip she was carrying was one of them little graphophones. It was for a fact, all shut up as pretty as a picture, and everytime a new record would come from the mail order and us setting in the house in the winter, listening to it, I would think what a shame Darl couldn't be to enjoy it too. But it is better so for him. This world is not his world; this life his life.

"It's Cash and Jewel and Vardaman and Dewey Dell," pa says, kind of

hangdog and proud too, with his teeth and all, even if he wouldn't look at us.
“Meet Mrs Bundren,” he says.

EDITORS' NOTE



This volume reproduces the text of *As I Lay Dying* that has been established by Noel Polk. The copy-text for this novel is William Faulkner's own ribbon typescript setting copy, which has been emended to account for his revisions in proof, his indisputable typing errors, and certain other mistakes and inconsistencies that clearly demand correction. Faulkner typed and proofread this document himself, and it also bears alterations of varying degrees of seriousness by his editors.

According to Faulkner's sarcastic testimony in his notorious introduction to the Modern Library *Sanctuary* in 1932, he wrote *As I Lay Dying* "in six weeks, without changing a word." The manuscript and typescript reveal that he did not, of course, write it "without changing a word," although the dates on the manuscript indicate that he did indeed complete the holograph version in about eight weeks, between October 25 and December 29, 1929. "I set out deliberately to write a tour-de-force," he claimed later. "Before I ever put pen to paper and set down the first words, I knew what the last word would be.... Before I began I said, I am going to write a book by which, at a pinch, I can stand or fall if I never touch ink again." He wrote *As I Lay Dying* at the University of Mississippi power plant, where he was employed as a fireman and night watchman, mostly in the early morning, after everybody had gone to bed and power needs had diminished. He finished the typing, according to the date on the carbon typescript, on January 12, 1930, and sent it to Harrison Smith, who published it with very few editorial changes on October 6, 1930.

Extant documents relevant to the editing of *As I Lay Dying* are the holograph manuscript and the carbon typescript, at the Alderman Library of the University

of Virginia, and the ribbon typesetting copy, at the Humanities Research Center of the University of Texas. No proof is known to survive; this is unfortunate, since there are a number of differences between the typescript and the published book that must have occurred in proof.

American English continues to fluctuate; for example, a word may be spelled in more than one way, even in the same work. Commas are sometimes used expressively to suggest the movements of voice, and capitals are sometimes meant to give significances to a word beyond those it might have in its uncapitalized form. Since standardization would remove such effects, this volume preserves the spelling, punctuation, capitalization, and wording of the text established by Noel Polk, which strives to be as faithful to Faulkner's usage as surviving evidence permits.

The following notes were prepared by Joseph Blotner and are reprinted with permission from *Novels 1930—1935*, one volume of the edition of Faulkner's collected works published by The Library of America, 1985. For further information, consult Calvin S. Brown, *A Glossary of Faulkner's South* (New Haven: Yale University Press, 1976); Jessie McGuire Coffee, *Faulkner's Un-Christlike Christians: Biblical Allusions in the Novels* (Ann Arbor: UMI Research Press, 1983); André Bleikasten, *Faulkner's As I Lay Dying* (Bloomington: Indiana University Press, rev. ed., 1973); and *William Faulkner's "As I Lay Dying,"* ed. by Dianne L. Cox (New York: Garland Publishing, 1984).

AS I LAY DYING] When asked the source of his title, Faulkner would

1 sometimes quote from memory the speech of Agamemnon to Odysseus in the *Odyssey*, Book XI: “As I lay dying the woman with the dog’s eyes would not close my eyes for me as I descended into Hades.”

2 laidby cotton] A cultivated crop that will require no further attention until it is picked at harvest time.

3 pussel-gutted] Faulkner defined this to mean “bloated.”

4 frailed] Variant of flailed. To whip or beat.

5 laid-by] See note 2.

6 I ... falls.] See Matt. 10:29.

7 Christmas masts] According to Faulkner, comic masks worn by children at Christmas and Halloween.

8 sweat ... Lord.] Cf. Gen. 3:19 and Matt. 13:12.

9 I ... chastiseth.] Anse’s garbled recollection of Heb. 12:6.

10 busted out] Plowed or harrowed in preparation for planting.

It ... away.] Book Four of *The Hamlet* (1940) tells the story of the incursion
11 of these “spotted horses” into Yoknapatawpha County in the first decade of
the twentieth century.

12 there ... sinned] See Jesus’ parable of the lost sheep in Luke 15:7.

13 Inverness] A town about ninety miles southwest of Oxford.

14 aguer] Anague, a malarial fever.

Yoknapatawpha county] The first appearance of the name of what Faulkner
would call “my apocryphal county.” Mississippi’s Lafayette County, where
15 Faulkner spent most of his life, is bounded on the south by the Yocona River.
Some early maps transliterated the river’s Chickasaw name as Yockney-
Patafa. According to Faulkner, it meant “water runs slow through flat land.”

ABOUT THIS GUIDE

The questions, discussion topics, and author biography that follow are designed to enhance your group's reading of three of William Faulkner's greatest novels: *The Sound and the Fury*, *As I Lay Dying*, and *Absalom, Absalom!* We hope that they will provide you with new ways of thinking and talking about three works that stand as major landmarks in the history of modern American literature, works that exemplify Faulkner's bold stylistic and formal innovations, his creation of unforgettably powerful voices and characters, and his brilliant insight into the psychological, economic, and social realities of life in the South in the transition from the Civil War to the modern era. In their intellectual and aesthetic richness, these novels raise nearly endless possibilities for discussion. The questions below will necessarily be limited and are meant to open several, but certainly not all, areas of inquiry for your reading group.

READER'S GUIDE

1. Which are the most intelligent and sympathetic voices in the novel? With whom do you most and least identify? Is Faulkner controlling your closeness to some characters and not others? How is this done, given the seemingly equal mode of presentation for all voices?
2. Even the reader of such an unusual book may be surprised to come upon Addie Bundren's narrative on [this page](#), if only because Addie has been dead since [this page](#). Why is Addie's narrative placed where it is, and what is the effect of hearing Addie's voice at this point in the book? Is this one of the ways in which Faulkner shows Addie's continued "life" in the minds and hearts of her family? How do the issues raised by Addie here relate to the book as a whole?
3. Faulkner allows certain characters—especially Darl and Vardaman—to express themselves in language and imagery that would be impossible, given their lack of education and experience in the world. Why does he break with the realistic representation of character in this way?
4. What makes Darl different from the other characters? Why is he able to describe Addie's death [[see here](#)] when he is not present? How is he able to intuit the fact of Dewey Dell's pregnancy? What does this uncanny visionary power mean, particularly in the context of what happens to Darl at the end of the novel? Darl has fought in World War I; why do you think Faulkner has chosen to include this information about him? What are the sources and meaning of his madness?
5. Anse Bundren is surely one of the most feckless characters in literature, yet he alone thrives in the midst of disaster. How does he manage to command the obedience and cooperation of his children? Why are other people so generous with him? He gets his new teeth at the end of the novel and he also gets a new wife. What is the secret of Anse's charm? How did he manage to make Addie marry him, when she is clearly more intelligent than he is?
6. Some critics have spoken of Cash as the novel's most gentle character, while others have felt that he is too rigid, too narrow-minded, to be sympathetic. What does Cash's list of the thirteen reasons for beveling the edges of the coffin tell us about him? What does it tell us about his feeling for his mother? Does Cash's carefully reasoned response to Darl's imprisonment seem fair to you, or is it a betrayal of his brother?
7. Jewel is the result of Addie's affair with the evangelical preacher Whitfield (an aspect of the plot that bears comparison with Hawthorne's *The Scarlet*

Letter). When we read Whitfield's section, we realize that Addie has again allied herself with a man who is not her equal. How would you characterize the preacher? What is the meaning of this passionate alliance, now repudiated by Whitfield? Does Jewel know who his father is?

8. What is your response to the section spoken by Vardaman, which states simply, "My mother is a fish"? What sort of psychological state or process does this declaration indicate? What are some of the ways in which Vardaman insists on keeping his mother alive, even as he struggles to understand that she is dead? In what other ways does the novel show characters wrestling with ideas of identity and embodiment?

9. This is a novel full of acts of love, not the least of which is the prolonged search in the river for Cash's tools. Consider some of the other ways that love is expressed among the members of the family. What compels loyalty in this family? What are the ways in which that loyalty is betrayed? Which characters are most self-interested?

10. The saga of the Bundren family is participated in, and reflected upon, by many other characters. What does the involvement of Doctor Peabody, of Armstid, and of Cora and Vernon Tull say about the importance of community in country life? Are the characters in the town meant to provide a contrast with country people?

11. Does Faulkner deliberately make humor and the grotesque interdependent in this novel? What is the effect of such horrific details as Vardaman's accidental drilling of holes in his dead mother's face? Of Darl and Vardaman listening to the decaying body of Addie "speaking"? Of Vardaman's anxiety about the growing number of buzzards trying to get at the coffin? Of Cash's bloody broken leg, set in concrete and suppurating in the heat? Of Jewel's burnt flesh? Of the "cure" that Dewey Dell is tricked into?

12. In one of the novel's central passages, Addie meditates upon the distance between words and actions: "I would think how words go straight up in a thin line, quick and harmless, and how terribly doing goes along the earth, clinging to it, so that after a while the two lines are too far apart for the same person to straddle from one to the other; and that sin and love and fear are just sounds that people who never sinned nor loved nor feared have for what they never had and cannot have until they forget the words" [[see here](#)]. What light does this passage shed upon the meaning of the novel? Aren't words necessary in order to give form to the story of the Bundrens? Or is Faulkner saying that words—his own chosen medium—are inadequate?

13. What does the novel reveal about the ways in which human beings deal with death, grieving, and letting go of our loved ones?

WILLIAM FAULKNER (1897–1962)

William Cuthbert Faulkner was born in 1897 in New Albany, Mississippi, the first of four sons of Murry and Maud Butler Falkner (he later added the “u” to the family name himself). In 1904 the family moved to the university town of Oxford, Mississippi, where Faulkner was to spend most of his life. He was named for his greatgrandfather “The Old Colonel,” a Civil War veteran who built a railroad, wrote a bestselling romantic novel called *The White Rose of Memphis*, became a Mississippi state legislator, and was eventually killed in what may or may not have been a duel with a disgruntled business partner. Faulkner identified with this robust and energetic ancestor and often said that he inherited the “ink stain” from him.

Never fond of school, Faulkner left at the end of football season his senior year of high school, and began working at his grandfather’s bank. In 1918, after his plans to marry his sweetheart Estelle Oldham were squashed by their families, he tried to enlist as a pilot in the U.S. Army but was rejected because he did not meet the height and weight requirements. He went to Canada, where he pretended to be an Englishman and joined the RAF training program there. Although he did not complete his training until after the war ended and never saw combat, he returned to his hometown in uniform, boasting of war wounds. He briefly attended the University of Mississippi, where he began to publish his poetry.

After spending a short time living in New York, he again returned to Oxford, where he worked at the university post office. His first book, a collection of poetry, *The Marble Faun*, was published at Faulkner’s own expense in 1924. The writer Sherwood Anderson, whom he met in New Orleans in 1925, encouraged him to try writing fiction, and his first novel, *Soldier’s Pay*, was published in 1926. It was followed by *Mosquitoes*. His next novel, which he titled *Flags in the Dust*, was rejected by his publisher and twelve others to whom

he submitted it. It was eventually published in drastically edited form as *Sartoris* (the original version was not issued until after his death). Meanwhile, he was writing *The Sound and the Fury*, which, after being rejected by one publisher, came out in 1929 and received many ecstatic reviews, although it sold poorly. Yet again, a new novel, *Sanctuary*, was initially rejected by his publisher, this time as “too shocking.” While working on the night shift at a power plant, Faulkner wrote what he was determined would be his masterpiece, *As I Lay Dying*. He finished it in about seven weeks, and it was published in 1930, again to generally good reviews and mediocre sales.

In 1929 Faulkner had finally married his childhood sweetheart, Estelle, after her divorce from her first husband. They had a premature daughter, Alabama, who died ten days after birth in 1931; a second daughter, Jill, was born in 1933.

With the eventual publication of his most sensational and violent (as well as, up till then, most successful) novel, *Sanctuary* (1931), Faulkner was invited to write scripts for MGM and Warner Brothers, where he was responsible for much of the dialogue in the film versions of Hemingway’s *To Have and Have Not* and Chandler’s *The Big Sleep*, and many other films. He continued to write novels and published many stories in the popular magazines. *Light in August* (1932) was his first attempt to address the racial issues of the South, an effort continued in *Absalom, Absalom!* (1936), and *Go Down, Moses* (1942). By 1946, most of Faulkner’s novels were out of print in the United States (although they remained well-regarded in Europe), and he was seen as a minor, regional writer. But then the influential editor and critic Malcolm Cowley, who had earlier championed Hemingway and Fitzgerald and others of their generation, put together the *Portable Faulkner*, and once again Faulkner’s genius was recognized, this time for good. He received the 1949 Nobel Prize for Literature as well as many other awards and accolades, including the National Book Award and the Gold Medal from the American Academy of Arts and Letters and France’s Legion of Honor.

In addition to several collections of short fiction, his other novels include *Pylon* (1935), *The Unvanquished* (1938), *The Wild Palms* (1939), *The Hamlet* (1940), *Intruder in the Dust* (1948), *A Fable* (1954), *The Town* (1957), *The Mansion* (1959), and *The Reivers* (1962).

William Faulkner died of a heart attack on July 6, 1962, in Oxford, Mississippi, where he is buried.

“He is the greatest artist the South has produced.... Indeed, through his many novels and short stories, Faulkner fights out the moral problem which was repressed after the nineteenth century [yet] for all his concern with the South, Faulkner was actually seeking out the nature of man. Thus we must turn to him for that continuity of moral purpose which made for the greatness of our classics.”

—RALPH ELLISON



“Faulkner, more than most men, was aware of human strength as well of human weakness. He knew that the understanding and the resolution of fear are a large part of the writer’s reason for being.”

—JOHN STEINBECK



“For range of effect, philosophical weight, originality of style, variety of characterization, humor, and tragic intensity, [Faulkner’s works] are without equal in our time and country.”

—ROBERT PENN WARREN



“No man ever put more of his heart and soul into the written word than did William Faulkner. If you want to know all you can about that heart and soul, the fiction where he put it is still right there.”

—EUDORA WELTY

APPROACHING WILLIAM FAULKNER

As with any great literature, there are probably as many ways to read William Faulkner's writing as there are readers. There are hundreds of books devoted to interpretations of his novels, numerous biographies, and every year high school teachers and college professors guide their students through one or more of the novels. But after all is said and done, there are the books themselves, and the pleasure of reading them can be deep and lasting. The language Faulkner uses ranges from the poetically beautiful, nearly biblical to the coarse sounds of rough dialect. His characters linger in the mind, whether for their heroism or villainy, their stoicism or self-indulgence, their honesty or deceitfulness or self-deception, their wisdom or stupidity, their gentleness or cruelty. In short, like Shakespeare, William Faulkner understood what it means to be human.

Much of Faulkner's fiction is set in the fictional Mississippi county Yoknapatawpha (*Yok'na pa taw pha*) and most of his characters are southerners who to one degree or another, are struggling with life in a country that has experienced defeat, resisting change, and dealing with a lingering nostalgia for a time that many of them never knew. Faulkner's South is, of course, a segregated South, and most of his characters are white southerners, many of whom have not and will not accept the reality of racial equality. Faulkner himself became involved in the early Civil Rights struggle, but being a southerner who rarely left the small Mississippi college town where he grew up, he understood the difficulty of the racial divide, and in his writing we can find some of the most subtle explanations of the difficult relationship between blacks and white, as well as some of the most horrifying descriptions of the effects of racial hatred.

But if Faulkner were only concerned with the lives of southerners in the long period after the Civil War and into the first half of the twentieth century, his writing would not have the appeal it does (and he might not have received the Nobel Prize for Literature). Faulkner deals with universal themes, and his characters, speaking in their own, sometimes barely articulate, sometimes profoundly insightful voices, express the fears, joys, and confusion of struggling with life: the voices of the Bundren family and their neighbors and acquaintances alternating in *As I Lay Dying* lend the narrative much more power

than a simple telling of the plot would. Allowing the “idiot” Benjy to narrate the first section of *The Sound and the Fury*, in which time is confused and details accumulate slowly, makes the reader consider how events are interpreted and what the mind makes of memories. In *Light in August*, Joe Christmas never knows his true origins, but his assumptions, and the beliefs of others, lead to a dramatic portrayal of the effects of prejudice.

Often tragic, sometimes absurdly comic, Faulkner’s plots are frequently driven by forces that cannot be controlled by his characters: the definition of classic tragedy. In *As I Lay Dying*, the family set off on a journey to fulfill the dying wish of Addie Bundren, only to be stymied by an almost biblical series of events: fire and flood among them. Benjy, Quentin, and Jason Compton in *The Sound and the Fury* are each affected by something that happened to their sister, which they could not or did not prevent, and perhaps by the effects of history itself. In *Light in August*, the lives of two characters who never meet, Lena Grove and Joe Christmas, lead to both horrifying tragedy and a small but significant ray of hope.

So, how do we approach Faulkner? We approach him through his language, letting ourselves hear the poetry in it, stopping to savor a phrase (or look up an unfamiliar word!), or just reading until the sound becomes familiar. We approach him through his characters, hating them or loving them, fearing for them, hoping for them or merely wondering how they survive. We approach him through the stories he tells, because they are familiar or strange, because they sound like history or myth or just a good tale. We can even approach him through what we know about Faulkner’s own life and times or through what we read in the newspaper every day or what we have experienced in our personal lives. If the definition of classic literature is that it concerns things that we continue to want (and need) to read about, then we can simply read Faulkner.

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New York

ALSO BY WILLIAM FAULKNER

ABSALOM, ABSALOM!

One of Faulkner's finest achievements, *Absalom, Absalom!* is the story of Thomas Sutpen and the ruthless, single-minded pursuit of his grand design—to forge a dynasty in Jefferson, Mississippi, in 1830—which is ultimately destroyed (along with Sutpen himself) by his two sons.

AS I LAY DYING

As I Lay Dying is the harrowing account of the Bundren family's odyssey across the Mississippi countryside to bury Addie, their wife and mother. Told by each of the family members—including Addie herself—the novel ranges from dark comedy to deepest pathos.

A FABLE

Winner of the Pulitzer Prize and the National Book Award, this allegorical novel about World War I is set in the trenches of France and deals with a mutiny in a French regiment.

FLAGS IN THE DUST

The complete text, published for the first time in 1973, of Faulkner's third novel, written when he was twenty-nine, which appeared, with his reluctant consent, in a much cut version in 1929 as *Sartoris*.

LIGHT IN AUGUST

A novel about hopeful perseverance in the face of mortality, *Light in August* tells the tales of guileless, dauntless Lena Grove, in search of the father of her unborn child; Reverend Gail Hightower, who is plagued by visions of Confederate horsemen; and Joe Christmas, an enigmatic drifter consumed by his mixed ancestry.

THE REIVERS

One of Faulkner's comic masterpieces and winner of a Pulitzer Prize, *The Reivers* is a picaresque tale that tells of three unlikely car thieves from rural Mississippi and their wild misadventures in the fast life of Memphis—from horse smuggling to bawdy houses.

REQUIEM FOR A NUN

The sequel to Faulkner's most sensational novel *Sanctuary*, was written twenty years later but takes up the story of Temple Drake eight years after the events related in *Sanctuary*. Temple is now married to Gowan Stevens. The book begins when the death sentence is pronounced on the nurse Nancy for the murder of Temple and Gowan's child. In an attempt to save her, Temple goes to see the judge to confess her own guilt. Told partly in prose, partly in play form, *Requiem for a Nun* is a haunting exploration of the impact of the past on the present.

THE SOUND AND THE FURY

One of the greatest novels of the twentieth century, *The Sound and the Fury* is the tragedy of the Compson family, featuring some of the most memorable characters in American literature: beautiful, rebellious Caddy; the man-child Benjy; haunted, neurotic Quentin; Jason, the brutal cynic; and Dilsey, their black servant.

THE UNVANQUISHED

The Unvanquished is a novel of the Sartoris family, who embody the ideal of

Southern honor and its transformation through war, defeat, and Reconstruction: Colonel John Sartoris, who is murdered by a business rival after the war; his son Bayard, who finds an alternative to bloodshed; and Granny Millard, the matriarch, who must put aside her code of gentility in order to survive.

Snopes Trilogy

THE HAMLET

The Hamlet, the first novel of Faulkner's Snopes trilogy, is both an ironic take on classical tragedy and a mordant commentary on the grand pretensions of the antebellum South and the depths of its decay in the aftermath of war and reconstruction. It tells of the advent and the rise of the Snopes family in Frenchman's Bend, a small town built on the ruins of a once-stately plantation. Flem Snopes—wily, energetic, a man of shady origins—quickly comes to dominate the town and its people with his cunning and guile.

THE TOWN

This is the second volume of Faulkner's trilogy about the Snopes family, his symbol for the grasping, destructive element in the post-bellum South. Like its predecessor *The Hamlet*, and its successor *The Mansion*, *The Town* is completely self-contained, but it gains resonance from being read with the other two. The story of Flem Snopes' ruthless struggle to take over the town of Jefferson, Mississippi, the book is rich in typically Faulknerian episodes of humor and of profundity.

THE MANSION

The Mansion completes Faulkner's great trilogy of the Snopes family in the mythical county of Yoknapatawpha, Mississippi, which also includes *The Hamlet* and *The Town*. Beginning with the murder of Jack Houston and ending with the murder of Flem Snopes, it traces the downfall of the indomitable post-bellum family who managed to seize control of the town of Jefferson within a

generation.

BIG WOODS

The best of William Faulkner's hunting stories are woven together brilliantly in *Big Woods*. First published in 1955 and now available in paperback for the first time, the volume includes Faulkner's most famous story, "The Bear" (in its original version), together with "The Old People," "A Bear Hunt," and "Race at Morning." Each of the stories is introduced by a prelude, and the final one is followed by an epilogue, which serve as almost musical bridges between them. Together, these pieces create a seamless whole, a work that displays the full eloquence, emotional breadth, and moral complexity of Faulkner's vision.

COLLECTED STORIES

"A Bear Hunt," "A Rose for Emily," "Two Soldiers," "Victory," "The Brooch," "Beyond"—these are among the forty-two stories that make up this magisterial collection by the writer who stands at the pinnacle of modern American fiction. Compressing an epic expanse of vision into narratives as hard and wounding as bullets, William Faulkner's stories evoke the intimate textures of place, the deep strata of history and legend, and all the fear, brutality, and tenderness of which human beings are capable. These tales are set not only in Yoknapatawpha County but in Beverly Hills and in France during World War I; they are populated by such characters as the Faulknerian archetypes Flem Snopes and Quentin Compson ("A Justice") as well as ordinary men and women who emerge in these pages so sharply and indelibly that they dwarf the protagonists of most novels.

GO DOWN, MOSES

Go Down, Moses is composed of seven interrelated stories, all of them set in Faulkner's mythic Yoknapatawpha County. From a variety of perspectives, Faulkner examines the complex, changing relationships between blacks and whites, between man and nature, weaving a cohesive novel rich in implication and insight.

INTRUDER IN THE DUST

Intruder in the Dust is at once engrossing murder mystery and unflinching portrait of racial injustice: it is the story of Lucas Beauchamp, a black man wrongly arrested for the murder of Vinson Gowrie, a white man. Confronted by the threat of lynching, Lucas sets out to prove his innocence, aided by a white lawyer, Gavin Stevens, and his young nephew, Chick Mallison.

KNIGHT'S GAMBIT

Gavin Stevens, the wise and forbearing student of crime and the folk ways of Yoknapatawpha County, Mississippi, plays the major role in these six stories of violence. In each, Stevens' sharp insights and ingenious detection uncover the underlying motives.

PYLON

One of the few of William Faulkner's works to be set outside his fictional Yoknapatawpha County, *Pylon*, first published in 1935, takes place at an air show in a thinly disguised New Orleans named New Valois. An unnamed reporter for a local newspaper tries to understand a very modern *ménage à trois* of flyers on the brainstorming circuit. These characters, Faulkner said, "were a fantastic and bizarre phenomenon on the face of the contemporary scene.... That is, there was really no place for them in the culture, in the economy, yet they were there, at that time, and everyone knew that they wouldn't last very long, which they didn't.... That they were outside the range of God, not only of respectability, of love, but of God too." In *Pylon* Faulkner set out to test their rootless modernity to see if there is any place in it for the old values of the human heart that are the central concerns of his best fiction.

SANCTUARY

A powerful novel examining the nature of evil, informed by the works of T.S. Eliot and Freud, mythology, local lore, and hardboiled detective fiction, *Sanctuary* is the dark, at times brutal, story of the kidnapping of Mississippi

debutante Temple Drake, who introduces her own form of venality into the Memphis underworld where she is being held.

THREE FAMOUS SHORT NOVELS

In this book are three different approaches of Faulkner, each of them highly entertaining as well as representative of his work as a whole. *Spotted Horses* is a hilarious account of a horse auction, and pits the “cold practicality” of women against the boyish folly of men. The law comes in to settle the dispute caused by the sale of “wild” horses, and finds itself up against a formidable opponent, Mrs. Tull. *Old Man* is something of an adventure story. When a flood ravages the countryside of the lower Mississippi, a convict finds himself adrift with a pregnant woman. His one aim is to return the woman to safety and himself to prison, where he can be free of women. In order to do this, he fights alligators and snakes, as well as the urge to be trapped once again by a woman. Perhaps one of the best known of Faulkner’s shorter works, *The Bear* is the story of a boy coming to terms with the adult world. By learning how to hunt, the boy is taught the real meaning of pride and humility and courage, virtues that Faulkner feared would be almost impossible to learn with the destruction of the wilderness.

UNCOLLECTED STORIES OF WILLIAM FAULKNER

This invaluable volume, which has been republished to commemorate the one-hundredth anniversary of Faulkner’s birth, contains some of the greatest short fiction by a writer who defined the course of American literature. Its forty-five stories fall into three categories: those not included in Faulkner’s earlier collections; previously unpublished short fiction; and stories that were later expanded into such novels as *The Unvanquished*, *The Hamlet*, and *Go Down, Moses*. With its introduction and extensive notes by the biographer Joseph Blotner, *Uncollected Stories of William Faulkner* is an essential addition to its author’s canon—as well as a book of some of the most haunting, harrowing, and atmospheric short fiction written in this century.

THE WILD PALMS

In this feverishly beautiful novel—originally titled *If I Forget Thee, Jerusalem* by Faulkner, and now published in the authoritative Library of America text—William Faulkner interweaves two narratives, each wholly absorbing in its own right, each subtly illuminating the other. In New Orleans in 1937, a man and a woman embark on a headlong flight into the wilderness of passions, fleeing her husband and the temptations of respectability. In Mississippi ten years earlier, a convict sets forth across a flooded river, risking his one chance at freedom to rescue a pregnant woman. From these separate stories Faulkner composes a symphony of deliverance and damnation, survival and self-sacrifice, a novel in which elemental danger juxtaposes with fatal injuries of the spirit. *The Wild Palms* is grandly inventive, heart-stopping in its prose, and suffused on every page with the physical presence of the country that Faulkner made his own.



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JRC SCIENCE FOR POLICY REPORT

Application Programming Interfaces in Governments: Why, what and how

Channelling government digital
transformation through APIs

Vaccari L., Posada M., Boyd M.,
Gattwinkel D., Mavridis D., Smith R. S.,
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2020

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APPLICATION PROGRAMMING INTERFACES IN GOVERNMENTS: WHY, WHAT AND HOW

Channelling government digital transformation through APIs

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All errors remain the sole responsibility of the authors.

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Abstract

Application programming interfaces (APIs) are a 50-year-old technology that can be applied to many fields and that, for some years, the public sector has used to implement its digital transformation (e.g. for the publication of public-sector information and for public service provision in different areas), although this technology is not yet fully used to support government policies. Recently, the European Commission has produced a series of policy instruments that require or suggest the adoption of APIs in governments and in some specific areas in particular. These initiatives include the Open Data EU Directive 2019/1024, which requires the use of APIs for ‘high-value’ and dynamic datasets and the European Commission ‘European strategy for data’ Communication COM/2020/66 that reports on future investment in ‘the establishment of EU-wide common, interoperable data spaces’.

The goal of this report is to present the main results of a 2-year study on the adoption of APIs in governments, which also supports the adoption of the abovementioned policy instruments. Even though the cohesive and coordinated adoption of APIs in the public sector is still in its early stages, the results of this study demonstrate that APIs present many benefits for the public sector, including fostering innovation in governments and related public services, improving efficiency, improving access to government open data, increasing economic opportunities for private companies using government APIs and enabling the creation and facilitation of interactions between governments (G2G) and between governments and businesses (G2B) in relation to digital ecosystems. However, these benefits also carry technical and organisational costs.

In adopting APIs, governments can also encounter risks and challenges. These include cybersecurity issues, missing API governance structures, the difficulty in adopting proper legal instruments to adhere to current regulation, the lack of an API culture and the need for agile platforms to adapt digital public services provision to a rapidly evolving society. To tackle these issues, this study has developed a basic API framework for governments. It provides a cohesive, coordinated approach to APIs that deals with the problems and complexity that result from ad hoc implementation of APIs. It frames existing efforts within a more coordinated suite of activities including (i) the alignment of API adoption with policy goals, (ii) the creation of platforms and ecosystems based on APIs, (iii) the organisation of teams and the development of an API culture and (iv) designing processes based on API best practices.

The recommendations and actions outlined in this framework, to be performed in policy priority areas, should also be followed. APIs need to be explicitly adopted to support the new Commission priorities and EU and Member State policies; this adoption should be accompanied by the creation of shared best practices and guidelines to implement an API culture in governments. In addition, the proposed framework should be adopted, further validated and continuously refined to guide government API strategies and digital government strategies, and governments should be more digital-ecosystems aware, engaging multiple stakeholders to co-create and co-design API-based systems.



Preface

Digitalisation is transforming public administration across Europe. Technologies such as artificial intelligence, the internet of things and cloud computing are, undeniably, key elements of this transformation, facilitating public administrations' decision-making process, from policy design to service delivery. Soon enough public administrations will be expected to learn how to exploit and interact with digital twins, informed by thousands of data sources. Governments already not only utilise their own available data to create data ecosystems spanning both the public and the private sectors, but also use the power of data to offer entirely new services (e.g. location-based information for investors, gleaned from digitising thousands of government documents).

Undoubtedly, all this will not happen by itself. The public sector at all levels has to take decisive steps to keep up with the digital transformation of society. In this respect, this joint report of the Directorate-General for Communications Networks, Content and Technology and the Joint Research Centre is timely.

If networks are the motorways of the digital age, application programming interfaces (APIs) are the interchange nodes and connections at which data arrive in containers and then are repacked from one container to another and shipped in trucks to the destination points (i.e. heterogeneous information technology (IT) systems of public and private organisations). Connecting to API interchange nodes lets these organisations build innovative digital public services and modern applications for citizens and businesses.

While other technologies have enjoyed the limelight, APIs have revolutionised the way 'digital is done' in the private sector. The public sector cannot fall behind. APIs will be essential for a number of initiatives at the European level, from the publication of high-value datasets in compliance with the Open Data Directive to the creation of European data spaces and the access of public administration to artificial intelligence and high-speed computing.

This study will support policymakers who would like to understand the benefits and challenges of API adoption, IT leaders and other innovators eager to speed up digitalisation in their remit, and managers willing to assess the API maturity of their organisation, as well as the technical staff in charge of the implementation of API policy.

Following the new Commission strategy on Europe's digital future, the discussion on how key innovative technologies can advance the digital transformation of public administration throughout Europe is in full swing. This study aims to make a significant contribution to this debate. We invite you to take advantage of its findings.



Executive summary

Application programming interfaces (APIs) have long been a foundational part of information and communications technology (ICT) architectures; nonetheless, their role became highly relevant in the light of the digital transformation of society. This relevance stems from the fact that APIs are the connective nodes of modern digital architectures in all sectors of the global digital economy and society. Owing to this connective capability, APIs play an important role as technical and organisational enablers of digitalisation.

The digital transformation of society is also putting pressure on governments to adapt to the digital era. The goal of digital government is twofold. On one side, governments need to transform into a robust digital ecosystem that is flexible, can adapt to advances in technology and is able to ‘rewire’ the interactions between societal actors. On the other side, governments need to oversee the behaviour of digital environments and ensure societal well-being and stability (e.g. by counteracting technology-driven monopolistic behaviour, controlling the abuse of power due to information asymmetries or ensuring the robustness of critical infrastructure). APIs can play a role in this government transformation by enhancing governments’ processes, providing new means for governments to interact with citizens and other societal actors, and fostering innovation in public service delivery.

The purpose of this report is to assess the relevance of APIs in the context of the digital transformation of government. Specifically, the report (i) evaluates the current status of API adoption in governments, (ii) analyses the value, opportunities and challenges that the adoption of APIs brings to government and (iii) proposes a potential roadmap for a coordinated adoption of APIs in government structures distilled from the thorough analysis of extensive literature on current practices. The report aims to support policymakers in understanding the value and implications of API adoption in governments. It also targets governments’ information technology (IT) leaders and decision-makers.

Main findings

The study concludes that APIs are essential enablers of the transformation towards digital governments. This conclusion is rooted in three main characteristics of API solutions, namely that they are modular, reusable and easily scalable (near-zero marginal cost solutions). These characteristics endow digital environments with high flexibility both technically and organisationally. Technically, APIs underpin the creation of digital ecosystems and add agility to innovative processes in organisations. Organisationally, API solutions facilitate governments’ digital interactions with actors and systems both internally (G2G) and externally (with businesses (G2B) and citizens (G2C)). Moreover, APIs are interfaces in which the relationships between digital actors are defined, namely who can access what and under what circumstances. This has implications for the governance perspective of digital environments. In this regard, APIs technically enable the control and monitoring of the dynamics between actors and systems.

Based on these enabling characteristics, the main findings of the study can be summarised as follows:

APIs are a foundational technological solution that requires attention in digital government agendas. APIs are a necessary component in the digitalisation of government operations and processes. The technical and organisational flexibility that APIs grant to organisations could be used to streamline information flows to all phases of policymaking. A coordinated approach to API adoption is also necessary to harness the transformative potential derived from cross-fertilisation opportunities. This coordination is crucial to also mitigate risks derived from the increased vulnerability that loosely coupled API systems may confer.

APIs can assist governments in steering the organisational change management of digitalisation. The analysis of the usage of APIs can provide relevant information on the exchange of resources, on the actors and dynamics of digital interactions and on processes’ performance and, ultimately, can support budget allocation decision-making. This information is key to design the transformational roadmap and improve government efficiency by means of (i) increasing the innovative potential of public service provision and (ii) enhancing policymaking by

facilitating access to virtually any relevant information required in all phases of the policy cycle (policy design, implementation and monitoring).

APIs foster innovation in public administration processes and public service provision. API solutions are intrinsically modular and reusable. This results in API-enabled digital environments having a high degree of flexibility (innovative potential) and virtually unlimited access to digital assets (digital ecosystem enabler). Moreover, APIs can assist governments in drawing on data from multiple sources, working across government departmental siloes, collaborating with industry, research and non-profit sectors, and reusing government assets to achieve greater sustainability within limited resources and to deliver more efficient public services to society.

API solutions facilitate governments' digital interactions with internal (G2G) and external (G2C and G2B, as well as the reverse: C2G and B2G) actors. APIs are the glue of functional digital ecosystems. The creation of an 'ecosystem' of providers and consumers fosters synergies and efficiency, and can also spawn the development of innovative service models, some of which may lead to revenue generation for the agencies concerned. Their ability to provide access to the heart of government in turn allows governments to realise their objectives of openness and of delivering efficient, secure, transparent and interoperable citizen-centric services. APIs are, therefore, a crucial technological component of empowering the evolution of public service delivery models, enabling agencies to accelerate their transformation from e-government to digital government.

API adoption carries budgetary, organisational costs and important challenges. Depending on the role that government takes when adopting APIs, these costs can greatly vary. From the results of our research the yearly budget used to maintain APIs is rather low. Nevertheless, coordinating the API adoption at the whole organisation level requires more resources, in particular at the setup phase. Moreover, the adoption of API implies challenges such as those required to overcome the organisational change management and cultural shift and lack of skills, to protect cyber-security vulnerabilities and to adhere to current regulations, such as GDPR. In particular, cyber-security is a crucial aspect to consider in the digitalization process. APIs are 'doors' to access digital infrastructures thus, the security and resilience of digital environments will also depend on the robustness of the API infrastructure of organisations.

Multiple API-related activities are occurring at the European Union institutions level, within Member States and at regional and city government levels. Some of these activities are driven by governance policies, and an interoperability policy, but more often are ad hoc approaches. Private industry examples, however, show that where APIs are introduced in an ad hoc manner, over time they increase complexity and do not generate the desired benefits. To avoid ad hoc solutions, duplications and delayed action, European programmes implementing these policies should adopt APIs in a coordinated way (e.g. by publishing common EU guidelines) as soon as possible. Best practices are emerging for the adoption of government APIs, and there are a number of similarities in how innovative governments at all levels are implementing APIs. Stakeholders engaged and surveyed throughout the study prioritised best practices as a key area of knowledge needed to enable action. If APIs are successfully implemented across the government in a coordinated and cohesive way, there is a greater likelihood of increasing efficiency, and generating external value including both improved social value and new economic development.

Policy context

The policy relevance of APIs is linked to (i) their capacity to provide flexible access to digital assets and (ii) their connective role among different actors and systems. Current regulations such as the *Open Data Directive* (European Union, 2019a) and the *Payment Services Directive (PSD2)* (European Union, 2015a) do, explicitly or implicitly, require and mention the use of API solutions to streamline, both technically and organisationally, the exchange of data and functionalities among disparate actors.

More recently, the relevance of APIs has acquired momentum due to digitalisation, in particular as follows.

APIs are a key enabler for the European digital strategy. The creation of resilient and competitive digital ecosystems, which are underpinned by APIs, is highlighted in several European digital strategy documents supporting the priority A *Europe Fit for the Digital Age*. For instance, under the *European strategy for data* (European Commission, 2020a) the European Commission will ‘explore the need for legislative action on issues that affect relations between actors in the data-agile economy’. Moreover, the *European industrial strategy* (European Commission, 2020b) stresses the need for a ‘partnership approach to the governance of industrial ecosystems’ to cross-fertilise products and services among sectors. Also, the *SME Strategy for a sustainable and digital Europe* (European Commission, 2020c) mentions the need to ‘Empowering SMEs to reap benefits of the digital transformation’. In addition, the small and medium-size enterprise (*SME*) *strategy for a sustainable and digital Europe* (European Commission, 2020c) mentions the follow as a priority: ‘Empowering SMEs to reap benefits of the digital transformation’. As regards the European approach to artificial intelligence uptake, APIs will have a role in empowering businesses to start, to scale up, to innovate and to compete on fair terms.

APIs are an enabler of the data economy and therefore can also support the priority of having ‘Europe as a leader in the data economy’. The Commissioner for the Internal Market, Thierry Breton, said:

‘Our society is generating a huge wave of industrial and public data, which will transform the way we produce, consume and live. I want European businesses and our many SMEs to access this data and create value for Europeans – including by developing Artificial Intelligence applications. Europe has everything it takes to lead the “big data” race, and preserve its technological sovereignty, industrial leadership and economic competitiveness to the benefit of European consumers’ (Breton, 2020).

When successfully used, APIs have become fundamental components for the private sector in making powerful digital platforms and enhancing the sector’s and third parties’ digital ecosystems. Indeed, these systems can reuse APIs in ways that were not forecast and can, potentially, lead to digital innovations. Making APIs available to third parties is often advantageous for both API providers and consumers. Application developers can reuse existing and solid APIs, making the creation of their products more efficient. In turn, API providers gain complementary added value by, for example, increasing the access control to their digital assets (and related products). In the best-case scenario for the platform firm, and depending on the sector, the type of data and the business model, APIs can become the basis of a successful ecosystem, with exponentially growing revenues and low marginal costs. APIs can efficiently streamline access to public data and allow the creation of new services, delivery models and service delivery channels by the private sector for the benefit of citizens and the improvement of businesses, including new business models.

Key conclusions

The evidence collected from our research for this study recognises the high value of APIs in enabling governments to deliver on digital transformation goals, to capitalise on the investment made on government (open) data, to form digital ecosystems and to move towards more platform-based models in which value is co-created with a range of external and internal stakeholders.

Our main recommendation is that EU governments at different levels and the European institutions should take systematic and structured approaches to increase the use of APIs. APIs are essential for implementing the requirements of the *Open Data Directive* on high-value and dynamic datasets (European Union, 2019a). APIs are also crucial to guarantee that the data spaces identified by the Commission communication *A European Strategy for Data* (European Commission, 2020a) will not become ‘siloed’ environments.

APIs and proper API strategies have to be adopted to support the new Commission priorities and policies at the EU level. Governments should incorporate APIs into their digital strategies to support these policy goals. To do so, **we suggest considering the adoption of the API framework summarised in this document and fully described in our dedicated technical report** (Mark Boyd et al., 2020a). The framework provides a cohesive, coordinated approach to

APIs that overcomes the challenges of complexity that result from ad hoc implementations. Given that the maturity of digital government structures is uneven, the framework has been designed to be flexible enough to help governments identify the specific actions they need to focus on. These actions are structured into four areas: (i) aligning API adoption with policy goals, (ii) building platforms and ecosystems based on APIs, (iii) organising teams and developing an API culture and (iv) developing processes based on API best practices.

Future work

Future activities will meet the following objectives: engage public- and private-sector stakeholders (e.g. by creating specific working groups and mixed public/private workshops), focus on cybersecurity and privacy aspects, analyse API legal and organisational aspects, and provide a set of technical recommendations on API discoverability and access.

Concrete tools to let governments assess their degree of adoption of APIs will also be provided. A maturity toolkit could allow self-assessment and guide governments in implementing the proposed API framework (Mark Boyd et al., 2020a). Within the framework, a tool has been undertaken to help governments identify their progress towards implementing it fully. An early online version of the tool has also been created to help governments quickly score their maturity and to help them to identify and prioritise future actions (Mark Boyd et al., 2020b). Further testing and refinement will occur on the framework so that governments can take a more cohesive approach while still gaining value from their current API-related activities.

Efforts will also be dedicated to work within the European Commission to invest in creating and improving a common culture on APIs. Best-practice operational guidelines and standards should be followed or created to assist governments in the implementation of product management and life cycle approaches. This study found a range of best practices being implemented by governments and private industry. There is sufficient agreement on architectural styles, security minimum standards and API design for these factors to be collected into standards and shared across European governments. While there is almost uniform agreement among governments and private industry that a product management approach should be taken, there are fewer resources available to guide government stakeholders in implementing best practices and tools. Efforts to support in defining and identifying this new skill set area will be provided also to align with existing initiatives, such as the Interoperability Academy (European Commission, 2019a) and the European Support Centre for Data Sharing (European Commission, 2020d).

Quick guide

This report is organised in eight sections. The introduction ([Section 1](#)) gives a basic definition of APIs and describes the study motivation and methodology. The following sections illustrate the ‘who’ ([Section 2](#)), ‘what’ ([Section 3](#)), ‘why’ ([Section 4](#)), ‘how’ ([Section 5](#)) and ‘where’ ([Section 6](#)) of government APIs. The report also presents a set of policy recommendation ([Section 7](#)) and the final section presents the main conclusions of the study ([Section 8](#)).

The report targets IT managers, decision-makers and policymakers. Policymakers and decision-makers will be most interested in understanding the relevance of the adoption of APIs in government ([Section 2](#)), in the API EU policy landscape ([Section 3.1](#)), in the value generated by APIs ([Section 4](#)), in the description of the proposed EU API framework ([Section 5.1](#)), in the domains and thematic areas to focus on ([Section 6](#)) and in the policy recommendations ([Section 7](#)).

The technical aspects (including a discussion on APIs in [Section 1.1](#)), the landscape of API cases, standards and best practices ([Sections 3.2, 3.3, and 3.4](#)) and the various ways to adopt API in governments ([Section 5](#)) will be of most relevance to IT professionals. For those readers interested in more API technical details, our APIs for digital government (APIs4DGov) report on web API standards and specifications provides more information (Santoro et al., 2019).

1

INTRODUCTION

SUMMARY

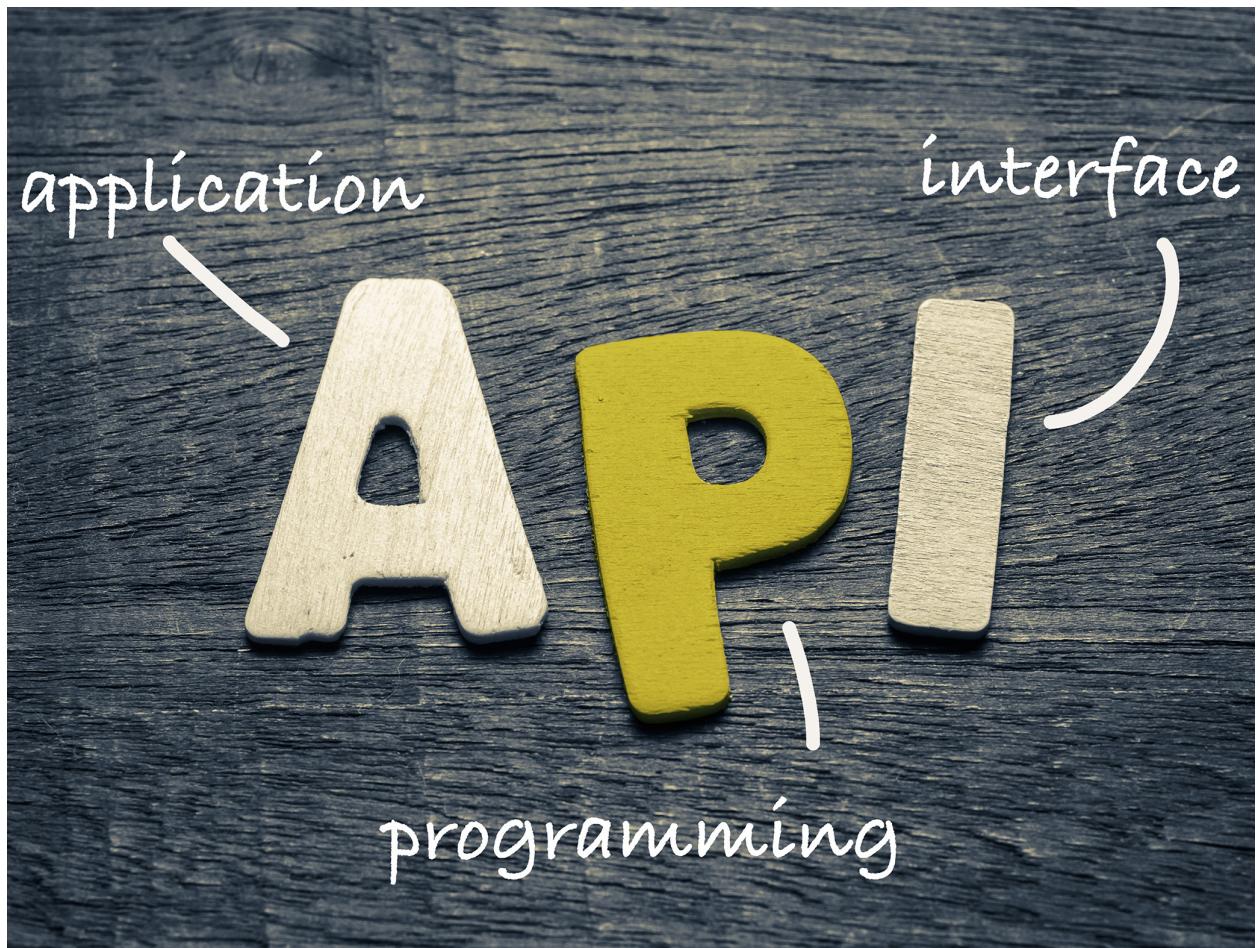
This report presents the results of the European Commission application programming interfaces (APIs) for digital government (APIs4DGov) study, which aimed to understand the role of APIs in the public sector and, specifically, the motivations for their use and the way governments should implement them. This first section defines APIs, illustrates the motivations behind the study and briefly explains the applied research methodology.

An API is a machine-to-machine interface, different from a machine-to-human interface, such as web applications. Instead, it works behind applications, in the sense that applications can use APIs to exchange information with other applications to share digital assets (i.e. data and services).

Technically, APIs constitute the interfaces of the various building blocks that application developers can assemble to create their products to reach specific goals. The notion of APIs is not new but, with web APIs acquiring more and more importance, they are now the main way used by organisations to exchange data and services among software applications.

APIs' main technical advantage is the possibility for a provider to publish machine interfaces to let applications access the API provider's digital assets. These interfaces can be exposed to regulate the access to information for different users and, depending on the sharing policies of the provider, they can be reused multiple times, both for the original purpose that the APIs were created or for different purposes. API users, in turn, can also 'mesh' multiple APIs to build new innovative applications.

APIs also create business opportunities, as they can be seen as other software products that, in the context of the API economy, have a value chain. This is how, for example, pioneering companies such as Amazon, Google, Facebook, Apple and Twitter have exposed amazing technological solutions to the public, transforming existing businesses and creating new industries.



① INTRODUCTION

Application programming interfaces (APIs) are machine-to-machine digital interfaces that facilitate the exchange of data and services (functionalities). The purpose of this report is to support the European Commission institutions and initiatives, Member States and public institutions in their effort to adopt the use of APIs when pursuing the digital transformation of their government and public administration operations. Therefore, although it will sometimes be necessary to address the API topic by describing its technical details, this report is not intended to address mainly technologists or information technology (IT) practitioners in governments who directly create and use APIs. Instead, this study aims to serve parties interested in understanding the reasons for implementing an API adoption strategy and the many ways in which this adoption can be accomplished.

This document has been prepared as a final deliverable of the study *Application Programming Interfaces for Digital Government (APIs4DGov): The road to value-added open API-driven services*, performed by the Joint Research Centre (JRC), in collaboration with the Directorate-General for Communications Networks, Content and Technology (DG CNECT) of the European Commission. The 2-year study started at the beginning of 2018 and was conducted in the context of the European Commission's digital single market (DSM) strategy. The work aims to improve the understanding of the current use of APIs in digital government and their added value, as well as to assess the feasibility of establishing a European API framework for digital government. In short, it attempts to answer two questions.

1. Why should governments invest in the adoption of APIs?
2. How should they do it?

1.1 | Application programming interfaces: definition

Informally speaking, an API is, first of all, an interface, a concept that all of us are familiar with. A typical example of an interface is that between a plug and power socket for connecting electric equipment to the alternating current power supply in our buildings. A second example of an interface that is often used is the mobile phone interface that many of us use to interact with web applications. Like these, an API is also an interface but, instead of energy, it exchanges data and services and, instead of with a human, it exchanges this information between two computers. Thus, an API is a programming interface in the sense that it links computers via two types of software programs: an application running on a provider computer and one or more applications running on a client computer.

The notion of APIs is not new, as they are the interfaces of the various building blocks that application developers can assemble to create their products to reach specific goals. This notion probably first appeared in 1968 (Cotton and Greatorex, 1968). Since then, APIs have been used for many purposes so that, technically, they are ‘the calls, subroutines, or software interrupts that comprise a documented interface so that an application program can use the services and functions of another application, operating system, network operating system, driver, or other lower-level software program’ (Shnier, 1996). With the advent of the web, APIs acquired more and more importance and they now represent the main way

that applications created by organisations exchange data and services. As we are particularly interested in these kinds of APIs, in the remainder of this document, unless otherwise specified, the term ‘API’ will be used to refer to web APIs.

One of the key uses of APIs is to transfer data between providers’ and clients’ applications. Figure 1 shows an example taken from the Danmarks Adressers Web API (DAWA) in which a client application requests a list of physical addresses from the DAWA repository and a provider application API returns them (Danish Agency for Data Supply and Efficiency, 2019).

If we look at the ‘request’ made by the client application, it contains two parts ⁽¹⁾: the first is the API URL (the unique identifier on the web that indicates the API) and the second is formed of the API parameters (a set of ‘filters’ that let the user define which parts of the data are needed). Thus, in this example, the API offers the possibility of requesting the exact subset of values of a dataset needed by the client application. Compared with the traditional ‘bulk download’ of a dataset from a traditional data catalogue ⁽²⁾, this allows the client application to save transactional time and storage. This example also shows that APIs offer a stable and controlled layer to access the datasets. There is no need to download the entire dataset and to manage the alignment of the local data with the remote data. In this sense, APIs could represent a strategic

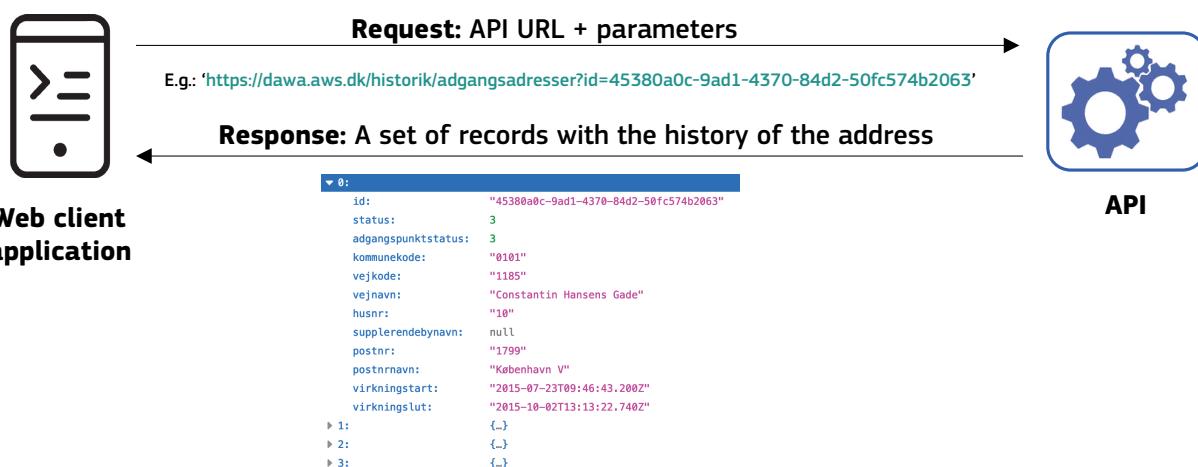


FIGURE 1: Example of a web API requesting data from DAWA.
Source: JRC, own elaboration.

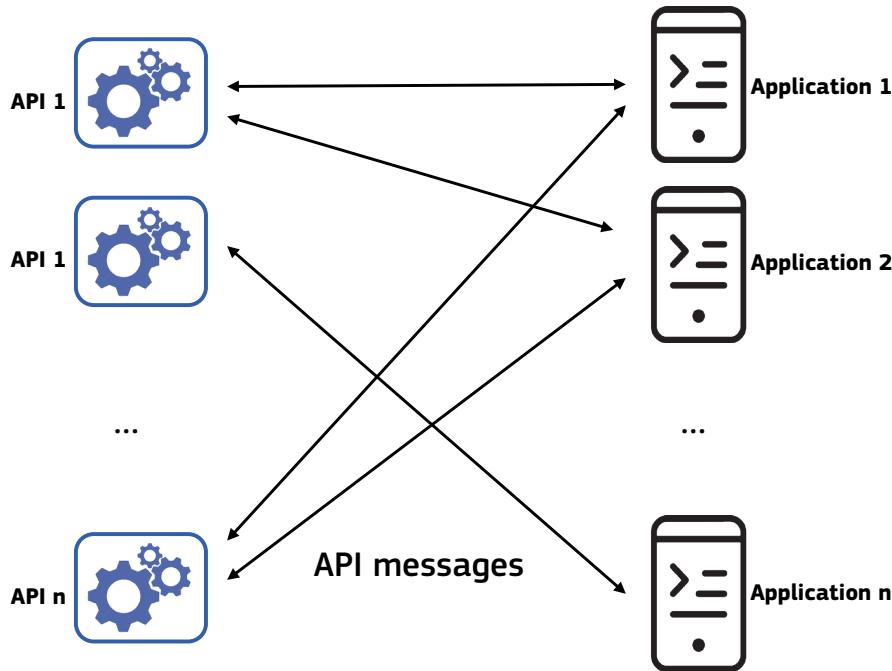


FIGURE 2: One or more APIs can be reused by one or many applications.
Source: JRC, own elaboration.

solution to exploit the investments made in the publication of government open data.

APIs can also be used to offer reusable services (functionalities). These functionalities can be very simple but also very complex, such as powerful artificial intelligence (AI) functionalities (ProgrammableWeb.com, 2019a) or mapping components (Google, 2020a).

Moreover, as shown in Figure 2, APIs can be reused many times by different user applications. Thus, they can either be used to build the final programs for which they were designed or be ‘meshed’ to build innovative products.

Technically, APIs can be designed and implemented in a number of different ways that depend on the use of available standards and specifications. Section 3.3 gives an overall summary of these solutions. Should the reader be interested in more detail, we suggest our report on web API standards and specifications (Santoro et al., 2019).

APIs are also (technical and service) contracts that, once in place, let developers rely on them and access their resources. To be reliable, the essential characteristics of APIs are their availability, documentation, consistency and versioning. Websites, besides the fact that they implement a machine-to-human interface instead of a

machine-to-machine interface, are not contracts, as their final users can adapt to them even when they change their appearance and structure. Software applications are not as flexible (at least currently) as humans and need the definition of a contract to include interaction with each

‘‘ APIs are calls, subroutines, or software interrupts that comprise a documented interface so that an application program can use the services and functions of another application, operating system, network operating system, driver, or other lower-level software program ’’

“ APIs are technical contracts that can be seen as software products that have a value chain ”

other through APIs. This does not mean that an API cannot change. Instead, its implementation can change but its interface must remain stable (or at least must implement a versioning strategy) to let applications built on it while continuing functioning (Jacobson et al., 2011).

APIs can also be seen as software products that, in the context of the API economy, **have a value chain** (Gartner, 2016; Jacobson et al., 2011). APIs represent an indirect channel for data and service providers to reach the end users of web applications and act ‘behind the scenes’ (i.e. they are used by web applications to access the digital assets needed). Figure 3 represents actors, products and interrelationships of a basic API value chain. The model is ‘basic’ in the sense that it does not take into consideration other intermediaries in the system. These intermediaries can, for example, build platforms that aggregate and distribute data and APIs, such as the one presented in Figure 20.

The flow in Figure 3 includes the following roles and products.

- The flow starts with a **digital asset provider** that wants to allow others to use and share its products. Products are represented by digital assets, such as data (e.g. a satellite map, a registry of companies or statistical data), functionalities (e.g. weather forecasting or returning the geo-coding of an address) or other assets (e.g. streaming of internet of things (IoT) data or cybersecurity mechanisms). It is important to understand that these digital assets must have a ‘value’ (e.g. social or economic value) for the end users. If there is not this value the API will not be used.
- The **API provider** allows APIs to exchange digital assets in the best possible way to be used by the intended audience. The API provider can be the same as the digital asset provider, but this is not always the case. Private API providers can, for example, distribute government open data through APIs. API providers can also offer the possibility of discovering their APIs through API catalogues or portals.
- Once the API is created, a number of **API consumers** can make use of digital assets to create applications. Technically, application developers can develop applications that run on

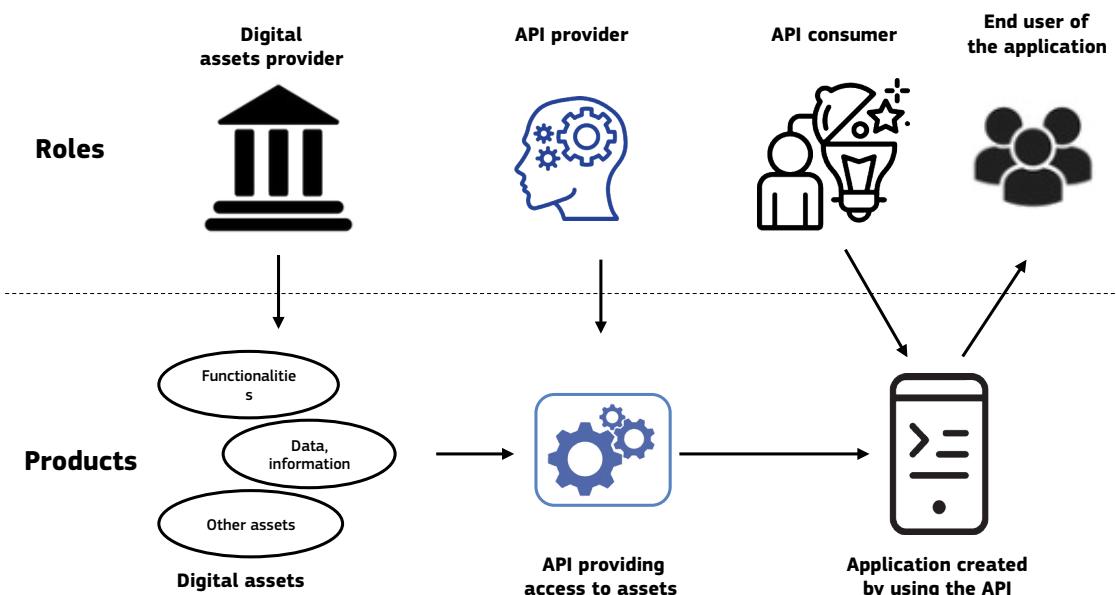


Figure 3: API value-chain.
Source: JRC, own elaboration.

a client machine (e.g. within a web browser on a mobile phone). API consumers can publish their application in private-sector marketplaces or in catalogues offering public-sector digital services.

- Finally, the application can be used by a number of **end users** to satisfy their needs (e.g. to book

a medical visit, check the timetable of public offices, register their company in a public registry, check and find bicycle paths or find a children's playground in their city).

1.2 | The digital government context

Digital technologies are changing every dimension of our lives, including our interaction with public government authorities and services. The term 'digital transformation of the public sector' refers to the process of the conversion or substitution of analogue public administration operations to/with their digital counterparts. This transformation has an impact both within the organisational boundaries of public administration and on external actors of the private sector, civil society and the citizenry.

The Organisation for Economic Co-operation and Development (OECD) identifies the elements of digital transformation in governments. The OECD argues that digital transformation can improve service delivery and efficiency within the public sector and achieve wider economic growth and increased social equality. The OECD also highlights the benefits of increased transparency and improved citizen engagement through such an approach (OECD, 2014).

In addition, the OECD clarifies that it is not enough to simply introduce information and communications technology (ICT) solutions into public administrations. Instead, the potential integration of technology needs to be grounded in the wider context of the modernisation of the public sector. More specifically, the OECD suggests that increased social inclusion, transparency and accountability, alongside participatory democracy, collaboration and partnership, are key aspects in the progression towards digital government. Achieving digital government will, in some areas, require progression through a period of e-government, the middle stage in digital transformation. Under e-government, governments make greater use of digital technologies, particularly the internet, to achieve better government, focusing on delivering services tailored to individuals' needs, but also on providing a means to improve the public's contribution to policymaking. It is argued that, to reach digital transformation and a true digital government status, organisations will need to pass through an

e-government stage involving the increased use of internet technologies for 'better government, focusing on delivering services tailored to individuals' needs in a user- or citizen-driven setting, while also achieving improved efficiency and productivity' (OECD, 2016).

In a recent study proposed within the European Location Interoperability Solutions for e-Government (ELISE) action, as part of the interoperability solutions for public administrations, businesses and citizens (ISA²) programme, the authors define a digital transformation framework, with different levels of maturity of digital government for an organisation. The framework proposes and describes in detail the characteristics of five transformation stages: (i) e-government, in which the focus is on having services online for users' convenience and cost savings; (ii) open government, which often takes the form of public programmes intended to promote transparency, citizen engagement and the data economy (e-government and open government programmes often coexist, with different leadership and priorities); (iii) data-centric government, whereby the focus shifts from meeting citizens' or users' needs to proactively exploring new possibilities that are inherent in strategically collecting and leveraging data; (iv) fully transformed government, whereby the organisation, agency or department has fully committed to a data-centric approach to improving government and to innovation in government; and (v) smart government, whereby the process of data-centric digital innovation is embedded across the entire government and the innovation process is predictable and repeatable, even in the face of disruptions or sudden events that require rapid responses (Valayer and Williams, 2018).

The public sector in the European Union has advanced a lot in terms of e-government and digital transformation initiatives both in developing on an individual level and in integrating cross-sector and cross-border initiatives (European

Commission, 2019b). Specifically, in the last 10 years, the political instruments used to advance the modernisation of public administrations across the European Union have been the e-government action plans (³). These have supported coordination and collaboration between Member States and the Commission and led to joint actions on e-government. The most recent EU e-government action plan (2016–2020), in particular, has helped to put in place key objectives for the DSM and policy developments supporting open government and modernisation goals. The vision of this plan requires that ‘by 2020, public administrations and public institutions in the European Union should be open, efficient and inclusive, providing borderless, personalised, user-friendly, end-to-end digital public services to all citizens and businesses in the EU. Innovative approaches are used to design and deliver better services in line with the needs and demands of citizens and businesses. Public administrations use the opportunities offered by the new digital environment to facilitate their interactions with stakeholders and with each other’ (European Commission, 2016a).

To implement this vision, the 2016–2020 action plan had three main policy priorities, all of which would be supported by the adoption of APIs in the digital transformation of governments:

1. to modernise public administration with ICT, using key digital enablers;
2. to enable cross-border mobility with interoperable digital public services;
3. to facilitate digital interaction between administrations and citizens/businesses for high-quality public services.

Each of these priorities set out concrete actions to accelerate the implementation of existing legislation and the related uptake of online public services. In the next section, we focus on the link between these priorities and the adoption of APIs in governments (i.e. on the motivations and objectives behind this study).

1.3 | Motivation and objectives

This report explains how APIs support digital governments and help create new public services, new delivery models and new service delivery channels, aiming to better serve citizens and enable new business models to be developed. The research, analysis and results of this study aim to contribute to the following specific EU digital government policy documents and initiatives (see also [Section 3.1](#)):

- the Open Data Directive (European Union, 2019a), which specifically requires the mandatory use of APIs for ‘high-value’ and dynamic datasets as ‘conditions for [their] reuse’;
- the communication *A European Strategy for Data* (European Commission, 2020a), which reports on the future investment in ‘the establishment of EU-wide common, interoperable data spaces’;
- the communication *Towards a Common European Data Space* (European Commission, 2018a) which, in terms of business-to-business (B2B) data sharing, reports that ‘there is strong support from stakeholders for non-regulatory measures, such as fostering the use of APIs for simpler and more automated access to and use of datasets’;
- the EU e-government action plan 2016–2020 (European Commission, 2016b);

- the implementation of the European interoperability framework (EIF) (European Commission, 2017a);
- the implementation of the ‘once-only’ principle (OOP) (European Commission, 2017b);
- the ‘building block’ approach adopted in the Connecting Europe Facility (CEF) telecommunications programme (European Commission, 2020e).

This work complements the following studies that have been carried out in this area, analysing a great wealth of open government cases to better understand its enablers, drivers and barriers and the value of its services in e-government:

- the study on collaborative production in e-government (European Commission, 2014a);
- the report *Towards faster implementation and uptake of open government* (European Commission, 2016c);
- an analysis of the value of the new generation of e-government services (European Commission, 2016d).

This study aims to gain an understanding of the current use and socioeconomic impact of APIs in digital governments and to assess the feasibility of establishing a European API framework for digital government. In particular, the study focuses on the following topics.

- **Investigating the state of play of the use of digital government APIs.** This topic includes a review of the current landscape of digital government APIs in the public sector in Member States and outside the EU. The landscape includes an analysis of the opportunities enabled by digital government APIs for public administrations, individuals, business and society, and reports on current trends and horizons of APIs in the private and public sector in Member States and outside the EU. This investigation also identifies key enablers and drivers of, as well as barriers to, the provision and roll-out of government APIs and the assessment of potential risks and mitigation actions for the public sector and society.
- **Identifying the added value of digital government APIs.** This topic explores if and, if so, why APIs should be considered an option to support the digital transformation of the public sector. Potential socioeconomic impacts of the adoption of APIs by governments

to support data-driven government services are of central importance to understanding the added value of APIs.

- **Defining a basic digital government API EU framework and the road ahead.** To understand how the public sector could capitalise on a digital government API ecosystem, the study aims to identify the ICT standards, and to provide a set of recommendations and guidelines for public administrations and a set of policy recommendations for digital government services and APIs. It also identifies a set of domains and thematic areas in which the opening of digital government services through APIs would be most beneficial.

This report presents the main results of the study and closes and complete the series of publications and outputs published within the study, listed in Annex 3.

1.4 | Structure of this report

This report is organised as follows: besides the introduction, the policy recommendations and the concluding sections, the other sections illustrate the ‘who’ ([Section 2](#)), ‘what’ ([Section 3](#)), ‘why’ ([Section 4](#)), ‘how’ ([Section 5](#)) and ‘where’ ([Section 6](#)) of government APIs.

In particular, this section gave a definition of APIs and illustrated the overall purpose of the study.

[Section 2](#) demonstrates the relevance of APIs in digital government and related government roles.

[Section 3](#) continues with a deep analysis of the API landscape in governments in different areas. First, it illustrates the European Commission initiatives that are most closely related to the API topic. It then gives a summary of the API cases published by governments and public institutions, with a specific focus on the cases selected and analysed for the study. Next, it summarises the main web API technical specifications and standards. Finally, it discusses the study literature review of the API best practices for governments.

[Section 4](#) explains why governments should invest in APIs. It gives a qualitative analysis of the costs, benefits, opportunities and challenges distilled from our research. It also highlights aspects related to the API impact in society.

[Section 5](#) focuses on how governments could adopt APIs. It first presents a robust proposal for a basic digital government API EU framework. The proposal was built on the study API landscape outcomes and was validated in a number of different ways (through focus groups in workshops, the advisory board of the study and a pilot project). [Section 5](#) then illustrates how to select operational tools and measure the impact of the adoption of APIs. Next, it gives an overview of the legal aspects to be considered when adopting APIs in governments. Finally, it gives a list of key enablers, drivers, barriers and risks that we have identified in our research.

[Section 6](#) identifies the main thematic areas, technologies and digital domain ecosystems that the governments of the European Union area should focus on when adopting APIs.

[Section 7](#) summarises our policy recommendations.

[Section 8](#) concludes the report and illustrates further steps.

The annexes contain a glossary that focuses on government APIs ([Annex 1](#)), a description of our research methodologies ([Annex 2](#)), a list of the study outputs (reports, datasets, workshops and tools; [Annex 3](#)) and a reference list of the main EU policy legal instruments related to the adoption of APIs in governments ([Annex 4](#)).

RELEVANCE OF APPLICATION PROGRAMMING INTERFACES IN DIGITAL GOVERNMENT

SUMMARY

A description of API strategies can assist governments in their digital transformation by steering the necessary organisational change management process. APIs can provide crucial information on the use of resources, actors and dynamics in digital interactions, as well as on processes' performance, and can ultimately support budget allocation decision-making. This information is key to designing the transformational roadmap and ultimately improving government efficiency by means of (i) increasing the innovative potential of public service provision and (ii) enhancing policymaking by facilitating access to virtually any relevant information required in all phases of the policy cycle (policy design, implementation and monitoring). This work has identified potential links between the adoption of APIs in governments and the achievement of these goals, in particular regarding efficiency, accountability, inclusion, security, fairness, sustainability, transparency and trustworthiness.

The foundation of digital ecosystems is built on the interconnection of APIs. Inherent features of APIs, such as reusability and modularity, potentially enhance the exploitation of digital assets by both internal and external players. Digital solutions can be composed of a highly flexible assemblage of APIs involving several actors. Owing to these enabling characteristics, the definition of API strategies is crucial for the development of a functioning digital ecosystem.

Organisations can publish APIs for internal and external purposes and can restrict their use to a selected number of users or release them with no constraints. Based on the constraints on APIs, users can be identified only within the agency that publishes the APIs or among multiple government agencies. APIs can also be shared among different organisations of both the public and the private sectors. Thus, beneficiaries of APIs published by a government agency can be identified within it or inside the same government. Beneficiaries can also include other governments, public service providers, the private sector, non-profit organisations and citizens.

Governments can play different API-related roles within digital ecosystems, namely as ecosystem active participants, ecosystem owners or ecosystem regulators. As ecosystem active participants, governmental entities can take roles such as digital asset curators, API providers, API consumers, digital service providers or API assemblers.

This report focuses in particular (but not only) on the role of governments as API providers, which can share their APIs with different target groups, both internal and external to the organisation.



② RELEVANCE OF APPLICATION PROGRAMMING INTERFACES IN DIGITAL GOVERNMENT

This section describes the relevance of APIs in the context of digital government. It then further explores the topic from three different angles: (i) how government APIs can support government goals, (ii) what the role of APIs is in public service provision and (iii) which API-related roles a government can take, with a specific focus on the API provider role.

Advances in digital technologies have sparked a tidal wave of transformation, transforming society and rewiring the interactions between each of its components. Governments are no exception in this transformational wave. The digital transformation has altered the relationship between citizens and governments. For instance, it has altered citizens' expectations of government performance, government interactions with citizens and public service delivery. In this context, the digital government objective is twofold. On one side, governments need to transform into robust digital ecosystems that are flexible enough to adapt to advances in technology and that are able to rewire the interactions among societal actors. On the other side, governments need to oversee the behaviour of digital environments and ensure societal well-being and stability (e.g. counteract technology-driven monopolistic behaviour

and control the abuse of power due to information asymmetries).

APIs play a fundamental role in this transformation from both the **technical** and the **governance** perspectives (Bonardi et al., 2016; Briscoe et al., 2011; Huhtamäki et al., 2017; Iyer and Subramaniam, 2015a; Jacobson et al., 2011). On the technical side, API solutions provide digital environments with a high degree of flexibility (innovative potential) and virtually unlimited access to digital assets

“ APIs play a fundamental role in digital transformation of governments both from the technical and the governance perspectives”

“ APIs are boundaries where the interactions among digital actors are defined: what digital assets are exposed, to whom, under which conditions ”

(digital ecosystem enabler). On the governance side, API solutions allow digital environments to modulate digital interactions. In essence, **APIs are boundaries through which interactions among digital actors are defined**: what digital assets are exposed to whom and under which conditions (Ghazawneh and Henfridsson, 2013). All in all, APIs technically enable (i) the creation of digital environments and (ii) the control and monitoring of dynamics among their actors. In this sense, the definition of API strategies is crucial for the development of digital ecosystems (Briscoe and De Wilde, 2009).

The relevance of the creation of resilient and competitive digital ecosystems is highlighted in current European strategy documents. For instance, under its data strategy, the European Commission will ‘explore the need for legislative action on issues that affect relations between actors in the data-agile economy’ (European Commission, 2020a). Another example is the industrial

strategy (European Commission, 2020b), which stresses the need for a ‘partnership approach to the governance of industrial ecosystems’ to cross-fertilise products and services among sectors. In this sense, the connecting role of APIs makes them a key factor in understanding how digital environments work and evaluating interactions among their stakeholders. This information can support the assessment of the robustness, resiliency and competitiveness of digital environments. Therefore, the understanding of API dynamics can inform policymaking to steer digital environments (e.g. infrastructure needs, capacity building, market incentives, market regulations, API-related challenges and opportunities derived from the pervasive deployment of IoT and AI applications).

From an organisation’s perspective, APIs are policy-relevant technical enablers of the digital transformation of government, and the definition of API strategies can assist governments in steering the necessary organisational change management process. APIs can provide crucial information on the use of resources, actors and dynamics of digital interactions, and processes’ performance, and can ultimately support budget allocation decision-making. This information is key to designing the transformational roadmap and ultimately improving government efficiency by means of (i) increasing the innovative potential of public service provision and (ii) enhancing policymaking by facilitating access to virtually any relevant information required in all phases of the policy cycle (policy design, implementation and monitoring).

2.1 | Application programming interfaces’ support to government goals

The European Union aims to create a fertile environment that allows for inclusive growth, sustainable development and well-being. In this context, governments’ policies, administration and public services should be designed to be human-centred and efficient, robust, secure, fair, transparent and accountable. Following this rationale, this work has identified potential links between the adoption of APIs in governments and the achievement of these goals, in particular in terms of the following factors.

- **Efficiency.** Inherent features of API solutions, such as reusability and modularity, endow organisations with internal efficiency gains. These gains stem from the flexibility that APIs provide to create easily scalable

interorganisational digital solutions. Efficiency gains are attained through the reduction of costs (e.g. avoiding data infrastructure replication) and by increasing efficacy (e.g. reducing response times, improving digital assets’ quality or the functional reduction of errors due to increased validation capabilities). Moreover, APIs can help streamline government processes via innovation. Digital solutions that integrate different APIs can assess the efficiency of processes modularly. This information is key to understanding flaws and opportunities for improvement. The modular nature of APIs eases the re-engineering of the process. Examples of these efficiency gains can be found in [Section 4.1.2](#).

In a broader sense, the adoption of APIs can lead to improved efficiency of the organisation itself. APIs allow the monitoring of what assets are accessed and who is accessing them. This demand-side information is crucial for designing solutions that best match real needs. In the context of government, the analysis of such demand information can provide enhanced fiscal footprints in the budget and, ultimately, support budget allocation management in a period of fiscal consolidation (for instance, government authorities in the Netherlands provide government spending data through APIs). These data could be combined with the reported usage of associated digital assets (with a level of granularity up to API modules) to justify budgetary decisions (e.g. which specific data or functionalities are most relevant) and thus channel funds towards them.

- **Accountability.** API solutions provide access to specific digital assets by stipulating a technical contract that defines what access is granted, to whom and how. Digital services may be composed of the integration of disparate APIs, potentially owned by different departments or even institutions. Making the full-service chain modular may imply that the accountability of actions can be well defined and compartmentalised. Coordination efforts are needed to orchestrate the accountability chain appropriately (e.g. through service-level agreements (SLAs) or terms of reference).
 - **Inclusion.** A loosely coupled API landscape provides high flexibility in designing digital public services. Typically, the costs of adding customisation features to digital services are contained. In this sense, theoretically, digital service provision could be adapted to the specific needs of all citizens (i.e. user-centric design), ensuring no one is left aside.
 - **Security.** An API is an open door that, if not properly implemented, might increase the vulnerability of a digital system. The resilience of a system of interconnected APIs is key and therefore the security dimension of relevant digital assets should be scrutinised and guaranteed. This has both social (in terms of stability, with the worst case scenario being a government shutdown) and economic implications, such as a significant increase in costs.
 - **Fairness.** A direct link between the use of APIs and the achievement of equity in the distribution of public
- resources is not obvious unless indirect effects of specific applications are considered. Equitable distribution to public resources requires the identification of the usage of resources by the disparate social groups. APIs may facilitate this on the condition of the existence of digital assets that allow the correlation of usage with classification by social groups.
- **Sustainability.** API deployments rely on ICT infrastructures that have energy consumption (Roberts, 2009). API design should assess ICT infrastructures' energy footprint. This practice would facilitate the evaluation of environmental, social and governance metrics to analyse ethical impact and sustainability practices of organisations. There are already initiatives investigating this area, for example the Sustainable Digital Challenge launched by APIdays global, which intends to identify the key principles and best practices of sustainable design, architecture and code to develop more sustainable software (APIdays global, 2020).
 - **Transparency.** An API is a technical interface that provides access to digital assets. Therefore, an API is the technical means to provide access to open data and public-sector information in a machine-readable fashion. In this sense, providing access to public-sector information through APIs could facilitate the automation of the monitoring of government processes and therefore could contribute to institutional transparency goals. As an example, the Open State Foundation (OSF) integrates data provided through APIs by government authorities within the Netherlands to create a real-time visualisation of governments' spending.
 - **Trustworthiness.** Digital services operated through a chain of APIs leave a digital trace of their use. Technical means can be put in place to trace who did what and when. Digitalised processes follow the logic of software procedures and are performed equally in all cases. The combination of the detection of unexpected anomalies in processes' flows and tracing back these anomalies to potential offenders, facilitated through APIs, may improve the trustworthiness of service provision. In Slovakia, for example, taxes collected from home-based tourist accommodations can be reconciled with tax income thanks to APIs and can potentially identify under-reporting and allow more accurate tax collection (Sidor et al., 2019).

2.2 | Application programming interfaces in public service provision

Public service is the operational realm of government. Public services are meant to facilitate interactions between citizens and their government. In the context of digital government, public service provision is expected to happen through digital channels. Technically, digital service provision by government does not differ from that provided by the private sector. Nevertheless, the objectives of public and private service provision do differ. Public services are meant to support socioeconomic well-being and stability, while private services aim to generate profit. In a way, the objective of public service provision resembles the concept of 'customer satisfaction' in supply chains, except that the customer is society as a whole.

Following the supply chain analogy, a public digital service is defined as the digital product resulting from the assemblage of different digital assets (data or functionality) provided by different intermediaries (internal or external to the organisation) so that the consumers (the citizenry) can satisfy their own needs regarding their interaction with the government (see Figure 4). In this context, **APIs are instrumental to the connective nature of public digital service provision**. In particular, APIs facilitate the connection between intermediaries (e.g. API and application developers) and also modulate the interactions between them (i.e. who can access what and under which conditions).

Also similar to supply chains, public digital service provision creates value by adding intermediaries, as intermediaries' assets can help to better address citizens' needs. From an organisational perspective, the more API-related intermediaries there are, the more flexibility there is to cross-fertilise and improve digital services. However, this also implies great coordination efforts among all actors involved. Along this line, Figure 4 illustrates the four actors embodied in digital service provision from an API perspective, namely, institutional bodies, digital service providers, intermediaries and the citizenry. The following paragraphs will describe each actor, explore their objectives and challenges, and provide an example.

An **institutional body** is any government entity (national, local or regional) in charge of organisational decision-making about public service provision. This actor should look for opportunities that maximise socioeconomic gains, ensure robustness of the digital system and improve its innovative potential, all within the public budget constraint. Table 1 lists potential policy options that institutions might consider for streamlining the adoption of digital solutions facilitated through APIs. An example of an institutional body is the regional administration of Regione Lombardia (Italy). Within this study, we have analysed the API

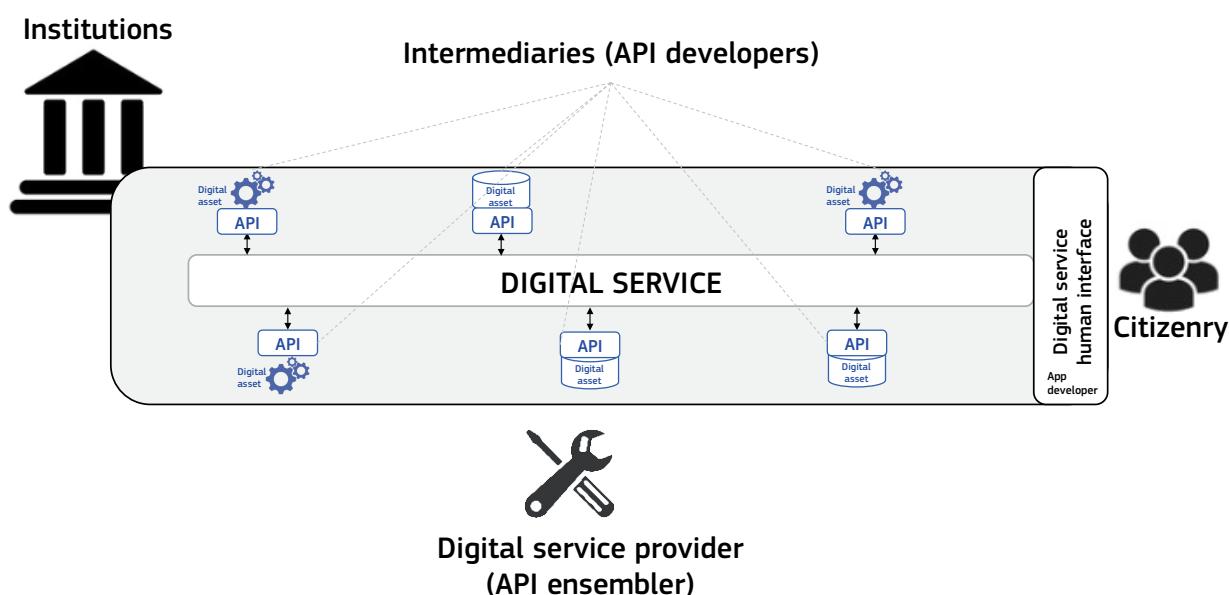


FIGURE 4: Actors of digital service provision.
Source: JRC, own elaboration.

Area	Policy options
Legal	<ul style="list-style-type: none"> — Legal acts — Amendments to current regulations
Financial	<ul style="list-style-type: none"> — Budgetary lines for service provision through APIs — API procurement workflows (externalisation) — Funding mechanisms (e.g. co-financing)
Organisational	<ul style="list-style-type: none"> — Setup of new agencies or governance bodies — Setup of new profiles in existing bodies — Setup of interagency committees
Technical	<ul style="list-style-type: none"> — Training programmes to upgrade skills of civil servants — Infrastructure requirements — Assessment frameworks — Guidelines and recommendations

TABLE 1: API-related policy options.

Source: JRC, own elaboration.

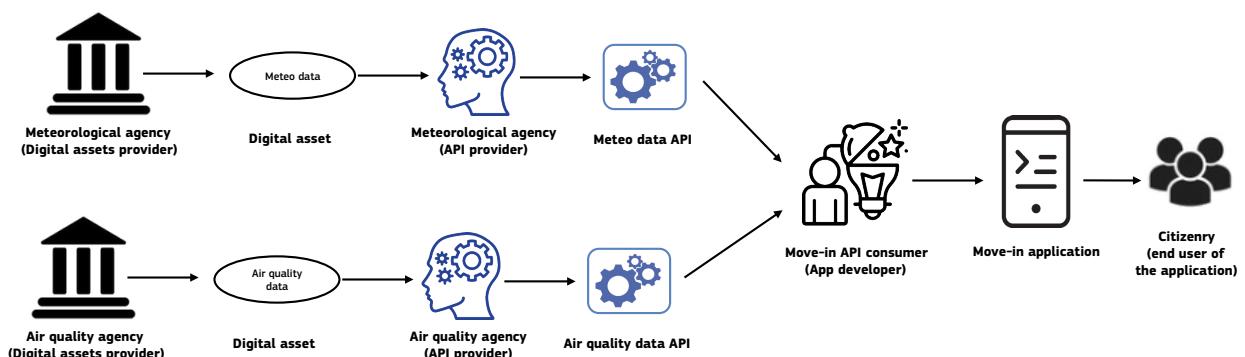
ecosystem of this institution and also collaborated with its representatives to implement a pilot project on the validation of the API framework illustrated in [Section 5](#). Regione Lombardia coordinates 16 directorates that are in charge of implementing different policies (e.g. agriculture, employment, environment, mobility and transport, and tourism). At the time of writing, Regione Lombardia sets out, through regional legislation (Regione Lombardia, 2012) the obligation to adhere to the API-enabled digital ecosystem for data exchange. It has created a governance body ‘E015’ to orchestrate and foster the dynamics of the ecosystem and its participants (Regione Lombardia, 2020a).

A **digital service provider** is any government entity in charge of the design, implementation and operations of a digital service. This actor will pursue the optimisation of the efficiency of the processes of service provision. To realise this, the entity has to manage a number

“ APIs are instrumental in public digital service provision for its connective nature ”

of organisational, financial and technical aspects. An example of a digital service provider is the environmental directorate of Regione Lombardia (see Figure 5), which is in charge of the air quality monitoring service. This public service entails the integration of data coming from both internal and external sources (e.g. air quality monitoring sensors, vehicle characteristics, industry emissions, traffic and meteorological data). The availability of APIs eases the exchange of these data. An example of a digital service built on those APIs is ‘Move-in’ (Regione Lombardia, 2020b). This digital service supports the implementation of the environmental policy on emissions by private vehicles. Move-in is concretely implemented as an application that allows the users of pollutant vehicles to drive a number of kilometres a year in restricted areas. The calculations are based on the type and environmental efficiency of the vehicle. Move-in is an adaptive solution that provides citizens with some flexibility to adapt to current environmental requirements without drastically disrupting their household income (e.g. by purchasing a new vehicle).

Intermediaries of the digital service chain can include API providers and application developers. These players might benefit from the reduction of costs (e.g. unneeded duplication of resources), from the improvement of the quality of their digital assets (based on usage insights and feedback loops), from becoming empowered and resourced

**FIGURE 5:** Move-in API system.

Source: JRC, own elaboration.

owing to the scalability demand and from increasing profits in the case of the private sector (G2B intermediary). However, these opportunities may bring risks, such as the exposure of internal inefficiencies, competition with other entities or increased costs to ensure security. Examples of APIs provided by intermediaries in the Move-in system are those that provide data from the meteorological stations (Regione Lombardia, 2020c) and those that provide data about the quality of the air (Regione Lombardia, 2020d). The app developer then developed the Move-in mobile application, which provides citizens with a user-friendly interface where they can find out the number of kilometres that are still available.

In turn, **citizens** are the end users that consume digital services. The citizenry could benefit from the overall increase in efficiency and from improved transparency and trustworthiness in the processes while facing potential

exclusion owing to the digital divide or pressure through imperative demand of skill adaptation.

Understanding the objectives of all actors is key for modulating the interactions between them. In this sense, the adoption of APIs in the digital transformation of public services poses new organisation opportunities for the modular composition of APIs. There are multiple combinations of participants involved in the design of digital service chains. In this sense, digital service provision can be (i) **direct**, when entirely managed by and composed of government actors with no mediation of external participants (private or third sector), (ii) **indirect**, when managed by external participants, governed by public institutions and composed of a combination of internal and external participants, and (iii) **mixed**, when the management and composition of the digital provision is a combination of internal and external participants.

2.3 | Government roles in application programming interface-enabled digital ecosystems

The foundation of digital ecosystems is the interconnections between APIs. The inherent features of APIs, such as their reusability and modularity, increase the reach of digital assets both within and outside organisations (Iyer and Subramaniam, 2015b). Digital solutions are often composed of a highly flexible setup of APIs (Kane et al., 2015) involving several actors. Owing to this connectivity, the definition of API strategies is crucial for the development of a functioning digital ecosystem (Briscoe et al., 2011).

Governments can play different API-related roles within digital ecosystems, namely as ecosystem owners, ecosystem regulators or ecosystem active participants.

- As ecosystem owners, governments can technically and organisationally control the dynamics of their digital realms through the monitoring of their APIs.
- As ecosystem regulators, governments can use APIs to technically define (i) the terms under which digital interactions can happen in regulated environments and (ii) the metrics that the actors involved should report to allow for the control and monitoring of regulatory

actions. Each of these actions has different financial, legal and organisational implications.

- As ecosystem active participants, government entities can play two of the roles identified in Figure 3 (i.e. API provider and API consumer, including application developer, digital service provider or API assembler, as illustrated in [Section 2.2](#)).

“ Governments can play different API-related roles within digital ecosystems: ecosystem owner and ecosystem regulator and ecosystem active participant (providers and consumers) ”

In this section, we will describe in detail all of these roles and provide examples of their implementation, illustrating,

in particular, the role that is the focus of this report, that is, governments acting as API providers.

2.3.1 Governments as ecosystem owners/controllers

Benefits of the setup of digital ecosystems have been documented. Specifically, benefits can be gained through direct internal efficiency gains (e.g. a reduction in error rates or in digital services' implementation time and costs) and through fostering organisations' innovation by exposing digital assets and profiting from internal and external complementarities (Bonardi et al., 2016). However, to realise these outcomes, the definition of flexible digital interactions is key to streamlining efficiency gains while guaranteeing the robustness and sustainability of the digital ecosystem. Steering the potential of API-enabled digital ecosystems requires strong strategic organisational coordination (Kane et al., 2015). A government can play the role of the owner of the digital ecosystem and thus modulate the digital interactions through the ruling of API dynamics.

As an example, the ICT department of Regione Lombardia (Italy) has adopted an organisational approach to the

ruling of API-enabled digital ecosystems. Figure 6 illustrates the role of APIs within this approach (Regione Lombardia, 2020a). Specifically, Regione Lombardia has conceptualised the following aspects: (i) the legal context, namely regulatory incentive systems; (ii) organisational arrangements, namely actors, dynamics and responsibilities; (iii) financial aspects; and (iv) technical pillars, namely conceptual subenvironments, vertical (domain-specific) and horizontal digital blocks, and the marketplace for APIs. Disparate digital services are designed within the ecosystem in different policy-relevant domains: mobility, air quality monitoring, health, emergency responses and tourism promotion. Regione Lombardia stresses the unexpected innovative power that cross-fertilisation brings for both public service provision and public administration processes (Panebianco, 2019). Regione Lombardia describes its digital ecosystem as a living organism that evolves and learns from its own experiences.

APIs & Digital Ecosystems

Reference scenario

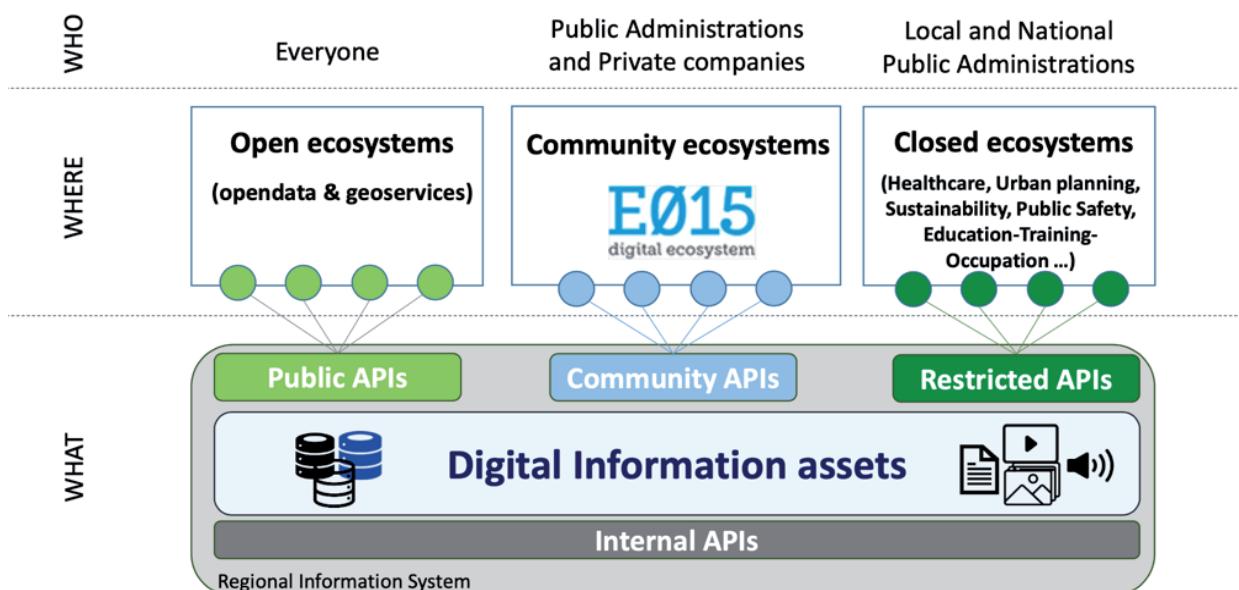


FIGURE 6: The EØ15 initiative.
Source: (Panebianco, 2019).

2.3.2 Governments as ecosystem regulators

The digital transformation of society entails the deployment of robust and resilient digital ecosystems. The governance of digital ecosystems is key to strike the balance between competition and collaboration among players within digital chains while ensuring system stability and societal gains. Governments are expected to monitor these environments and ensure that they contribute to the well-being and stability of the whole society they represent. An example

of this role is the case of regulation of the banking sector, specifically under the second Payment Services Directive (PSD2) (European Union, 2018a). In this case, APIs have been largely adopted to implement PSD2 technically due to their flexibility and modularity. Another example is the Open Data Directive, for which the use of APIs has been suggested for all the datasets and stated as mandatory for ‘high-value’ and dynamic datasets (European Union, 2019a).

2.3.3 Governments as application programming interface consumers

APIs offer the possibility of accessing digital assets, such as data or functionality, in an efficient and effective way. The availability of a multitude of APIs endows organisations with high flexibility to utilise both internal and external digital assets. By acting as API consumers, government entities may incorporate external digital assets (G2G, B2G or C2G) into their process flows. In this sense, governments are more flexible to adapt to digital transformation by means of cross-fertilisation and the fostering of innovation in government process flows. The reuse of external digital assets could bring complementarity benefits such as a reduction in costs (see also [Section 4.1](#)).

For example, in the case of DAWA, one of our case studies (Williams, 2018), governments consume APIs from government sources (G2G). DAWA exposes data and functionality regarding Denmark’s addresses, access addresses, road names and postcodes and is used to establish address functionality in IT systems. The target audience for DAWA APIs is developers who want to

integrate address functionality into their applications/IT systems. At the time of our analysis, there were approximately 5 000 IT systems that collected data regarding Danish addresses using DAWA, many of which were other government entities that integrate DAWA digital assets into their processes.

Another example of governments consuming APIs, this time from external actors (B2G), is the consumption of Airbnb data by the Danish tax authority. Airbnb signed a collaboration agreement with the Danish tax authority to ensure that hosts on Airbnb can share their homes responsibly and enjoy new benefits: hosts can enjoy tax-free earnings up to DKK 28 000 for primary homes and up to DKK 40 000 for summer houses (compared with DKK 11 000 on non-data-sharing platforms. In return, Airbnb plans to start sharing earnings data on hosts who have a listing in Denmark with the Danish tax authorities for all bookings made as of 1 July 2019. The information shared will be subject to strict European and national privacy rules (Airbnb, 2019).

2.3.4 Governments as application programming interface providers

In this section, we analyse in detail the role of governments as API providers. We will define the different kinds of APIs that a government can publish, list the different types of consumers of these API providers and, finally, present the beneficiaries of these APIs.

API solutions can expose government digital assets and facilitate digital interactions with both internal (e.g. G2G intra-agency interactions) and external players (G2G interagency interactions and G2B and B2G extra-government interactions). In this sense, API solutions enable the creation

of public-sector digital ecosystems. Depending on the different types of stakeholders involved, the ecosystem can develop internally or externally to the government agency that provides the API. In the former case, the ecosystem is built within a government entity (e.g. agency or department) or between different government entities. In the latter case, it may be wider reaching, for example between a government and another government or between a government, third-party provider or private company and a large number of developers. In any case, the APIs will define the interaction among the participants both technically and organisationally.

APIs can be classified by the type of access provided to different stakeholders. Different authors (Jacobson et al., 2011; Lacheca, 2016; Mehdi et al., 2018; Webster, 2018) agree on the categories, but not on how to name them. In particular, there is currently no agreement on the precise meaning and disambiguation of the terms ‘private’, ‘public’ and ‘open’. A ‘private’ API can refer, for example, to an API provided by the private sector or to APIs used privately within an agency. A ‘public’ API can refer both to APIs provided by the public sector and to APIs that are publicly available on the web. An ‘open’ API can also refer to APIs publicly available on the internet or to published APIs that can be used without restrictions, as is the case for ‘open data’ (OpenKnowledge foundation, 2020).

For this reason, we adopt the classification of Williams (2018), but use the following terms to disambiguate the semantics of the different types of APIs for government and any other kind of organisation APIs:

- **Internal APIs** generally used to facilitate the sharing of data and services *between* systems within an agency, avoiding the need for complex point to point integration. They are not visible to any system outside of the agency that created the API and are generally in the domain of its IT department.
- **External APIs** designed to be accessible outside the agency boundaries, ranging from interagency interactions to the wider population of web and mobile developers. This means they may be used by developers both inside and outside agency.

Additionally, the access to organisation APIs can be *restricted* and *unrestricted* to the API consumers:

- **Restricted APIs** limit the access to the digital assets they provide to a number of authorized stakeholders.
- **Unrestricted APIs** do not limit the access to the digital assets they provide. Optionally, registration or the citation of the attribution of the APIs could be requested.

Depending on the stakeholders identified in Figure 7, APIs can be further classified into different categories.

- **Intra-agency system APIs** are used to facilitate the sharing of data between systems within an agency,

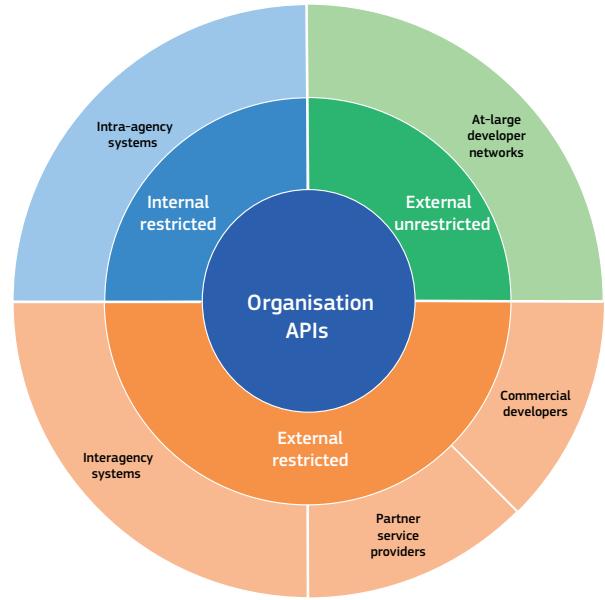


FIGURE 7: APIs stakeholders and API types.
Source: JRC, own elaboration, based on Lacheca (2016).

avoiding the need for complex point-to-point integration. They are not visible to any person or body outside the agency and are generally in the domain of the IT department. An example is a link between an internal human resources system and a payroll solution.

- **Interagency system APIs** are available to other government agencies and allow them to share data only once they have been authenticated. This supports many of the core tenets of digital government, allowing agencies to collect data on a citizen only once, and then share it securely. An example may involve the sharing of citizen data between, say, the agency responsible for income and taxation and those providing benefits so that eligibility can be confirmed. Although not specifically mentioned in Figure 7, the ability to use APIs is not constrained by sector or geographical boundaries. These APIs could include, for example, an application-to-application link between governments of different Member States.
- **Partner service provider APIs** are open to partnerships perhaps in the private sector, which may include healthcare providers, for example, who in some countries are interested in sharing healthcare records or confirming eligibility for free or subsidised treatment based on data held by a government agency.
- **Commercial developer APIs** integrate data from several sources with commercial purposes. They create

business opportunities by ‘mashing’ the data (e.g. combining data on public transportation networks with location data available on an individual’s smartphone to help the citizen make travel choices in real time). APIs make third-party integration of software and data easier and less problematic than not using them. Developers have access to the API at all times, so they can ensure that the two-way communication between assorted pieces of software is correct, rather than having to guess at the appropriate methods to use. It is also worth noting the economic stimulation that this can bring. For example, Transport for London’s policy (ProgrammableWeb.com, 2019b) of working with major

IT players (Google, Apple, Waze, etc.) but allowing their data to be available via the Open Government Licence has led to the creation of additional economic activity of the order of GBP 100 million of direct value and has enabled the creation of some 1 000 jobs (European Commission, 2017c).

- **At-large developer network APIs** do not require permission to access them. These APIs are the access point for developers to access large public data sources such as census information or other similar statistical data, including live sensor data from which to create citizen-facing applications.

Beneficiaries of government application programming interfaces

There are many beneficiaries of the government delivery of its digital assets with APIs. All sectors of society can benefit from more efficient government operations, reduced duplication and greater departmental collaboration (European Commission, 2020a). In this context, we have identified a number of target groups that can consume government APIs.

need to liaise with schools and educational institutions. Typically, each agency creates and maintains its own schools’ database and updates it as needed. In an API-first model, the education agency may create and maintain a standard database of all school and education contacts and other agencies would access this via an API in their systems (Thomson, 2015).

- **The internal agency/department that created the API.** Based on the implementation of the software three-tier/n-tier architecture best practice, known also as ‘dogfooding’, the main users of an API should be the creators. APIs should be used first by the internal government agency that created them. Thus, they are regularly monitored and understood from a user perspective. In addition, they will be aligned with need, to primarily create value for the internal agency. For example, a frequently updated dataset that is maintained by a government agency could be accessed via an API so that internal agency users share a single source of truth that can be trusted to always be the most current version of the database, rather than uploading and checking the version control of multiple copies of a dataset accessed by various staff members (Varteva, 2016).
- **Other government agencies/departments.** A second key user group generating high value from a government API would be other government agencies. Ideally, datasets and other assets should be shared across government (API-first model) rather than each agency creating its own dataset for the same domain. For example, many agencies across a government may
- **Other governments (tiers).** Within one nation, multiple tiers of governments need to use APIs from other government tiers. For example, national governments may have census data, demographic data and population projection data available via an API. City governments may need to use these data for their planning services and city plans.
- **Other governments (cross-border).** One of the key goals of European Union policy is to enable better sharing of data across borders (European Commission, 2017a). This is required in domains including tax, migration, tourism, trade, logistics, education, business registrations and personal healthcare records. Providing data on the movement of goods, people and money can best be managed using APIs to ensure that a single source of truth is maintained, that data can be updated in real time, that duplication in data entry (and therefore the potential for errors) is reduced, that exchanges can occur more efficiently and that mechanisms to protect the privacy and security of data are efficaciously adopted.
- **Industry.** Industry sectors can make use of government APIs. For example, weather data are

useful to many stakeholders in the agricultural industry. Also, ports' logistics data are useful to stakeholders in manufacturing, retail, transport and healthcare. Industry can also make use of key shared services available via APIs. For example, in Singapore, banks predominantly use the government's national identity verification APIs, which has sped up citizens' ability to open bank accounts and that of banks to approve loans to validated customers (Lee, 2019).

- **Business.** At the individual business level, the use of government APIs can help companies and small and medium-sized enterprises (SMEs) to speed up their processes, access relevant market information, communicate more effectively with government and generate more revenue. For example, businesses can consume government tax APIs directly in their book-keeping software so that their accounts are always in line with tax regulations, reducing paperwork and providing more certainty with regard to tax requirements. In turn, governments can reduce auditing costs and more effectively communicate tax regulations and rates (OECD, 2019a). For example, as detailed in [Section 4.1.5](#), API-AGRO is an online data exchange platform based on APIs, namely a two-sided market that brings together data suppliers and data users. The API-AGRO platform gathers various data assets drawn from multiple data sources and for multiple purposes. At the same time, the platform gathers open data from administrative files concerning farmers and integrates open data APIs from the French ministry of agriculture and food published in the French national API portal (Government of France (DINSIC/DINUM), 2020a).
- **Non-profit organisations.** Non-profit organisations can use government APIs to better inform their constituencies, demonstrate demand, verify users and enhance their product features. For example, the Barcelona-based open-source technology provider Decidim uses a city plan API and government national identity verification APIs to create feedback and consultation platforms that can verify that individual

users are citizens of the local government (Aragón et al., 2017).

- **Providers of services of public interest.** Such service providers (e.g. utility companies such as electricity and water supply) can use government APIs to identify service users, define service catchment areas, confirm eligibility and work with governments on providing holistic care. In New York City, service providers have requested access to the city's services catalogue via an API so that they can integrate service directories and eligibility criteria directly into their intake process. This reduces the likelihood of clients being asked the same questions and helps ensure that clients are provided with information for all of the services they are eligible to receive within a single process (Quaintance, 2019).
- **Researchers.** Academic institutions can access data and services directly from governments via APIs to enhance their models and research programmes. As governments increase investment in digital assets useful for AI and machine learning algorithms, and increase their use of IoT sensors for air quality management and for geospatial intelligence, researchers will need real-time access to data to partner with governments on evaluations, impact assessments, the uptake of technology and support policy (Glickenhouse et al., 2016).
- **Citizens.** Citizens will benefit from the use of apps and services that consume government APIs. Weather apps could make use of weather data provided by government APIs. Transport route planners and ticketing apps could consume government transport data APIs. An event-based life approach to provide government services will automate and proactively engage citizens at key life event stages (e.g. birth, educational attainment, marriage, business creation and retirement) and utilise APIs to trigger and automate communications on service access and citizen requirements (Smart Nation Singapore, 2020).

APPLICATION PROGRAMMING INTERFACE LANDSCAPE FOR GOVERNMENTS

SUMMARY

The European Commission has, in many ways and for a considerable time period, encouraged the adoption of digital technologies across the EU. This has included providing guidance and suggesting voluntary measures to foster the development of digital government and the adoption of APIs, in addition to adopted legislation in specific domains, such as the Open Data Directive, which makes the adoption of APIs mandatory for high-value and dynamic datasets, the Single Digital Gateway (SDG) Regulation and the INSPIRE Directive. The European Commission also reinforces the concept of data sharing via APIs through other policy documents, such as the communications *Towards a Common European Data Space* and *A European Strategy for Data*, and initiatives such as the EIF, the ISA² programme, the EU e-government action plan 2016–2020 and the building blocks of the CEF.

The adoption of APIs by governments in the European Union is still in its initial stages. We have currently identified, collected from heterogeneous sources and classified 219 government APIs available on the internet. The main finding of the preliminary analysis of a selected set of cases studied is that web **APIs strongly support the digital transformation of government** and that when API strategies and solutions are implemented (at least in certain cases and domains), their uptake is **rapid** and **extensive**.

A specific and comprehensive survey on API strategies, implementation projects and vision in European Union governments reveals that API strategies in Europe are rather new – the oldest having been implemented only in 2014 – and several are planned to be deployed within 2020. A workshop on the same topics has uncovered further elements related to API adoption in government. In particular, it seems that the current efforts are focused on making individual organisation's resources available, but little thought is being given to the more strategic elements related to the creation of an ecosystem of APIs.

This study has collected a total of 78 documents on web API standards and technical specifications that can be used for different purposes: to represent a digital asset and transmit it, document it, make it secure, evaluate its performances and share it with the right terms of use. This study also looked at emerging government best practices and guidelines from around the globe, with a specific focus on activities undertaken in the European Union. Over 3 900 links were found, scanned and analysed for their relevance to APIs. Of this combined pool of documents, 968 were reviewed and 343 were chosen as relevant for government API best practices. An analysis of the common approaches, a strengths, weaknesses, opportunities and threats (SWOT) analysis and a gap analysis of the documents have been used to build the basic EU API framework presented in this report.



③ APPLICATION PROGRAMMING INTERFACE LANDSCAPE FOR GOVERNMENTS

This section presents the current landscape of API adoption in governments as distilled from our research. In particular, we will tackle four perspectives, one political and three technical. In the first part of the section, we list European Commission initiatives, both legal and operative, that either support or regulate API initiatives in the European Union. In the second part of the section, we present the landscape analysis of API cases and strategies produced by the European Union public institutions. The list of API cases has been gathered from a series of resources, including API catalogues and directories, previous studies and internal activities within the study (workshops, surveys

and case studies). The workshops and the survey on API strategies in the EU highlighted the essential elements we needed to identify government API enablers, drivers, barriers and risks. Next, we explore if Member States and leading-sector countries outside the EU are currently producing guidelines for digital government APIs. We also summarise the characteristics of the main standards, technical specifications and methodologies useful to design APIs at the technical level. In the final part of the section, we give an overview of the available literature on best practices for the adoption of APIs in government.

3.1 | Application programming interfaces in the European policy context

For a long time, the European Commission has been working on a series of initiatives and activities that deal with the digital transformation of governments and the adoption of APIs in governments. The aim of this section is therefore to provide some insight into these current

regulations and initiatives; information has been gathered both from the available policy documents and literature and from a number of meetings, workshops and interviews with specific related working teams of the European Commission.

3.1.1. European Union legal instruments

Within the context of the digital transformation of governments, the importance of the use of APIs is highlighted in relevant European Union legal policy documents. In this section, we group these documents into

Provision of data assets

The **European Commission Open Data Directive** (European Union, 2019a) provides a common legal framework for the European market for government-held data (public-sector information). This directive entered into force on 16 July 2019 and replaced the Public Sector Information Directive (Directive 2003/98/EC), dated 2003, which was subsequently amended by Directive 2013/37/EU. The new directive is built around two key pillars of the internal market, namely transparency and fair competition, and introduces substantive changes to the past legal text, especially linked to the use of APIs. In fact, even though the directive does not specify any particular API standard or technical specification, it mandates public organisations to make use of APIs to make their 'high-value' and dynamic datasets accessible. In particular, Article 5 ('Available formats') states the following.

- **The high-value datasets, as listed in accordance with Article 14(1) shall be made available for re-use in machine-readable format, via suitable APIs and, where relevant, as a bulk download.**

It also states the following.

- **Public sector bodies shall make dynamic data available for re-use immediately after collection, via suitable APIs and, where relevant, as a bulk download.**

“ The provision of ‘high-value’ and dynamic datasets through APIs is mandatory to facilitate data reuse ”

those regarding the provision of data assets, those related to the provision of public services and those regarding the provision of digital assets in the geospatial and banking sectors.

The European Commission communication *Data, information and knowledge management at the European Commission* (European Commission, 2016e) recognises the need to act in the field of data management and data sharing. To facilitate the implementation of the communication, the European Commission has developed an internal digital strategy (European Commission, 2018b) with a supporting internal data strategy that aims to transform the European Commission into a fully data-driven administration. The aim is to develop an ecosystem consisting of a set of interconnected and interacting elements, and one of the basic building blocks is the use of APIs.

Regarding specifically the **data economy domain**, business-to-business (B2B) data sharing is reported by the European Commission communication *Towards A Common European Data Space* (European Commission, 2018a), which states that 'there is strong support from stakeholders for non-regulatory measures [regarding B2B data sharing], such as ... fostering the use of APIs for simpler and more automated access to and use of datasets' and that the 'Support Centre for data sharing under the Connecting Europe Facility programme will put in place a set of measures to make it easier to share private sector data in addition to public sector data. It will offer know-how and assistance on data sharing by providing best-practice examples and information on APIs, existing model contracts and other legal and technical aspects'.

Moreover, the new communication *A European Strategy for Data* (European Commission, 2020a) reports on the **future investment in ‘the establishment of EU-wide common, interoperable data spaces’** and states that

‘the Commission will work on making more high-quality public sector data available for re-use, in particular in view of its potential for SMEs. In order to open up key public sector reference data sets

for innovation, it shall start the procedure for the adoption of an Implementing act on high-value data sets (Q1 2021) under the Open Data Directive, making these data sets available across the EU for free, in machine-readable format and through standardised Application Programming Interfaces (APIs).

In particular, the communication requires both the public and the private sectors to join the efforts, and also explores the need for a ‘data act’ legislative initiative in setting up true European data spaces. This will allow the EU to create a single market for data and to unlock unused data, allowing them to flow freely within the European Union and across sectors for the benefit of businesses, researchers and public administrations. These data should be available to all, whether public or private, start-up or giant companies. Data spaces will require ‘mechanisms for ensuring interoperability’ and this will require the use of APIs. Indeed, APIs are an enabling technology that can allow this flow of data, ensure governance and access security considerations are embedded in that flow, and allow those data to be used in a variety of systems.

To protect the processing of personal data and on the free movement of such data, the European Union established the **General Data Protection Regulation (GDPR)** (European Union, 2016). The regulation is an essential step in strengthening individuals’ fundamental rights in the digital age and facilitating business by clarifying rules for companies and public bodies in the DSM. As a novelty, the GDPR introduces the right to the portability of personal data, which will allow a customer to share the personal data that he/she has provided to a company with other companies with which he/she engages. The three key elements of the regulation are as follows.

1. Consent. For processing specific types of data, companies will be required to request specific, informed, unequivocal and, in some cases, explicit consent from its customers/users.

Provision of public services

Government commitments to the **Tallinn Declaration** (Estonian Presidency of the Council of the EU, 2017) can be supported by the adoption of APIs in public service provision. This can enable governments to deliver high-quality, efficient, secure and user-centric digital public services for citizens, as well as seamless cross-border

‘‘The European Data Strategy envisages investment in the setup of common, interoperable data spaces. APIs will be technical enablers of these environments’’

2. Data portability and the right to be forgotten.

A consumer can request that a company provide all the personal data that it has on him/her. These data should be transmitted in a structured, commonly used and machine-readable format directly to the other companies (at the request of the consumer) when technically feasible. The right to be forgotten entitles the data subject to have the data controller erase or block his/her personal data.

3. Security and traceability. For certain data processes, companies will be required to create certification mechanisms defined by law, aimed at reducing the legal risk and building up customer trust.

One aspect of the GDPR is that, if you have shared personal information with other parties, then you need to be able to provide a list of whom you have shared it with and ensure these other parties remove these data from their systems if requested to do so by the natural person to whom the data refer. In a digital ecosystem scenario, multiple stakeholders may also share personal information with third parties via APIs. Therefore, specific measures need to be implemented to log which parties have obtained the personal information. In addition, notification APIs might be supplied to the parties if the information needs to be corrected or removed.

public services for businesses. Key areas to consider are the ‘digital-by-default’ and ‘inclusiveness and accessibility’ principles, supporting transformative actions such as user centricity, in general, and the consistent quality of digital public services and their users’ experience, as well as working to increase the readiness of both businesses and

citizens to interact digitally with public administrations. The latter action may not only imply the use of APIs to support interaction but also the readiness of non-governmental actors to make use of those digital resources, including continued investment in digital skills for all involved and accessible digital services. Similarly, the Tallinn Declaration highlights the principles of ‘trustworthiness’ and ‘security’. Here, public service design needs to consider security and privacy needs involving modern solutions.

As a response to the call made by heads of state during the Digital Summit in Tallinn, Member States committed to accelerating the OOP for key public services. The OOP means that citizens and businesses should supply information only once to a public administration in the EU, regardless of what Member State they are in. This is also part of the proposal for the SDG. The **SDG Regulation** (European Union, 2018b) is a regulation that aims to eventually allow citizens and businesses to benefit from fully electronic public services in a cross-border manner by the end of 2023 for 21 procedures. This will require some fundamental changes to how information about

public services is exchanged and made available publicly. The European coordinator of the SDG has to collect the descriptions of public services from European public administrations in one unique portal; the collection would be automated to prevent problems caused by human error and to eliminate the need for manual updates. Member States and the Commission should aim to provide links to a single source of the information required for the gateway to avoid confusion among users as a result of different or fully or partly duplicative sources of the same information. To minimise human intervention in the updating of the links to be used by the common user interface, a direct connection between the relevant technical systems of the Member States and the repository of links should, where technically possible, be established. ‘The information included in the repository of links should be made publicly available in open, commonly used and machine-readable format, for example by APIs, to enable its reuse’ (4). The common ICT support tools could use the Core Public Services Vocabulary, which publishes its APIs to facilitate interoperability with national service catalogues and semantics (European Commission, 2019c).

Application programming interface regulation in specific domains

For the geospatial domain, the European Commission aims to create, with the **INSPIRE Directive** (European Union, 2007a), a European spatial data infrastructure for the purposes of EU environmental policies and policies or activities that may have an impact on the environment. To ensure that the spatial data infrastructures of the Member States were compatible and usable in a community and transboundary context, the INSPIRE Directive required that common implementing rules be adopted in a number of specific areas, including for specific web services. Recently, some proposals have been published to adopt APIs and map them with existing INSPIRE web services to exchange geographical feature datasets (Lutz et al., 2019) and geolocated sensors (Kotsev et al., 2018).

In the case of the banking sector, the European Union introduced in 2007 the **first Payment Services Directive (PSD)** (European Union, 2007b), which regulated the information requirements, the rights and the obligations of payment service users and the requirements of payment service providers for entering the market. In 2015, a revised version of the **PSD**

(PSD2) (European Union, 2015a) introduced several changes, of which the most relevant, for the scope of this report, was the introduction of third-party actors in the payment service market. It establishes that ‘account servicing payment service providers such as banks, shall allow third parties to obtain real-time data relating to customers’ accounts as well as provide access to such accounts by executing payment orders initiated through digital interfaces, on condition that customers give their explicit consent and that the account is available online’. Fintech companies are largely adopting API solutions in the implementation of PSD2 solutions and there are a lot of standardisation efforts ongoing in this domain, which is pivotal for the implementation of the directive. As well as public-sector organisations being customers or even potentially third-party providers, it is possible that some technical advances in this sector could lead to solutions for reuse in the public sector (Astore, 2018). At the technical level, PSD2 is supported by regulatory technical standards that include an API definition to help enable interoperability among banks and third parties (EBA, 2017).

3.1.2. European Union policy provisions

One of the actions of the e-government action plan 2016–2020 requires the European Commission to ‘Present a revised version of the European Interoperability Framework (EIF) and support its take-up by national administrations’. The **EIF** (European Commission, 2017a) supports increased ICT-based cooperation between Member State organisations. In particular, focus area 4 (‘Develop, maintain and promote key interoperability enablers’) of the interoperability action plan highlights the need to define components for enabling the exchange of content between public administrations, businesses and citizens through a common approach for better (end-to-end) quality public services. Indeed, implicitly, APIs play a fundamental role in enabling the exchange of this content.

The implementation of the EIF is mainly supported by the **ISA** programmes (European Commission, 2017d). The last ISA² programme entered into force on 1 January 2016 with the aim of supporting long-standing efforts to create a European Union free from electronic barriers at national borders (European Union, 2015b). ISA² facilitates cross-border and cross-sector interaction between European public administrations, businesses and citizens, enabling the delivery of electronic public services and ensuring the availability of common solutions, enabling them to benefit from interoperable cross-border and cross-sector public services. The ISA² programme has launched many actions that are relevant to the adoption of APIs in governments. The team responsible for the ISA² ‘catalogue of public services’ action (European Commission, 2018c), for example, has recently conducted a study on APIs (European Commission, 2019d) that encourages public administrations to define the data models supporting the public service implementation by following the Core Public Service Vocabulary Application Profile data models. These data models should be used to design the APIs that share these data and are used to access the EU *Catalogue of Services* (European Commission, 2018c).

Another relevant ISA² initiative addresses the Innovative Public Services project (European Commission, 2018d). This action aims to provide support for identifying the innovation potential and conditions of emerging disruptive technologies such as blockchain and distributed ledgers, AI- and IoT-related infrastructures, or technological solutions and platforms already mature in the private sector such as APIs, to better assess their impact, namely if they lead to more efficient and improved public services,

as well as improved interactions between governments, citizens and business.

A further action of the e-government action plan 2016–2020 requires the Commission to be ‘using the common building blocks such as CEF DSIs [digital service infrastructures] and follow the EIF’. The **CEF** funds a set of generic and reusable digital service infrastructures (DSIs), also known as ‘building blocks’ (European Commission, 2020e). The CEF building blocks offer basic capabilities that can be reused in any European or national project to facilitate the delivery of digital public services across borders and sectors. Digital building blocks have been created to help teams deliver digital public services faster, comply with regulation and make the DSM a reality. They include basic capabilities ⁽⁵⁾ that can be reused in any project to facilitate the delivery of digital public services across borders and sectors. Some of the building blocks use APIs and expose them to let third parties participate in the digital ecosystem enhanced by the building block (see also [Section 3.1.2](#)). These building blocks include the big data test infrastructure, a context broker, e-delivery and e-translation.

Recently, a set of pilot studies were developed to explore how CEF building blocks can support the **OOP** (European Commission, 2017b), which is also a core principle of the e-government action plan 2016–2020. According to this principle, citizens and businesses should be able to provide information once and have those data shared and reused with other public administrations. Communication with the government is, in many cases, compulsory for both natural and legal persons (e.g. declaring taxes, requiring a permit to operate in a specific field or applying for a social benefit). When the specific data are not in possession of a given authority, the public authority has two options: either request the information required from the person themselves or enable the application of the OOP. Efficient data sharing within the public sector would cut costs for citizens and public administrations (European Commission, 2017e), and APIs can greatly facilitate both OOP data sharing and the creation of interoperable digital services.

The EU-wide application of the OOP is also one of the pillars of the strategy for the DSM and one of the basic principles of the EU e-government action plan 2016–2020 (European Commission, 2016b). **The OOP Project** (TOOP) aims to explore and demonstrate the OOP across

borders while focusing on data from businesses. TOOP led to the creation of a solution architecture that connects 40 information systems using CEF building blocks, including e-delivery, e-signature and e-identification. To highlight this, TOOP's service design requirements are based, where possible, on the reuse of building blocks that have proven effective in cross-border interoperability environments. To implement TOOP architecture, both the data provider and the data consumer must use the **TOOP connector**, a software component that implements the full process of the message exchange in TOOP. Message exchange with the TOOP connector has to be performed via representational state transfer (REST) APIs (TOOP, 2018).

Under the CEF programme, the European Commission has also established a **European Support Centre for Data Sharing** to help organisations share and access data including through APIs. The scope includes both public and private organisations and focuses on two main activities. The first is a 'data-sharing practice observatory for collecting existing experience in data-sharing and developing original research on legal and technical aspects of data sharing'. The second is a 'helpdesk and feedback service ... supporting practitioners while capturing the richness of their experience in the field, and offering it back

to the community'. The activity also aims to develop public awareness and promote tools and services for generating economic and societal benefits. Moreover, the centre is active in organising specific API training modules (Support Centre for Data Sharing, 2020).

A quite recent activity supported by the European Commission and the Committee of the Regions, and promoted by many stakeholders and network of cities, is the '**join, boost and sustain**' declaration. The main purpose of the declaration is to scale the development of urban platforms and digital solutions in a coordinated way to maintain European cities' and communities' technological sovereignty. Within the initiative, the *Consolidated report of technical specifications to scale Living-in.EU*, referenced in the declaration, indicates in its high-level architecture framework model that APIs can enable both southbound and northbound interoperability (European Commission, 2019e).

Indeed, APIs are one of these key interoperability enablers, as they provide tools for faster and more efficient processing of data within public administrations; efficient public services can result in significant cost savings or the development of new kinds of services at the same cost.

3.1.3. Main conclusions from the analysis of the policy context

In the previous sections, after an introduction of the overall digital government context, we have listed the main policy initiatives in the European Union that enforce, support, enable and implement the digital transformation of governments and the sustainable and strong digital economy in Europe. Where needed, we have identified where these documents are associated with the adoption of APIs in governments and how this adoption could support reaching the goals proposed in the documents.

From the analysis of these documents, we observe that APIs are explicitly mentioned by the most recent policy legal instruments (European Union, 2019a; European Commission, 2020a). In many cases, these documents require the mandatory use of APIs to implement their

specific goals. However, the implementation instruments, such as programmes and activities, identified in [Section 3.1.2](#) still rarely explicitly mention the adoption of APIs in governments. This might mainly depend on the recent formulation of the policy and legal instruments and the necessary time to reach the implementation phase of these policies.

Following the trends illustrated in the next sections, API adoption in governments will possibly explicitly be sustained by the next policy provisions, under the next **digital Europe programme** (European Commission, 2018e) ⁽⁶⁾. As we also propose in [Section 5](#) and recommend in [Section 7](#), this could be the best time to adopt APIs across the whole European Union in a uniform, consistent and coherent way.

3.2 | Government application programming interface adoption

In the previous section, we have reported about the policy setting of the API adoption in European Union. The goal of this section is to go more in depth and check where and how APIs have been concretely implemented in the public sector. In the first part of this section we present our results about found government API cases, focussing in particular on the European Union statistics. Then, we

present our analysis of the API strategies we have gathered with different research methodologies and activities: A multiple-case study on seven specific government API cases, a workshop and a survey on government API strategies in the European Union. Finally, we summarize our main conclusions.

3.2.1. Government application programming interface cases

Government API cases are exposed by governments in different ways, formats and standards. For this reason, it is currently difficult to find automatically government API cases published on the web. Indeed, since the beginning of the study, we have been investigating the best methodology to collect them in an automatic and systematic way. Unfortunately, we soon discovered that, to date, this is not so easy. In fact there are not well-identified API catalogues where such cases can be found and filtered. In addition, as APIs are not websites, there is not a dedicated web search engine for them. Research has been conducted by IBM in a project called ‘API harmony’ (Wittern et al., 2016) but the project was recently discontinued. There are also some individual API experts (Lane, 2019) and companies’ initiatives that have investigated building API search engines, but they rely on their own API collected databases (APIs.io, 2020; ProgrammableWeb.com, 2020a) and/or are run on specific types of APIs (APIs.guru, 2020).

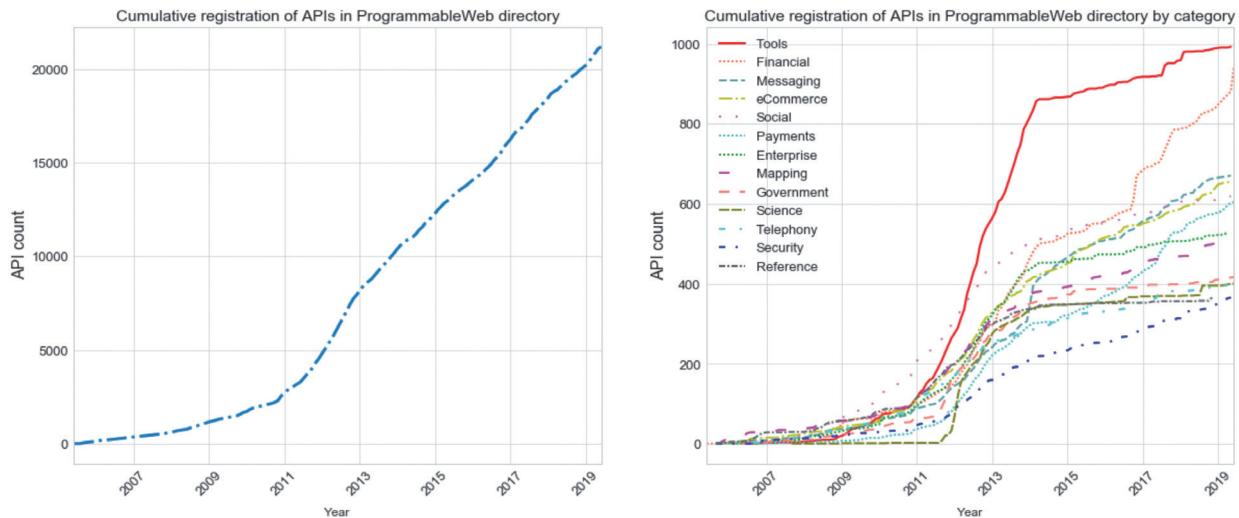
To gather and analyse the API government cases that could support our research, we identified and used a specific number of sources, including API registries and past API initiatives. We also organised a workshop and launched a survey on government API strategies, from which we collected the cases of the participants and contributors. This list of sources includes:

- the ProgrammableWeb API directory (ProgrammableWeb.com, 2020a);
- a list of API endpoints collected within a survey performed within the e-government action plan steering board members (European Commission, 2016f);
- the database of 395 cases taken from the study *Towards faster implementation and uptake of open government* (SMART 2015/0041) (European Commission, 2016g);

- the news web page provided as part of the DSM initiative entitled ‘Open eGovernment practices in all EU Member States make public services more collaborative, efficient and inclusive a useful list of relevant endpoints’ (European Commission, 2016h);
- the European Union open data portal (European Commission, 2020f);
- the European Data Portal (EDP) (European Commission, 2019f);
- the INSPIRE data catalogue (European Commission, 2020g);
- the research activities of the study listed in Annex 2.

Starting from the cases gathered from these sources (approximately more than 1 000 cases), we have verified and selected only those cases related to government APIs, and perform a landscape analysis.

From our early analysis of the ProgrammableWeb directory, the API adoption in governments has grown steadily since 2012. However, the observed adoption of APIs in government in the European Union is still scarce and uneven. Figure 8 shows the number of web API records that have been registered since 2005 until the first quarter of 2019 in ProgrammableWeb.com, a primary community resource for amateurs and professionals in the API industry. This resource maintains a directory of information about publicly accessible API endpoints that developers themselves self-declare and enrich. In August 2019, this directory listed 21 202 records, of which only 417 (~2%) had been categorised as ‘government’ (primary keyword).

**FIGURE 8:** Adoption of web APIs.

Left panel: cumulative count of the number of web APIs reported. Right panel: cumulative count of the numbers of the most common APIs by category.
Source: JRC, own elaboration, based on ProgrammableWeb.com (accessed in June 2019).

An indication of the purpose of the API is found in the information about its category, as listed in the directory. Table 2 lists the most frequent categories⁽⁷⁾ among the API records registered. Among the top categories are the financial and e-commerce categories, as well as the payments and enterprise categories. The right panel of Figure 8 also shows that the trends in the number of records of APIs registered in the payments and financial categories increased after the publication of PSD2 (European Union, 2015a), which might have influenced the development of this trend. Finally, we highlight that the government category ranks among the most frequent categories of records.

From the analysis of the ProgrammableWeb cases and of the other sources, we have identified 219 cases collected from the European Union Member States, the United Kingdom and the European Free Trade Association (EFTA) countries (Vaccari, 2020). The API cases belong to

different categories of APIs, each of them giving access to a different type of API digital asset.

— **Specific API.** This is a unique API built for a specific purpose that gives direct access to data or functionalities. It can have many endpoints or methods (see an example in Box 1).

— **API registry.** This is a list of APIs grouped in a catalogue, registry or directory.

— **Data catalogue API.** This is an API published to access the metadata of datasets (i.e. giving ‘indirect’ access to datasets), normally exposed by a government (open) data catalogue.

— **API platform.** This is a platform that supports the use of APIs.

Rank	First category	Number	Rank	First category	Number
1	Tools	993	11	Telephony	398
2	Financial	944	12	Security	366
3	Messaging	671	13	Reference	366
4	E-commerce	657	14	Search	346
5	Social	619	15	Email	346
6	Payments	605	16	Video	340
7	Enterprise	528	17	Travel	321
8	Mapping	510	18	Education	311
9	Government	417	19	Sports	303
10	Science	401	20	Transportation	292

TABLE 2: Most common categories of registered web APIs.

Source: JRC, own elaboration, based on ProgrammableWeb.com (accessed in June 2019).

- **API tool.** This is a tool used to manage APIs.
- **API standard.** This is a set of standards related to government APIs normally published by a public-sector institution (8).

Table 3 shows the distribution of the API cases by country and by administrative level (city, international, national and regional levels) and the total number of cases for each country.

We have also identified a number of APIs that are not specifically linked to any country, but have been published by the European Union (42 cases) or by international communities active within the European Union or EFTA countries' boundaries (15 cases). Box 1 illustrates the example of Europeana, an initiative of the European Union that gives access to thousands to European archives, libraries and museums to share cultural heritage for enjoyment, education and research (European Union, 2020a).

Country	City	Internat.	National	Regional	Total
Austria			2		2
Belgium	2		4	5	11
Bulgaria			2		2
Croatia			1		1
Cyprus			1		1
Czechia			7		7
Denmark	1		9		10
Estonia		1	4		5
Finland	6		4		10
France	3		6		9
Germany	5		4		9
Greece			5		5
Hungary			1		1
Iceland			1		1
Ireland	1		4		5
Italy	2		5	4	11
Latvia			2		2
Liechtenstein			1		1
Lithuania			1		1
Luxembourg		1	2		3
Malta			1		1
Netherlands	4	1	8		13
Norway			2		2
Poland			4		4
Portugal			2		2
Romania			1		1
Slovakia			2		2
Slovenia			1		1
Spain	5		2	5	12
Sweden	1		3		4
Switzerland			1		1
United Kingdom	4	1	20		25

TABLE 3: API cases by country.
Source: JRC, own elaboration based on Vaccari (2020).

Box 1.

A specific API example: European Union cultural heritage – Europeana APIs

Europeana collections are an initiative of the European Union, financed by the European Union's CEF and the European Union Member States. The Europeana collections contain over 50 million cultural heritage items, from books and paintings to 3D objects and audiovisual material, that celebrate over 3 500 cultural institutions across Europe. Europeana offers sophisticated search and filter tools to help the user find what he/she is looking for.

Europeana also offers APIs. The Europeana REST API allows a developer to build applications that use the wealth of Europeana's collections drawn from the major museums and galleries of Europe.

Over the past couple of years, the Europeana REST API has grown beyond its initial scope, as set out in September 2011, into a wide range of specialised APIs. At the moment, Europeana offers several APIs that can be used to not only get the most out

of Europeana but also to contribute back to the initiative.

It is possible to use the Europeana APIs in a simple way (e.g. to request all results for the word 'cat') via the 'Search API' function. However, it is also possible to delve into the structured metadata of Europeana (e.g. to ask for all the French 18th-century painters with at least five artworks available through Europeana) via a sophisticated SPARQL Protocol and Resource Description Framework (RDF) Query Language (SPARQL) service (W3C, 2013).

To obtain all of the information (metadata) associated with a single item, the 'Record API' function can be used. It is also possible to obtain a larger amount of metadata and to ultimately harvest the complete Europeana repository by using the Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH) service. Regarding contextual information that is associated with items, Europeana also offers an 'Entity API' function that gives access to information such as topics, persons and places. Finally, it is also possible to contribute information about the items that are available on Europeana via the 'Annotations API' function.

Figure 9 shows the number of APIs classified for each type of API. The majority of them are ‘specific’ APIs (i.e. those that have been created for a specific purpose in government). In this group, we included APIs as they are intended in the ‘traditional’ way (i.e. an endpoint or a group of endpoints that let developers find a web URL that they can use to build their applications). Figure 1 shows an example of specific APIs of DAWA (Denmark).

APIs for ‘data catalogues’ represent a consistent and important way to access information (‘metadata’) that describes digital assets (normally open data) published by governments. A high number of APIs have been published to access datasets published in government data catalogues, which provides final users with an opportunity to search for, find and access these digital assets (⁹). Some of these catalogues, such as the European Union Open Data Portal (see Box 2) and the INSPIRE catalogue, let a developer search among thousands of datasets via APIs.

API ‘registries’ include various ways to publish a grouped set of APIs (e.g. by institution, theme or standard). API registries can be published as a simple list of endpoints or as an API catalogue (i.e. in a more structured and documented way). An example at the national level is the French API catalogue (see Box 3), whereas an example at the regional level is the EO15 website of Regione Lombardia (Italy) (Regione Lombardia, 2020a), which also provides a set of guidelines for the publication of APIs for all the public institutions at the regional level (Regione Lombardia, 2020e).

Box 2.

APIs for the European Union Open Data Portal

The European Union Open Data Portal (EU ODP) aims to encourage the use of EU datasets for building third-party applications. To help achieve this, two APIs are proposed to be used by developers to search for datasets: a REST API and a SPARQL endpoint.

All the portal core functionalities (e.g. the dataset search functionality) are available through the REST API, which encompasses most of what a

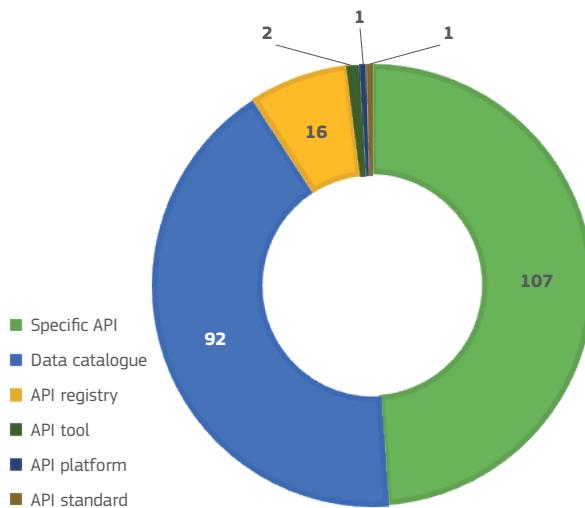


FIGURE 9: Types of APIs in analysed API cases (N=219).
Source: JRC, own elaboration, based on Vaccari (2020).

Figure 10 shows our classification by theme. API registries and APIs that grant access to data catalogues have been classified as ‘various’, as they give access to a number of heterogeneous APIs related to many domains. Geospatial APIs are normally made available by the geospatial catalogues (mainly retrieved from the INSPIRE geocatalogue), while government APIs are normally APIs that have been published by governments to give access to a service such as budgeting or administrative registries. A number of APIs have been published for companies’ registries under the theme ‘business’ and on the transparency of government politics (e.g. on the activities by politicians) under the theme ‘politics’.

human user can do with the web interface. The information retrieved can then be used by an external code to transform, update or reference and provide new input for further calls to the API. Specifications of the new API are published in OpenAPI Specification (OAS) format and the description file, in OAS format, is also available for download in YAML Ain’t Markup Language (YAML) format.

The SPARQL endpoint allows queries on the RDF descriptions of datasets. A graphical user interface is provided to enter your SPARQL queries. The models used to describe datasets catalogued on the EU ODP are described on the ‘Linked data’ page under ‘Metadata vocabulary’.

Box 3.

The French national API registry

France scores among the top three countries in the European Union in terms of overall open data maturity and is one of the three trend setters in Europe (European Commission, 2019g). At the national level, France offers an API register that essentially gathers all of the APIs of the administration into a single portal with similar documentation. The API listing – administered by the Direction interministérielle du numérique et du système d'information et de communication de l'État (DINSIC) – contains information on technical and functional descriptions of each API, its access conditions and particularly the documentation of the interface of the API (Government of France (DINSIC/DINUM), 2020a). The API registry is part of the French national API strategy, which also includes the FranceConnect platform, which provides users with a trusted identity based on one of their existing accounts at the national level. In

brief, the French API strategy includes the following elements (European Commission, 2018f):

- the development of APIs in each French administration and the gathering of every API description in the national catalogue;
- the development in each French administration of the use of existing APIs by facilitating onboarding of new service providers to consume existing APIs;
- the development of the FranceConnect platform, which provides a secure way to exchange information between FranceConnect service and data providers.

The API registry is not the same as the open data portal (DINSIC, 2020), which lets users access its datasets and services. The portal aggregates open data from all of the central administration entities, operating as a platform matching users and data providers. Each entry in this directory is accompanied by complementary assets such as documentation and often a showcase of potential reuse from third parties.

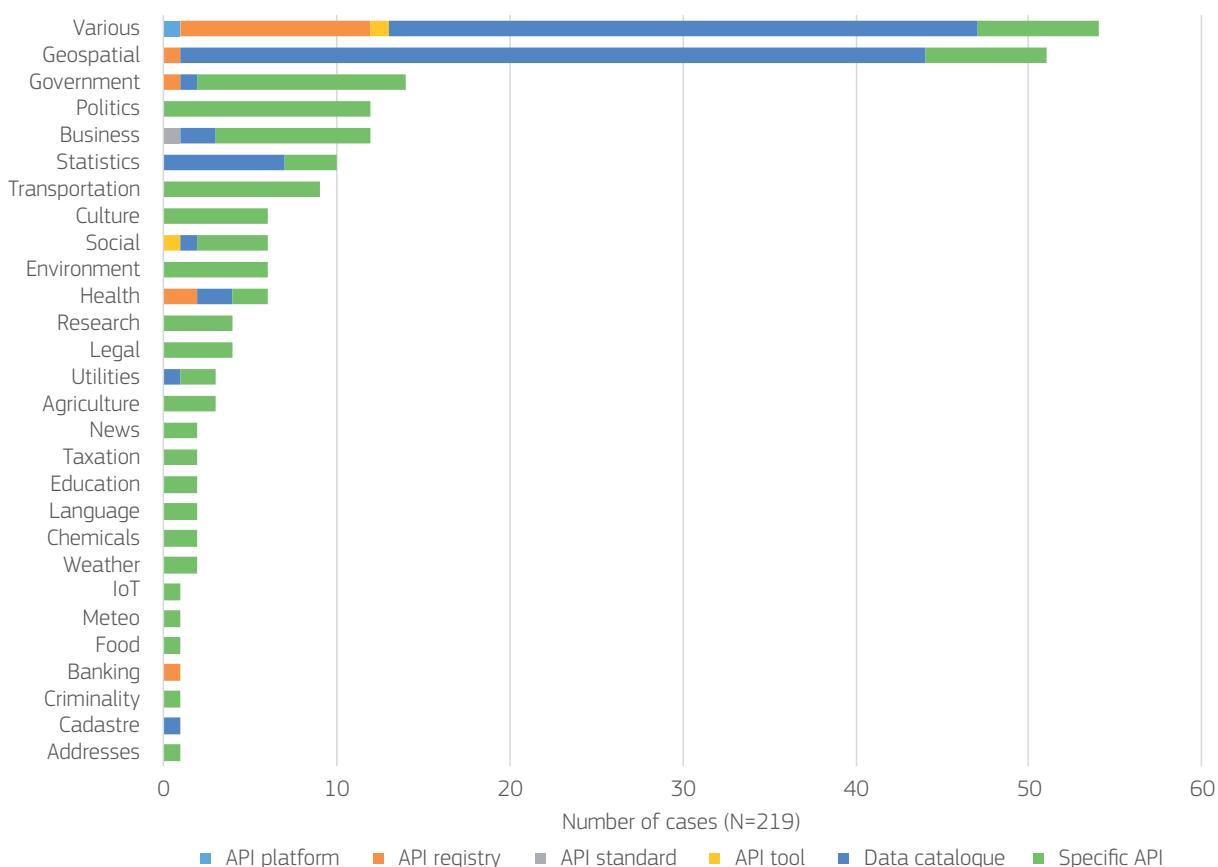


FIGURE 10: APIs classified by theme.

Source: JRC, own elaboration, based on Vaccari (2020).

The analysis of the cases concludes that, at least for the APIs publicly available on the web, government APIs in the European Union are still in an initial stage (i.e. the number of cases is relatively low). However, if we look at the cases of specific API initiatives, and exclude the

horizontal domains (e.g. geospatial, government, business and statistics), the sectors that have developed more APIs include transportation, culture, environment, health, agriculture, utilities, taxation, education, chemicals and weather.

3.2.2. Key enablers, drivers, barriers and risks

This section presents our findings on the drivers and enablers of, and barriers to, the provision and roll-out of API strategies in governments. We also assess potential risks and mitigation actions for the public sector, society (e.g. not protecting individual rights) and business (e.g. monopolistic practices). These findings are the result of our analysis based on the case studies (Williams, 2018),

the survey and the workshop activities, which are briefly presented in Annex 2. All of the sources provided rich information for the evaluation of the government API scene in Europe. We used these elements to provide an initial set of documents for the analysis of API best practices and to perform our analysis of why and how governments should adopt APIs (see [Sections 4](#) and [5](#)).

Key enablers

The survey explored the main enablers for API systems' adoption in government. Figure 11 depicts both the enablers identified in already functioning API strategies

and those predicted as part of API strategies under design. The enablers evaluated fall into three groups, namely organisational, budgetary and technical.

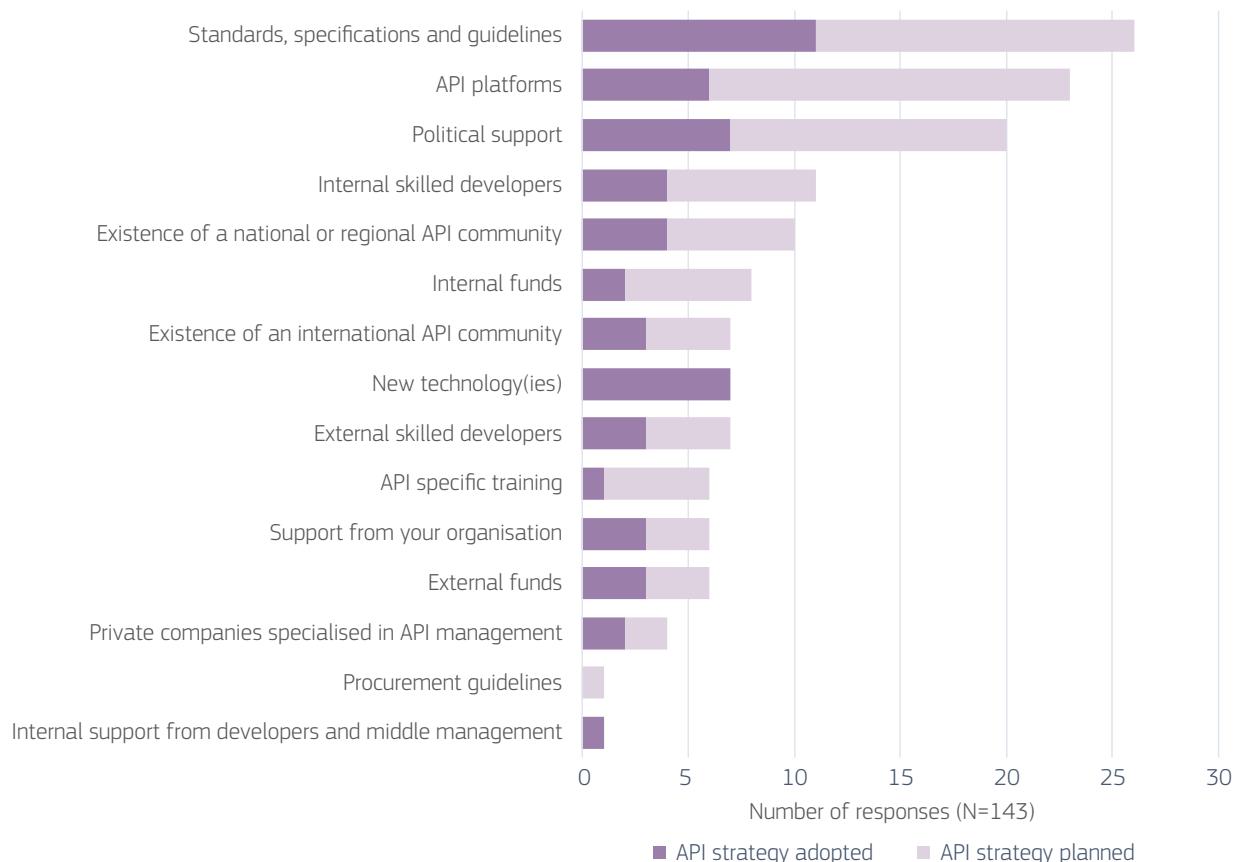


FIGURE 11: Key enablers for API strategies.

Source: JRC, own elaboration, based on the study survey results.

“ Multi-stakeholder and multi-level cooperation, political support and the existence of API development communities emerged as organisational API enablers ”

— Regarding the organisational perspective, both in the survey and in the presentations and discussions during the workshop, **the multistakeholder and multilevel cooperation requirements for successful API solutions emerged as a key enabler**. Along this line, several governance initiatives were introduced, such as (i) dedicated governmental entities to coordinate and orchestrate digital strategy issues at the national level (e.g. the Government Digital Service in the United Kingdom, DINSIC in France, the Malta Information Technology Agency in Malta and the Digital Transformation Team in Italy), (ii) a multiagency cooperation board to steer governance and coordination of e-government services (e.g. the governance and coordination of e-government services (SKATE) in Norway) and (iii) stakeholder networks sharing the same kind of challenges, such as smart city network initiatives (Interreg North Sea region, 2019; OASC, 2019; 6Aika, 2019; Synchronicity, 2019; European Commission, 2018f).

Enablers for API adoption, at a high level, included **political support and potentially legislation** (although these were not necessarily API specific). In more operational terms, capacity building was again highlighted, as were suggestions that organisations should define a business case for their APIs and that success stories from opening up data should be shared. Another enabler identified was the **existence of API development communities as a living ecosystem around the APIs**. In addition, political and organisational support was considered rather relevant as an enabler in actual API systems. The **availability of appropriate qualification profiles, both within and outside organisations, was recognised, and the lack of them was seen as a threat**.

During our workshops, participants requested specific actions to (i) update education curricula to include development skills to fulfil upcoming demand in general and (ii) evaluate the internal needs and definition of roles in public administrations.

- From the budgetary perspective, **the availability of funds (both internal and external) was acknowledged as an enabler, although surprisingly not as one of the most relevant. EU initiatives and funding were also identified to help in API systems**, especially in terms of supporting experience sharing among stakeholders. In addition, one respondent suggested the availability of procurement guidelines as a means to streamline the adoption of API solutions.
- From the technical perspective, the most acknowledged enabler was the **availability of standards, specifications and guidelines**. Standards were also discussed during breakout sessions of the workshop. Some participants requested API common building blocks, specifically with specifications and sample software implementations. Some argued that standards and regulations were slow processes that impeded governments in keeping pace with technological advances and, therefore, with social expectations. **There was consensus that the identification of patterns of when to apply different standards for what purposes was an enabler**. In particular, examples and API generators (e.g. OpenAPI specifications (OAS) or RESTful API Modeling Language (RAML)) were highlighted as useful, as were testbeds, demonstrators and good documentation, which can make it possible for developers, in particular, to try out APIs, alongside tools and open-source code that could help create an ecosystem of APIs. Participants focused on how organisational contexts within standards and guidelines were important for their use. They also noted that many standards and tools are in place to offer ‘something’ as a service on the web (e.g. REST, JavaScript object notation (JSON), Security Assertion Markup Language (SAML), CEF e-Delivery, Future Internet Ware (FIWARE) and OAuth). Lower levels of ICT maturity in the Member States can often lead to adoption of a lower level entry architecture, which may have an impact on innovation (e.g. for APIs in the context of the OOP). In addition, it was suggested that solution reuse is less attractive for managers’ careers, than building large-scale solutions, for which praise can be earned.

Other technical aspects such as the **availability of API platforms and connection with new technologies** (AI and the IoT) were considered in the survey and presented and discussed during the workshops. Finally, the **availability of new technologies** was seen as a key enabler.

“The availability of standards, specifications and guidelines are API implementation enablers”

Drivers

Our survey explored the main drivers for API systems' adoption in government. The participants were requested to select, among a number of drivers, those most important for them, namely those that influenced their strategy, objectives or requirements. Figure 12 depicts both the drivers identified in already functioning API systems and those predicted as part of API strategies under design.

From the results of the survey, **the main drivers appear to be related to organisations' policies and external stakeholder demand**, including the demand both for specific APIs and for specific applications achieved by using APIs.

Legal drivers (EU/national and local) were not declared on already operational API systems in the survey. However, in the discussion of the workshop, it was recognised that **new legislation has encouraged the adoption of APIs, with motivations being to make data more universally available**. Legal drivers were also predicted as drivers in the API strategies under design. Moreover, as

suggestions, respondents indicated an interest in regulatory actions for APIs. Specifically, there were requests for (i) an update to the Public Sector Information Directive (European Union, 2013) ⁽¹⁰⁾, (ii) enforcing a legal act to make the OOP mandatory as a means to mitigate the perceived GDPR legal barrier and (iii) enforcing the Services Directive (2006/123/EC) (European Union, 2006). In addition, the GDPR (European Union, 2016) was indicated as a possible enabler of API adoption, as it requires data minimisation ⁽¹¹⁾ and APIs can provide filtered access to the data.

“API drivers include organisation's policies, external stakeholder demand and new legislation”

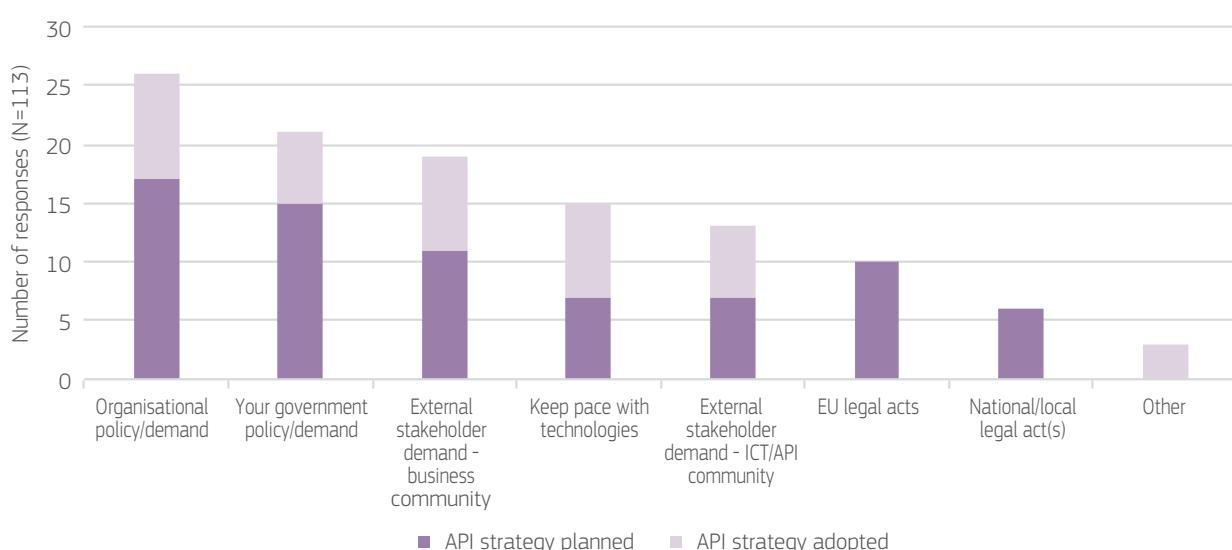


FIGURE 12: Drivers for API strategies.
Source: JRC, own elaboration, based on the study survey results.

Barriers

The survey explored the main barriers to API systems' adoption in government. Figure 13 depicts both the barriers identified in already functioning API systems and those predicted as part of API strategies currently under design. The main barriers declared were classified as social, political, legal, economic, organisational/cultural or technical/operational.

“ APIs are often perceived as primarily beneficial for external parties ”

- The results of the survey pointed to **organisational/cultural barriers as the most relevant barriers impeding API adoption**. In particular, respondents mentioned barriers such as the fact that **APIs are often perceived as primarily beneficial for external parties**. A **change in the political context, strategies and goals** can also affect API investments in the medium and long term. A resistance to change should also not be overlooked, especially when APIs are presented as alternatives to the long-invested legacy systems that some organisations have in place and understand well.

Legacy systems tend to be monolithic and it can be difficult to re-engineer them to API solutions; in addition, current software as a service (SaaS) may not fit the present API implementation requirements. This also applies to outsourcing/procurement models. Along these lines, both survey respondents and workshop participants requested efforts to (i) facilitate the necessary shift towards an SLA-driven mindset (multisector/domain with strong cross-coordination), (ii) build in-house technical capabilities in public administration (knowledge, processes and roles) and (iii) explore novel public-private partnership models.

- The operational/technical barriers identified were mostly related to the **time and costs associated with re-engineering existing systems to APIs** and to the lack of harmonisation of agile solutions, even within organisations. It should be noted that, in the survey, only one case identified technical or operational issues as actual barriers, suggesting that API standards are both available and used. However, they are envisaged as a potential barrier, so it is **likely that improved systems will be needed to better inform, educate and report to the API government stakeholders on the availability and use of web API standards**. This was confirmed by the results of the working groups of our workshop that focused on how organisational contexts within standards and guidelines can be important for their use. Specifically, the proposals included interests in guidelines, common building blocks (e.g. for access and identity management infrastructure), sample software/reference implementations (especially for testing local-level developments) and the patterns identified for the application of standards in different situations/conditions. Other support could take the form of case studies and (incentivised) good practice examples, especially when organisations can join a community and build APIs around a standard.

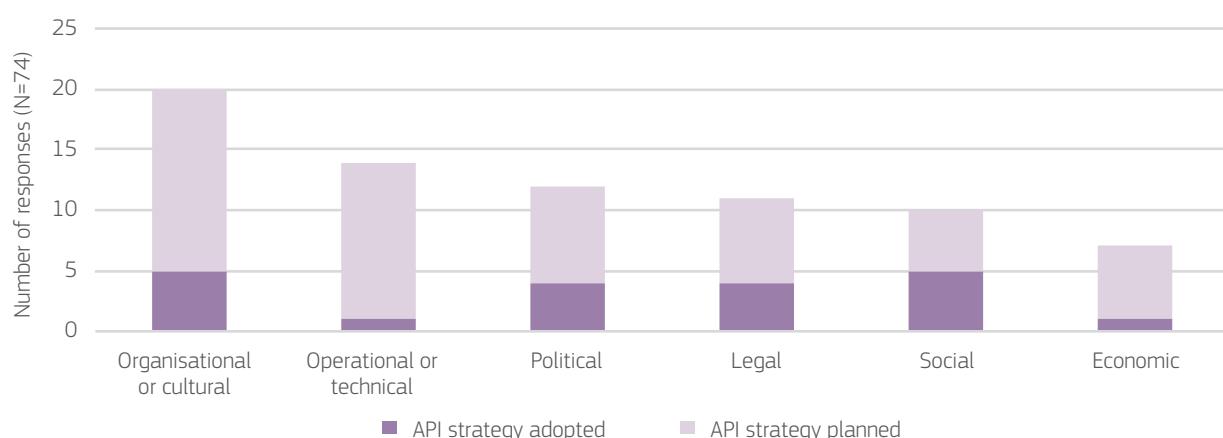


FIGURE 13: API barriers to API strategies.

Source: JRC, own elaboration, based on the study survey results.

- Two political barriers were mentioned by respondents, specifically **decision-makers' lack of understanding of APIs' potential and the lack of direct visible benefits for senior managers**. Participants explicitly mentioned as a political barrier in public organisations the competitive allocation of budget resources), as opposed to collaborative, environment. To tackle this, there could be a **need to break the IT siloes that reflect the administrations' organisations**. From a broader perspective, it could be considered that the benefits of APIs would stand out more, from which we could deduce where the promotion of APIs should be located and measured organisationally (e.g. cross-departmental, cross-agency or cross-project).
- Regarding legal barriers, when implementing APIs, some specific regulations must be taken into consideration. The **GDPR in particular was acknowledged as a barrier that could slow down the API adoption on the basis of its implications on any project involved in sharing data**. In particular, the difficulty in assessing the necessary efforts needed to ensure secure ways of protecting data privacy appropriately was indicated. Respondents and participants at the workshop requested actions to define proper data ownership flows and the definition of patterns addressing particular use cases (e.g. consulted work, city contractors and third-party data).
- **Social barriers are not normally anticipated for the adoption of API solutions under design, although two of the API systems that were already operational and involved in the survey reported social barriers to the major adoption of APIs from a public-sector data provider and, within this context, to cooperation among the stakeholders**. From the API provider perspective, government agencies that manage data and public administrations (with a vision) are key figures. They normally include the presence of a senior leader/champion to help promote the adoption of APIs in their organisation and, potentially, communicate with counterparts in other organisations. From the API consumer perspective, the immediate users of APIs

“ There is a need to better inform, educate and report the government stakeholders on API culture ”

are intermediate actors that build applications on the top of APIs, while citizens were clearly identified as consumers of end-user applications based on government APIs. Therefore, communities of users/developers are key to ensuring the uptake of APIs. Other intermediaries, acting between providers and consumers, may offer solutions for both API sharing and consumption (e.g. providing API digital platforms and marketplaces). Private-sector partners may have a role to play as supporting organisations, and may help to create economic benefits from the opportunities offered by government APIs.

- Economic barriers to API adoption in government environments were also identified. Specifically mentioned were the fact that **APIs are more expensive than plain/bulk data exchange, along with the long-term commitments that API systems require**. The **difficulty in providing a good-quality governmental API ecosystem** was also described as a barrier in economic terms. Specifically, respondents indicated that (i) government APIs may not create real markets for companies and (ii) implementing charging mechanisms may incur major costs in terms of infrastructure for the institution.
In our working group discussions, the participants expressed concerns about the fact that other, more fashionable, technologies (e.g. blockchain) are **competing for resources with the adoption of API solutions** and therefore the size (in the sense of the availability of resources) of government organisations may affect their readiness to innovate through API adoption.

Risks and mitigation measures

Our survey explored risks for API systems' adoption in governments and related mitigation measures. Figure 14 depicts both the risks identified in already functioning API systems and those predicted as part of API strategies under design.

A number of risks were identified, which can be grouped into technical, organisational, legal and economic risks.

— Within the technical (and social) risks, **cybersecurity** is considered as the major threat in both actual and potential API strategies. Like any other additional channel to the 'outside' world of the web, APIs inherently increase the permeability of an organisation's network, which can expose new vulnerabilities for exploitation. Therefore, APIs must be appropriately secure in terms of protection against cyberattacks. A number of organisational solutions exist, such as the adoption of API gateways to reduce the number of web endpoints (and so the number of possible channels exposed to cyberattacks) of an organisation. Solid security solutions exist such as OAuth and certificate-based authentication, which are used in conjunction with a wider cybersecurity strategy and cryptography (see also Santoro et al. (2019) for more information about security standards).

Technical sustainability is also a concern for API adoption, including the risk of **producing APIs**

Cyber-security is considered as the major threat in API strategies

that either will not scale or prove to be unstable in the future, because of technical changes/updates. In fact, even if standards for APIs are available in small pockets, such as the Open Geospatial Consortium (OGC) standards (OGC, 2019a) and the developing International Organization for Standardization (ISO) standard in financial services (ISO, 2018), many organisations are developing APIs based on an agreed internal specification or style guide to promote consistency, rather than what might normally be recognised as a de facto 'standard'. Each API comes with detailed documentation for consumers, which provides clarity on the type of API (RESTful, Extensible Markup Language (XML), GraphQL, gRPC (a remote procedure call (RPC) framework, etc.). There appears to be limited appetite for further standard development in the aftermath of open government models, which was different from the impact that open banking had in the EU, which precipitated the agreement of an API standard in the United Kingdom initially at least (European

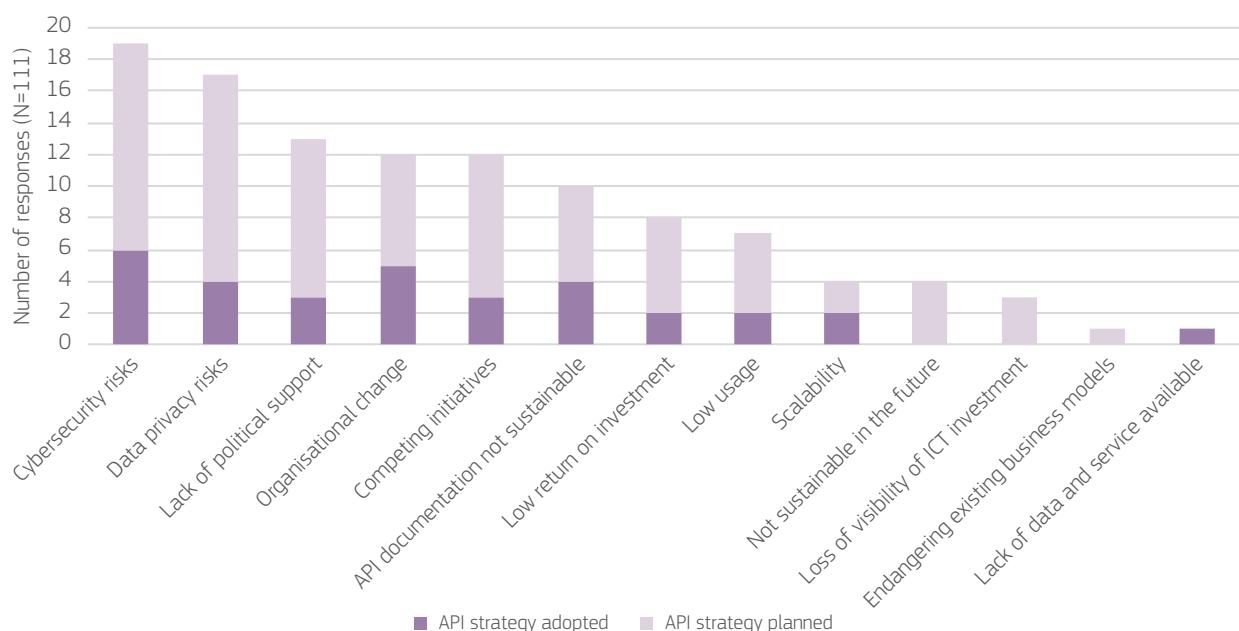


FIGURE 14: Risks for API strategies.

Source: JRC, own elaboration, based on the study survey results.

Payments Council, 2017). A possible mitigation measure is to identify, analyse and propose a set of existing standards that can be used to implement government APIs. To concretely implement this measure, we have recently published a JRC technical report on web API standards (Santoro et al., 2019).

A possible risk was indicated in the difficulty in **maintaining API specifications aligned with current version of APIs**. To mitigate this risk and facilitate the alignment between the documentation and the publication of APIs, many tools that help in semi-automatic documentation generation and alignment exist on the market (AlternativeTo.net, 2019).

Regarding mitigation measures, both respondents of the survey and workshop participants presented measures in place under their API initiatives. These measures included periodic security audits, the introduction of agile work processes for ICT and the allocation of resources for updating and maintaining API specification documentation, plus, of course, the use of widespread standards to guarantee the sustainability and the scalability of their API implementations.

— Related to organisational risks, **organisational change and a lack of political support** seemed to be particularly relevant. In addition, API adoption is likely to bring about organisational/business change and so a communication strategy would be needed. Such change may also be linked to, for example, a procurement strategy to help promote APIs. For instance, externalisation efforts should be rationalised and therefore more agile procurement systems should be put in place. Moreover, implementation decisions are being made by developers, but not necessarily involving inputs from enterprise architects. On the other side, developers have a strong end-user focus, but need to be informed of policy issues that have an impact on their work (e.g. the GDPR (European Union, 2016), which has a relevant impact on API adoption (Rizk, 2018)) while chief information officers need to pay attention to the possible impacts of developers' desire to 'experiment' in this context. As a mitigation measure, the creation of a central 'innovation agency' that can inform IT departments was seen as being beneficial, particularly in terms of communication and coordination.

Competing initiatives (i.e. the adoption of APIs without common guidelines and governance) have also been identified as both actual and potential

risks. To mitigate these risks, development approaches should be considered that are iterative and continuous, and should potentially also be considered for the strategy itself.

- Legal risks include a **breach of the data privacy of people and organisations**. In our survey data, privacy is seen as the most relevant risk, together with cybersecurity aspects, for those API solutions still under design. Protection from possible access and misuse of these data must be considered as a primary goal for an organisation adopting APIs. Moreover, in our discussion groups at our workshops, it was observed that, in relation to standards, **when they may have widespread support, legal requirements may limit the adoption of standards** by organisations needing to follow legal/sectoral requirements. Indeed, the formal change process can be costly and can take time.
- Economic risks include many aspects, such as the **risk of low usage of APIs, the loss of visibility of government activities on the web** (i.e. when APIs are invoked by third parties' applications and so the government' applications are substituted and become obsolete) and **business models becoming endangered by specific agencies or sectors of a public administration delivering their data via traditional channels**. Some mitigation measures have been introduced and, as observed in our research, regarding business models in the public sector, generating income from the provision of data that are publicly owned and are being used for the public good has not led to the charging of users who wish to consume or query this type of data. Examples of charging mechanisms being in place are limited, one being the United Kingdom's Ordnance Survey maps (Ordnance Survey, 2019) and another being the

“ The risk of producing not scalable or flexible APIs could be mitigated by exploring and proposing a set of suitable standards ”

Cable and Pipe Information Portal (KLIP (Belgium) – one of the explored case studies), which charges map

requestors to have a digital map of utility services generated for a specific location.

3.2.3. Conclusions on application programming interface adoption in governments

Besides the investigation into enablers, drivers, challenges and risks of the previous section, from our analysis we have found that the adoption of APIs in government is in quite an early stage, with the oldest API strategy having been implemented only in 2014, and several are planned to be deployed within 2018 (i.e. at the time the survey was proposed and the case studies were analysed). API strategies' stakeholder involvement and stakeholder dynamics vary greatly depending of the nature of the organisations (e.g. the sector, if it is a smart city and the difference between national and international bodies). Often, current API strategies are embedded within or linked to other ICT initiatives.

In addition, looking at the cases studied, **web APIs strongly support the digital transformation of government**. Table 4 summarises our results from the multiple-case study, that is, **when API strategies and solutions are implemented, their uptake is rapid and extensive**. This demonstrates, at least in the cases that we have analysed and that had a well-

defined goal, that, when implemented, APIs are used by a huge number of applications (see, for example, the number of applications developed from the Madrid Mobility Labs). In addition, in the cases analysed, APIs enable a digital connection with a high number of third-party organisations, such as in the case of the X-Road national platform (e-Estonia, 2019).

“ APIs underpin the digital transformation of government: when API strategies and solutions are adopted, their uptake is rapid and massive ”

Case study	API usage
DAWA	<ul style="list-style-type: none"> — 1.5 billion requests in 2017 and approximately 350 000 unique users per week — The number of API requests is limited to 100 requests per second — There is approximately 5 000 IT systems that request data regarding Danish addresses using DAWA — A unique point of access for addresses for everybody
Madrid Mobility Labs	<ul style="list-style-type: none"> — 480 million requests per year — More than 1 500 developers registered in the system — Around 50 apps developed (80 % of users)
X-Road	<ul style="list-style-type: none"> — 500 million requests per year — Over 1 billion transactions — 925 institutions and enterprises connected, including 706 public-sector institutions — 99 % of government services covered — Around 52 000 organisations are indirect users of X-Road services
Amsterdam city data	<ul style="list-style-type: none"> — 350 million requests per year — 8 000 visitors per month and an average of 20 minutes spent using the data interface
KLIP	<ul style="list-style-type: none"> — 120 million requests per year — 10 713 registered map requester initiators, including of 1 502 companies and 1 258 citizens — 200 000 map requests per year; for each request, six or seven utility companies are involved

TABLE 4: API usage in case studies.

Source: JRC, own elaboration, based on Williams (2018).

Our workshops have uncovered many elements related to API adoption in governments, with different levels of governments possibly behaving differently. National-level actors are perhaps more focused on providing access to data, whereas local organisations have more of a service-delivery focus. In addition, many of the examples being shared point to operational/implementation activities related to APIs. This is beneficial in helping the study to explore real examples, but there may currently be a limited view of the strategic elements that would place APIs in digital government thinking. In particular, it seems that the current efforts are focused on making individual organisation's resources available, but little thought is being given to the more strategic elements related to the creation of an ecosystem of APIs, whereby certain processes or applications rely on the reuse of APIs in multistakeholder contexts. To understand if

this conclusion is biased by the fact that technology-managerial roles were very well represented in the workshops (with decision-makers less represented), we have further investigated these aspects in [Section 3.4](#), which is dedicated to the analysis of the literature review of API best practices, recommendations and guidelines, and in the gap analysis that we used to develop the API framework proposed in this report (see [annex 2](#) of Boyd et al. (2020a)).

Survey respondents also provided relevant links to their strategy documentation and technical guidance. All of the documents have been considered in our literature review about government best practices and have also been added to the complete list of API best practices, guidelines and recommendations published in the JRC data catalogue (European Commission, 2020h).

3.3 | Application programming interface technical design and standards

For governments to be able to adopt APIs, they have to become acquainted with the many factors (some of which are specific to APIs or e-government and others are specific to a domain (a sector or industry)) involved in adopting standards and technical specifications: legal and policy initiatives, the design and architectural styles used to build APIs, organisational and technological solutions, and the recommendations, guidelines and best practices from private actors or communities. All these resources make a vast, heterogeneous and sometimes contradictory field of study that is not easy to embrace. However, in spite of the difficult task ahead, tackling these issues with the adoption of standards is necessary to produce sustainable (stable and widely adoptable) API strategies. There are several advantages to encouraging the use of standards, including the following.

— **Standards increase the ease of use of APIs.**

As an example, to enable third-party providers to create applications that could integrate multiple city data without needing to code integrations for each individual European city, Finland's 6Aika and CitySDK projects encouraged the use of common standards for city government APIs (6Aika, 2017a).

— **Standards can support communities of users.**

For example, FIWARE's next-generation service

interface (NGSI) standard makes it possible for a network of IoT developers and government partners to communicate around common building blocks (FIWARE Foundation, 2019).

- **Standards make it easier to create open-source tooling**, which can be shared among the sector to speed up API life cycle development practices. For instance, the OAS has led to the development of new tools such as automatic documentation and interactive sandbox generators, as well as new testing tools (OAI, 2019).
- **Standards remove the burden of upfront decision-making** by allowing government teams to default to industry best practices.

However, standards can also hamper government API adoption, and their drawbacks also need to be acknowledged and considered in any decision-making. Drawbacks include the following.

- Given the innovation that occurs with government APIs and the uniqueness of government API needs and approaches, **there are not always available, or known, standards to draw on**. The immaturity of some parts of the API tooling sector also means that the

discovery of emerging standards is difficult and may result in governments building new approaches because they are unaware a standard is being created. For example, the emerging Open511 standard, predominantly used in Canada but recently achieving version 1.0 status, is intended for transport data, but was rarely mentioned in government documents (OpenNorth, 2020).

- **Governments have often invested significant work in data models and approaches internally and may be resistant to moving to an industry standard.** Governments' existing work that is well accepted may not yet have achieved the planned return on investment, making it difficult to justify moving to a new standard. For example, many governments have created Simple Object Access Protocol (SOAP)-based APIs that meet functional requirements and so they cannot justify a move to REST-based APIs for all use cases.
- **Specifications and standards are continually evolving,** so adopting a standard will require a

product-management approach in which keeping up to date with the changes of the standard becomes a new resource requirement.

- **A standard may be primarily funded or supported by a single organisation,** which may mean that the development of that standard might be steered by that entity's interests rather than the interests of the community at large.

In this study, we have collected, analysed and classified the most relevant documents for supporting governments in their technological API journey, also considering the abovementioned advantages and drawbacks. In this section, we give a summary of our analysis, the complete results of which have been previously published (Santoro et al., 2019). The first part of this section aims to support governments in choosing the correct architectural style. The second part illustrates the use of standards provided by standardisation bodies or, at least, technical specifications written by well-recognised consortia, vendors or users.

3.3.1. Application programming interface design and architectural styles

As mentioned in [Section 1](#), it is important, when dealing with API technological aspects, to clarify the differences between APIs and web services. While the former have already been defined, various definitions exist of the latter. These definitions extend that given by the World Wide Web Consortium (W3C, 2004) by defining a web service as a service that is offered over the web, irrespective of the usage of specific protocols and message formats. While the generic definitions reported above generalise the restrictive and technology-driven definition of the W3C, they do not clarify the difference between a **service interface** and a **programming interface**: the former is provided by a web service, while the latter is a distinct characteristic of an API. In this report, we consider this difference relevant, as it affects the design of APIs, their implementation and their potential use. Web service interfaces, in fact, are designed to offer self-contained functionalities; they are a 'black box to their consumers and have a well-defined interaction contract' (Claus-Torp Jensen, 2014), which makes it difficult, for example, to use them in a flexible and agile way to build mobile applications. On the other hand, even if, technically, APIs are also web services, they are designed to be more flexible, ad hoc and easy-to-use and to be used at a micro level, and can be more easily

combined to develop applications such as those for mobile devices (Claus-Torp Jensen, 2014). Thus, web services and APIs differ at the design level but not at the technological level.

Regarding the **architectural styles**, APIs can be broadly categorised into the following main types: (i) **RPC APIs** and (ii) APIs that adhere to the REST architectural style, or **RESTful APIs** (Santoro et al., 2019).

The first category is characterised by a set of procedures or methods that the client application can invoke and that are executed by the server to fulfil a task, for example a data exchange or a data validation service call. **RPC APIs** essentially operate by replacing in-memory object messaging with cross-network object messaging (RPCs) in object-oriented applications (Feng et al., 2009).

RESTful APIs are based on the REST architectural style introduced by Fielding (2000). The REST architectural style, more oriented to resource management and representation, is a hybrid style derived from several of the network-based architectural styles and combined with additional constraints that define a uniform connector interface. In essence, here

the term ‘constraints’ refers to the set of characteristics that defines the REST architectural style (client–server, stateless interaction, uniform interface, resource identification, self-descriptive messages, manipulation of resources through representations and hypermedia as the engine of application state (HATEOAS)). In addition to resource representations, server responses also provide the operations that can be performed on such resources, e.g. data, as well as the endpoints that provide them.

Both RPC and REST require the same understanding of the data model, format and encoding of messages that are exchanged between the client and the server. In other words, when a message is exchanged, both the client and the server must be able to read it (data format and encoding) and ‘understand’ its content (data model⁽¹²⁾). However, the two architectural styles differ in several aspects, such as scalability and performance. From an interoperability point of view, the main difference between RPC and REST lies in the degree of client–server coupling, with coupling being tighter for RPC, and the REST architectural style allowing looser client–server integration. The degree of coupling has implications on how much a client and a server can evolve independently over long periods but remain interoperable.

Generally, whether REST or RPC is adopted depends on a specific predicted use case. Usually, REST better fits use cases in which the provider aims to share the resources with client applications, allowing them to navigate and modify such resources, or when the service may benefit from the distributed nature of Hypertext Transfer Protocol (HTTP) features (e.g. caching, as explained in Fielding (2000)). On the other hand, RPC is used to share functionalities with client applications that invoke such functionalities to fulfil some task (Maleshkova et al., 2010).

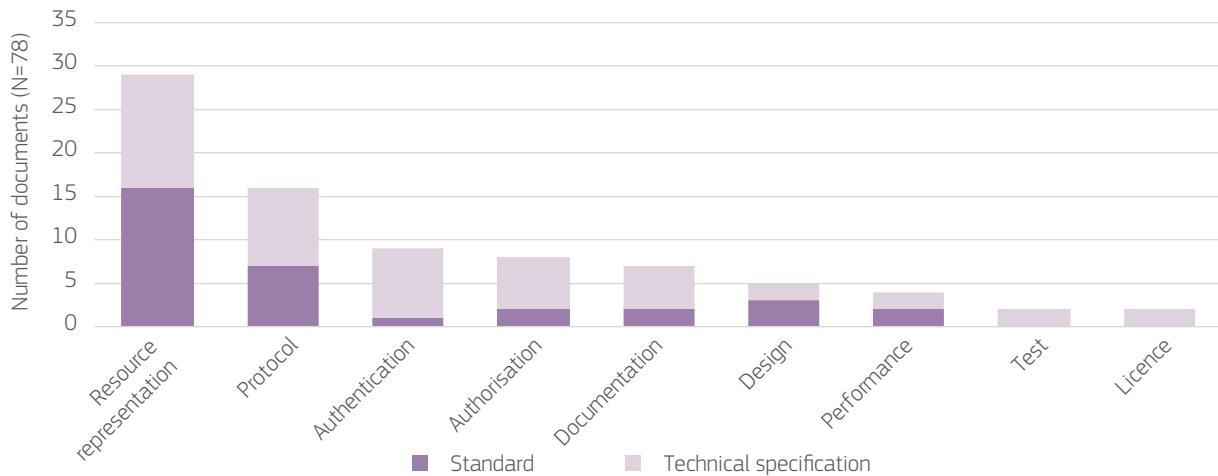
RPC and REST both adhere to the general request-response paradigm, but in recent years, **event-driven architectures** popularity has started to drastically increase as many organisations are realising they must react in real-time to their users, decouple their systems and transform into event-driven organizations. Event-driven architectures are software architecture paradigms promoting the production, detection and consumption of, and reaction to, events (Michelson, 2011). This architectural pattern supports loose coupling among software components and services. The advantage is that an event emitter does not need to know the state of the consumer, who the consumer is or how the event will be processed (if at all). It is a mechanism, for example, of pushing data through a persistent stream.

3.3.2. Web application programming interface standards and technical specifications

For the digital sector, especially in relation to the web, the existence of proper standards and specifications guarantees interoperability among countless digital assets, as defined by a number of standardisation bodies and communities. Standard APIs support reusability and are an enabler of interoperability. Reusability in any form improves quality because it extends operational use, as well as saving money and time. This makes the standardisation of APIs a major contributor to the development of a DSM in the EU. Some EU standards and specifications also exist in the domain-specific interoperability frameworks and should be applied more widely. For example, the INSPIRE Directive sets out interoperability standards for network services and for many thematic areas such as addresses, cadastres and roads of relevance to many public administrations (European Union, 2007a). These existing standards and specifications can and should be used more widely, namely beyond the domain for which they were originally developed.

A total of 78 documents were collected within the study, of which 15 are related to RPC and 21 to the REST architectural style. The rest of the documents can be considered ‘general purpose’ or neutral with respect to the design style. This distribution of technical specifications and standards reflects the fact that both RPC and REST are widely adopted and that the choice of which type to use is likely to be based on the specific use case to be implemented.

Figure 15 depicts the number and the type of technical specifications and standards for each category that we have used to classify the collection of documents. The largest number of technical specifications or standards have been classified as resource representation⁽¹³⁾ and (communication) protocol⁽¹⁴⁾ categories, reflecting the high level of available proposals. The licence category has the smallest number of technical specifications and standards; at the moment, in fact, API-specific licensing is relatively rarely used even if, of course, general work licences, such as the Creative Commons licences, can be used.

**FIGURE 15:** Number of technical specifications and standards per category.

Source: JRC, own elaboration based on Vaccari and Santoro (2019).

Category	Subcategory	Name
Functional specification	Resource representation	<p>Hypermedia specification:</p> <ul style="list-style-type: none"> — Hypertext Markup Language (HTML) (W3C, 2019; WhatWG, 2019) — Hypertext Application Language (HAL) (Kelly, 2011) — JSON for linked data (W3C, 2020) — JSON:API (Katz et al., 2015) — Structured Interface for Representing Entities (SIREN) (Swiber, 2012) <p>Media and link types:</p> <ul style="list-style-type: none"> — Internet Assigned Numbers Authority (IANA) link relation types (IANA, 2020a) — IANA media types (IANA, 2020b) <p>Vocabularies:</p> <ul style="list-style-type: none"> — Hydra core vocabulary (Lanthaler, 2020) — ISA core vocabularies (European Commission, 2020i) — Schema.org (Schema.org community, 2020)
	Communication protocols	<ul style="list-style-type: none"> — GraphQL (Facebook, 2020) — gRPC (Google, 2020b) — SPARQL (W3C, 2013) — WebSocket (Google and Isode Ltd., 2011)
Security	Authentication	<ul style="list-style-type: none"> — API key (Wikipedia, 2020a) — OpenID Connect (OpenID Foundation, 2020) — SAML (OASIS, 2019)
	Authorisation	<ul style="list-style-type: none"> — Extensible Access Control Markup Language (XACML) (OASIS, 2017) — OAuth 2.0 (IETF, 2020)
Usability	Documentation	<ul style="list-style-type: none"> — AsyncAPI (AsyncAPI initiative, 2020) — OpenAPI specification (OAI, 2020)
	Design	<ul style="list-style-type: none"> — EIF (European Commission, 2017a) — FIWARE (FIWARE Foundation, 2019) — OData (OData, 2019)
Test		<ul style="list-style-type: none"> — Postman collections (Postman, 2020) — Swagger (Swagger.io, 2019a)
Performance		<ul style="list-style-type: none"> — Cloud computing (ISO and IEC, 2014a; ISO and IEC, 2014b) — IT, cloud computing and SLA framework (ISO and IEC, 2016a)
Licensing		<ul style="list-style-type: none"> — Choose a licence (Creative Commons, 2019a) — How to choose a licence for your own work (Free Software Foundation, 2018) — JoinUp Licensing Assistant (JLA) (European Commission, 2019h) — Open-source licence tool from GitHub (GitHub, 2019a) — Swedish API licence (Swedish Governmental Agency for Innovation Systems, 2020)

TABLE 5: Shortlist of API standards.

Source: JRC, own elaboration.

With the aim to support API stakeholders in the identification and selection of such web API standards and solutions, Table 5 focuses on the web API standards landscape and is directed mainly at professional practitioners, providers, consumers and technical users working within the API digital universe⁽¹⁵⁾. The documents have been classified in different categories, each of them indicating their use with respect to API adoption. For each category, we give a shortlist of documents based on their utilisation, maintenance and stability. The shortlist will give the reader basic information about a selected

number of technical specifications and standards that support the study and/or that are of particular (real or potential) importance for administrations engaging in the use of APIs.

The shortlist, based on the work of Santoro et al. (2019), of the concepts and standards presented is the result of the gathering and analysis of a more extensive list of documents that is considered an integral part of the report and can be retrieved from the JRC data catalogue (Vaccari and Santoro, 2019).

3.4 | Application programming interface best-practice documents

This section gives an overview of the best practices, guidelines and recommendations we have gathered from the analysis of the currently available literature on API adoption by governments. A detailed description of our research, analysis and results in relation to these documents is available in Boyd et al., (2020a).

In this section, we first clarify the terms used and our methodology. We then provide some statistics on the geographical distribution and on the type of documents. Next, we give some literature review highlights. Finally, we present a shortlist of the documents that could be used as current reference literature by governments.

3.4.1. Definitions and methodology

The challenge for governments in implementing APIs is that, when introduced in an ad hoc manner, they can create additional complexity. Private industry has shown that, to be used effectively, APIs must align with broad business goals, use common rules and standards, and avoid simply

reflecting organisational structures and instead stick to the needs of the end users. In this way, APIs can be used consistently as a common technology across business operations (Vaughan and Boyd, 2018).

LITERATURE REVIEW METHODOLOGY



FIGURE 16: Literature review methodology document selection funnel.
Source: JRC, own elaboration based on (Mark Boyd and Vaccari, 2020).

Governments are now facing a similar learning curve to that experienced in the private sector in the past. The public sector will need to understand what the best available solutions and best practices are for driving the adoption of APIs in a sustainable, fast, efficient and effective way. In our literature review, the documentation is ranked by its robustness of evidence into best practices, guidelines and recommendations, which, respectively, align with the terms 'must', 'should' and 'may' (IETF, 1997).

We have based our collection of literature on a solid methodology and distilled publications from more than 300 online documents, the analysis of a number of case studies, and the workshops and survey organised within the study. We have also engaged many stakeholders both

from the private sector (i.e. through our participation at and co-organisation of three APIdays conferences in 2019) and the public sector, to transfer their knowledge to our research. Moreover, we have used this extensive and systematic best-practice literature review, using both government and private-sector sources, to build a proper evidence-based digital government API EU framework (see [Section 5.1](#)). Over 3 900 links were found and scanned for their relevance to APIs by using a keyword (KW) search, in addition to these documents. Of this combined pool of documents, 968 documents were reviewed and 343 were considered relevant for government API best practices. This included 63 specific government API guidelines and best-practice documents ⁽¹⁶⁾. Figure 16 gives an overall summary of this process.

3.4.2. Literature review statistics

Figure 17 illustrates the geographical distribution of the literature we found. Of the documents selected, 67 covered the European Union area and 91 were classified as 'international', coming from either private industry or international organisations such as the OECD or the

UN. The remainder were from European Member States and other countries. The full table, with a breakdown by country, can be found in the JRC data catalogue (European Commission, 2020h).

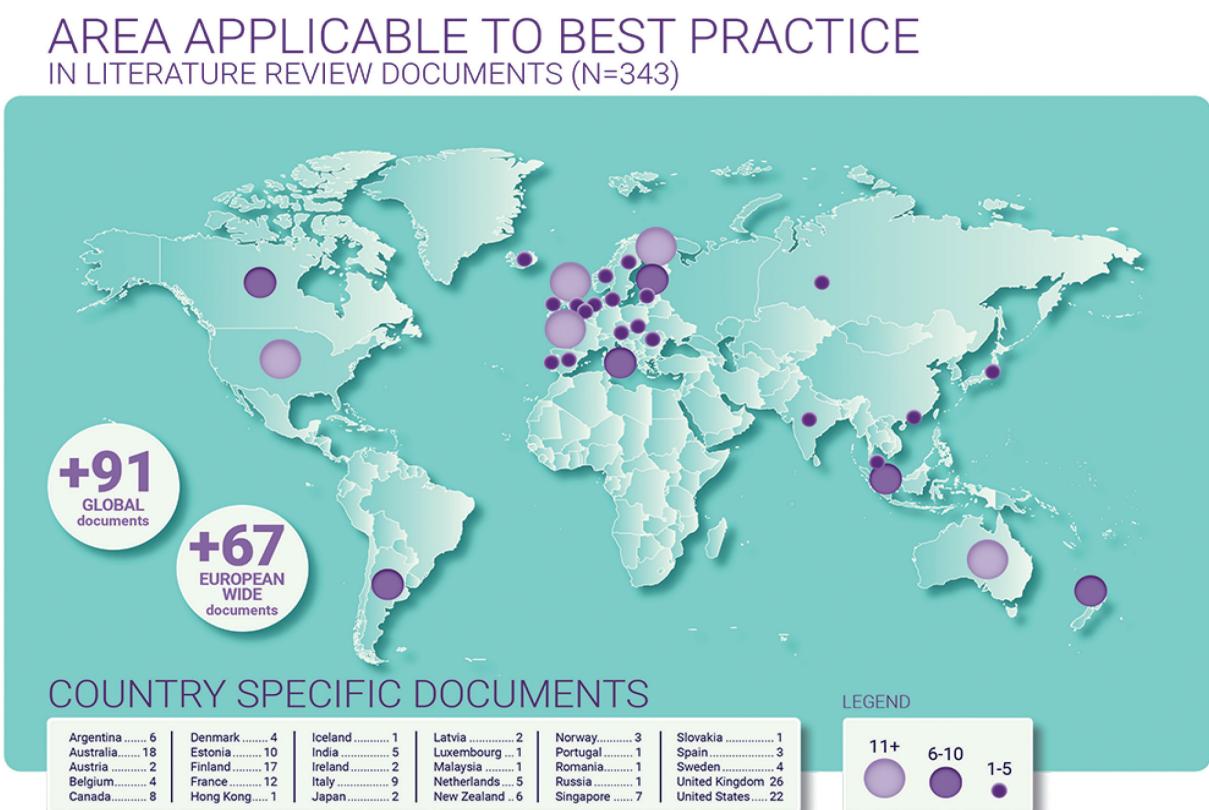


FIGURE 17: Literature review by density of country as document source.
Source: JRC, Brendan McGrath of *Gratix* elaboration based on (Mark Boyd and Vaccari, 2020).

As shown in Figure 18, the majority of literature reviewed (57.7 %) was drawn from public-sector sources, 11.7 % of the sources came from experts and 11.4 % came from private or not-for-profit companies. A relevant proportion of the documents was also authored by experts, consortia and communities, international organisations, academics, journalists and the non-profit sector.

In Figure 19, the main topic covered by each document is categorised, with these then grouped into API strategy (violet), API tactical (light violet) and API operational (grey). In the literature, the strongest consistency and evidence-based agreement was on operational aspects of API implementation, especially operational issues that were technical in nature, such as in designing APIs.

Following the completion of the analysis of all 343 documents, we selected and created a shortlist of documents that could be used by governments as reference literature. The list includes the following documents:

- international and strategic-oriented documents:

- the UN Environment Programme (UNEP) science business policy forum discussion paper: *The case for a digital ecosystem for the environment* (David Jensen and Campbell, 2018);
- the new EIF (European Commission, 2017a);

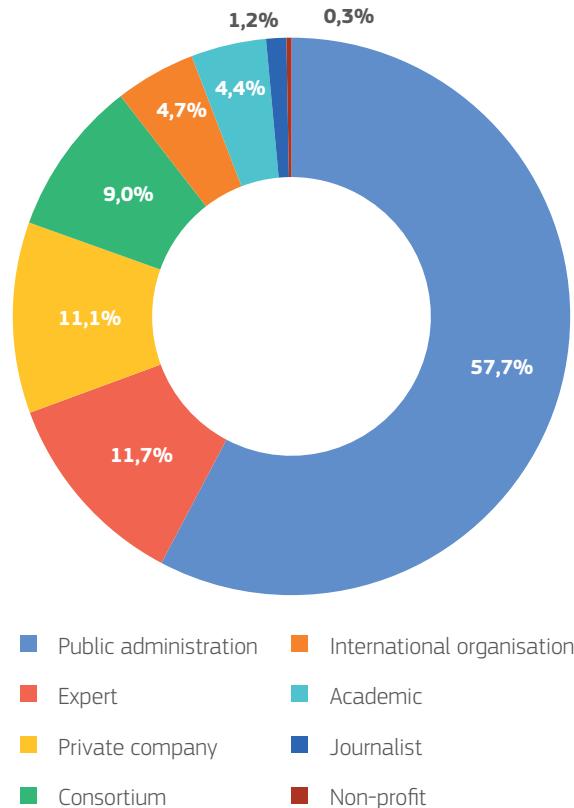


FIGURE 18: Literature review by type of author (N=343).
Source: JRC, own elaboration based on (Mark Boyd and Vaccari, 2020).

- the European Commission's European Union Location Framework (EULF) blueprint (European Commission, 2019i);

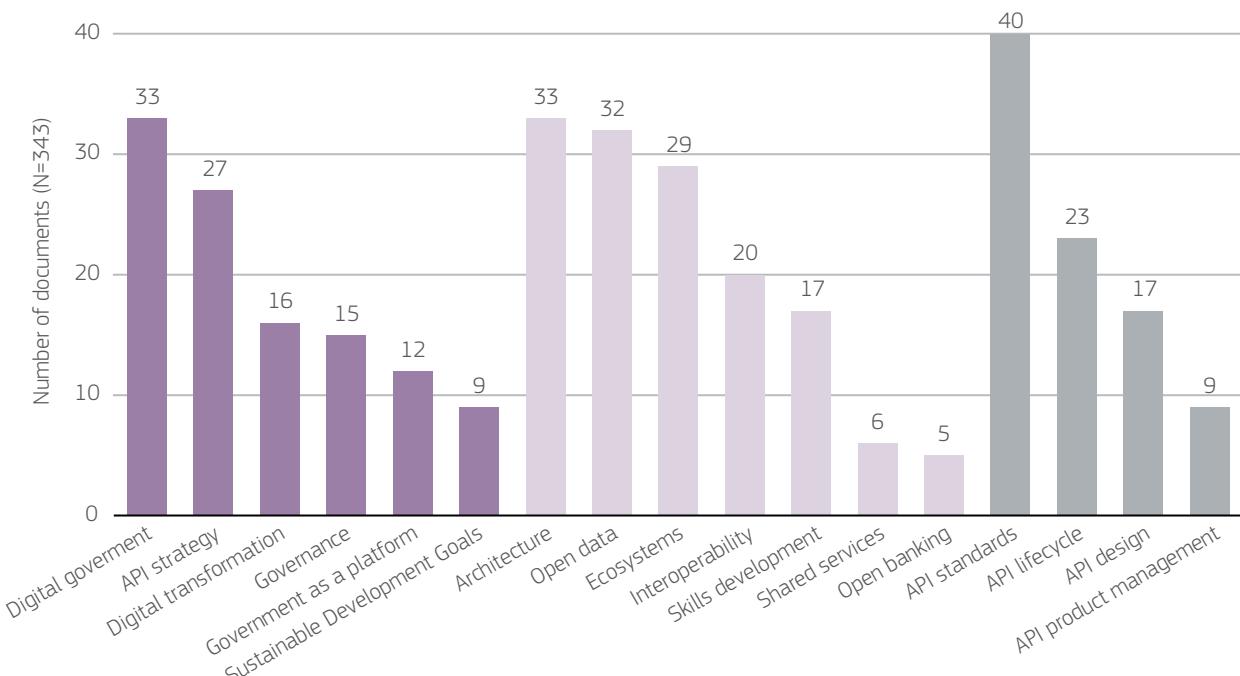


FIGURE 19: Main topics covered in literature review. Grouped by API strategy (violet), API tactical (light violet) and API operational (grey) documents.
Source: JRC, own elaboration based on (Mark Boyd and Vaccari, 2020).

- McKinsey and Company documents on its works with a wide range of large enterprises on reorienting their operations towards an API-first approach (McKinsey, 2019; Iyengar et al., 2018);
- guidelines at the national level (in alphabetical order):
 - Canada: API guidelines (Government of Canada, 2019a);
 - France: the FranceConnect system (presentation) (European Commission, 2018f);
 - Italy: the Italian 2019–2021 3-year plan for IT in the public administration (Italian digital agency (AGID), 2018);
 - New Zealand: API guidelines (Government of New Zealand, 2016);
 - Singapore: Finance-as-a-Service: API playbook (ABS-MAS, 2016);
 - the Netherlands: API strategy for the Netherlands government (Geonovum, 2019);
 - the United Kingdom: helping government use APIs better (European Commission, 2018f) and Making Government as a Platform Real (Loosemore, 2018);
 - Victoria: API guidelines and related information management framework (Victorian Government, 2019a; Victorian Government, 2019b).

3.4.3. Analysis of the literature

Our analysis of the documents identified and gathered in this study includes a summary of the common approaches identified from multiple governments and from private industry that have been designed and deployed for adopting government APIs.

During the literature review analysis, best practices, guidelines and recommendations were collated as ‘snippets’ from documents and grouped into the three levels of government application (strategy, tactical and operational). These snippets were tagged with relevant topic headings such as ‘governance’, ‘metrics’, ‘security’, ‘API design’ and ‘documentation’. Topic headings were later grouped into thematic areas. These thematic areas included ‘governance’, ‘policy alignment’, ‘technical implementation’ and ‘team composition’. They helped identify common areas of work that would need to be undertaken in a cohesive framework approach and they gave rise to the four pillars of the API framework illustrated in [Section 5.1](#).

During this distillation and categorisation process, common government-specific practices became apparent. These common approaches demonstrated best practices and emerging standard approaches to creating, hosting, publishing and managing government APIs.

The following list shows the most common approaches to government APIs observed in the literature. The common approaches were then grouped according to the thematic areas and included in the framework proposals. An indication of how these common approaches align with the specific proposals of [Section 5.1](#) is given. These have

been organised into strategic, tactical and operational levels.

— **Strategic**

- The implications of providing an API on whole-of-government operations need to be considered (proposal 1).
- When delivering digital platforms, platform owners need to measure platforms on both their ability to spur the desired activity and their likelihood of creating arbitrary advantage for a few users (proposal 1).
- Governance structures that are cross-departmental need to be established (proposal 3).
- Government departments should articulate the core principles that apply to the creation and delivery of APIs and digital services in general (proposal 4).

— **Tactical**

- Governments should define and support domain ecosystems to help understand use cases and ensure that consistent standards and data models are available for each ecosystem (proposal 6).
- API design should be ‘harmonised’ within government and across government tiers so that reuse is promoted. This will also help third-party providers to consume an API in a way that then allows them to scale their products and services to multiple jurisdictions (proposal 6).
- API team structures need to be established that include an API team leader (product manager), an architect, an evangelist and developers (proposal 7).
- APIs need to be viewed as products (proposal 8).

— **Operational.**

- Modern web methodologies need to be used in designing and implementing APIs, such as REST (proposal 10).
- APIs should provide appropriate documentation and ensure a high developer experience (proposal 11).
- Before an API goes live (i.e. before it is released for use), provisions should be in place to support the internal development and testing of APIs, handle release management, support the onboarding of application developers, define the service-level objectives and indicators that API consumers can expect from the API, support the usage of the API, encompass API life cycle/change management, cater for incidents/events, and manage security and privacy (proposals 11 and 12).

After this analysis of the literature, we performed a SWOT analysis, which was conducted to review gaps and challenges in the available literature. A gap analysis to identify missing guidance in the current approaches and specifically to identify the differences between private- and public-sector practices was also performed. This is important because, in some cases, governments can learn from private industry adoption, but governments have a different mandate, different roles and different goals from the for-profit private industry. Therefore, best practices from private industry must be considered within this broader context. These three analyses have been used to build the API framework described in [Section 5.1](#).



4

WHY GOVERNMENT SHOULD ADOPT APPLICATION PROGRAMMING INTERFACES

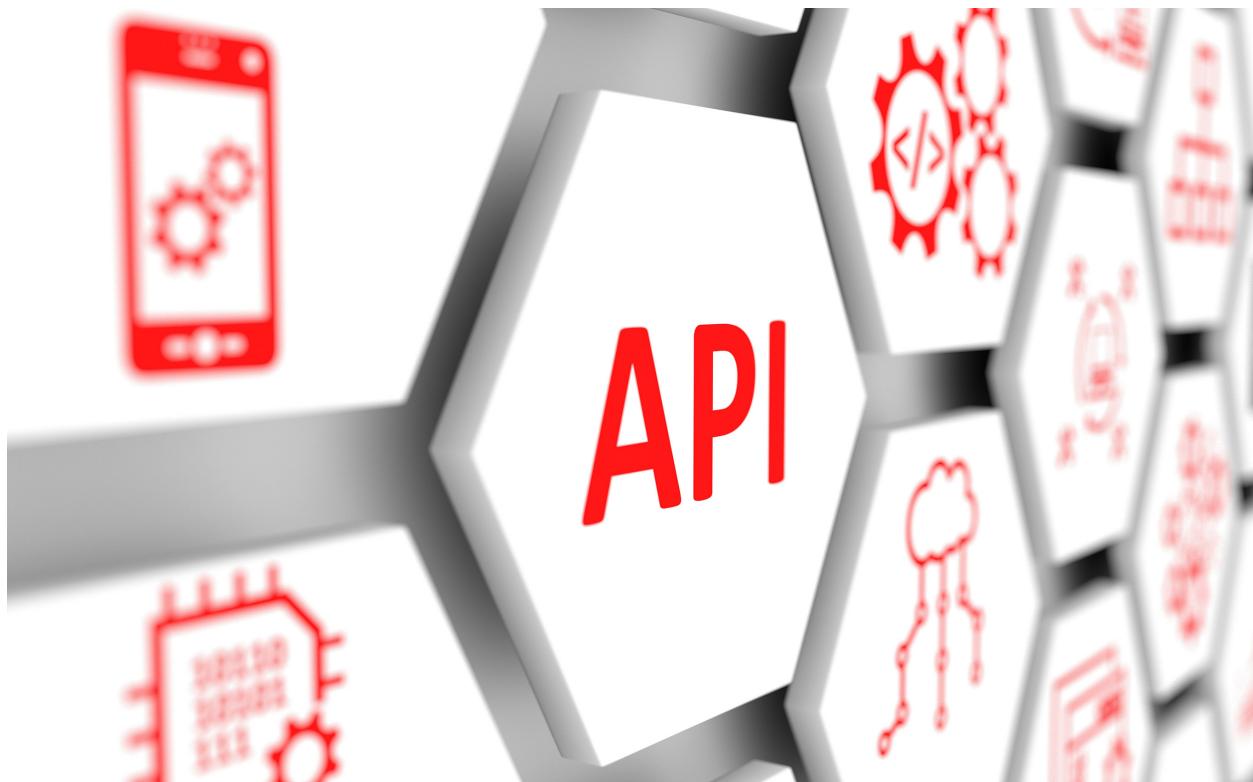
SUMMARY

This section presents the study's findings about the motivations and challenges behind the adoption of APIs in the public sector. There is evidence that the deployment of functional API systems has positive effects on performance in private organisations. However, how does the above reasoning hold in government environments? Governments' objectives fall beyond organisational profit. However, governments' performance and innovation can benefit from the potential that APIs bring to organisations.

Internal and external benefits have been identified for governments when they share their digital assets. Internal benefits include innovation triggering, efficiency gains and improving access to and the use of government (open) data digital assets. External benefits include the enablement of digital ecosystems, the rewiring of interactions with society actors, new economic opportunities and the possibility to orchestrate digital ecosystems. In addition, we have also observed economic benefits when government assumes a regulatory role in APIs.

API adoption also carries both **technical and organisational costs**. Moreover, the adoption of APIs implies **challenges** such as those involved in overcoming the organisational mindset shift required and the potential lack of skills, addressing cybersecurity vulnerabilities and adhering to current regulations on privacy aspects (e.g. as required by the GDPR).

By facilitating access to digital assets such as open data, APIs have an impact on government openness and transparency. In addition, governments can generate trust with citizens via additional mobile or desktop applications built on APIs to create virtuous feedback loops when citizens engage with government.



④ WHY GOVERNMENT SHOULD ADOPT APPLICATION PROGRAMMING INTERFACES

APIs are an essential component of the digital transformation of organisations. In this context, APIs are a technological enabler for improving government operations and processes, and for streamlining data flows to inform policymaking. However, capturing the contribution of APIs in this government transformation is a challenging exercise and it is even more challenging to quantitatively assess the impacts of API adoption. The low number of API strategies adopted by governments, the variability in technical complexity of API-enabled solutions and the breadth of

application domains makes it currently unachievable to reach generalised conclusions. Moreover, both relevant academic literature and data for quantitative analysis are scarce and scattered. Nevertheless, this section presents a qualitative analysis of evidence of motivations and disincentives for the adoption of APIs in the public sector collected from case studies, surveys, expert interviews and desktop research. Specifically, we found qualitative evidence regarding **benefits and opportunities, costs and challenges** and **social implications**.

4.1 | Benefits and opportunities

There is evidence that the deployment of functional API systems has positive effects on performance in private organisations (Benzell et al., 2017). APIs provide organisations with high digital flexibility owing to their capability for reuse and their modularity. In this sense, the design of digital solutions can benefit from the inclusion of external digital assets. Potential benefits result from eliminating the maintenance cost of external digital assets or from fostering innovation with a relatively low

investment. In addition, APIs can provide valuable insights into the usage and usability of digital assets. Organisations can use this information to value their assets and to facilitate priority setting for their digital infrastructures. All in all, APIs can be used to streamline the innovation of digital solutions and ultimately boost profit. Moreover, the scaling of API solutions entails marginal costs close to zero. This implies that the reach potential of digital assets through APIs is virtually unlimited. All these characteristics

have intrinsic economic implications, such as the potential achievement of economies of scale and economies of scope, and ultimately the fostering of sectoral innovation.

However, how does the above reasoning hold in government environments? Governments' objectives fall beyond organisational profit. However, governments' performance can benefit from the innovative potential that APIs bring to organisations. The ultimate goals of government fall outside the organisation: optimising societal well-being and ensuring stability. To realise these goals, governments utilise means from their legislative

and executive branches, in particular **policy design** and the **execution of public administration and public service provision**.

This section analyses the benefits of sharing government digital assets through APIs. Internal benefits include innovation triggering, efficiency gains and improving access to and the use of government (open) data digital assets. External benefits include the enablement of digital ecosystems, the rewiring of interactions with society actors, economic opportunities and the possibility to orchestrate digital ecosystems.

4.1.1. Fostering innovation in the public sector

Evidence of the innovative potential of APIs includes their power as **change inducers**. For instance, the

OSF integrates API open data from each government authority within the Netherlands – made available by the

Box 4. EU example: Estonia's X-Road platform

'X-Road is the backbone of e-Estonia. Invisible yet crucial, it allows the nation's various public and private sector e-Service databases to link up and function in harmony' (e-Estonia Briefing Centre, 2019).

X-Road is a government API framework developed by the Estonian government and licensed under the Massachusetts Institute of Technology (MIT) licence. It is also used as a backbone of the Finnish national data exchange layer. Originally built for SOAP/XML web services, it now extends to REST APIs. Rather than requiring governments to develop API management directly, X-Road provides an API management layer, including an API gateway, which is open sourced and available to governments worldwide (Finnerty, 2018).

The X-Road solution includes a security server to provide identity and access management for government API access. It also provides central monitoring of API traffic. In addition to the management of APIs, it also provides an aggregation layer in front of multiple databases. This facilitates the creation and delivery of data-access APIs.

As each government service/agency has its own database, they all use X-Road to securely communicate and share 'private and sensitive' data to protect the OOP of sharing data with government. The service also incorporates many other sectors, with over 900 organisations and enterprises including those in the banking, health and utility sectors. While they may use the platform to perform functions such as identity verification, powerful use cases such as automated extraction of funds from bank accounts for those failing to keep up to date with taxes are possible. All that being said, X-Road itself is a 'very low level engineered application' (Williams, 2018).

Following certification, an organisation deploys an X-Road gateway so that it can hold secure private communications via APIs with other certified organisations that are legally able to share data with it. As a collective toolset, the e-Estonia services provide the Government of Estonia and its partners, including Finland, with a platform on which to innovate and use digital transformation to deliver new services across the globe.

It should be noted that, currently, Estonia is also working on a next-generation government platform technical architecture that considers 'proactive services', intelligent virtual assistant, microservices, event-driven messaging environments and 'chaos engineering' to build messages 'rooms' called 'X-Rooms' (Vaher, 2020).

“ APIs induce change in organisations ”

Dutch Centraal Bureau voor de Statistiek (CBS). The OSF application offers a real-time visualisation of governments' spending. When the OSF started, there were limited data available via APIs. The OSF advocated the use of APIs for publishing these data. Once a sufficient number of individual cities made their data available to the OSF, it became the norm to publish these data via APIs.

APIs also **facilitate the adaptive evolution of legacy systems** towards digital government. For instance, the API infrastructure in Estonia (i.e. Estonia's X-Road platform (Nordic Institute for Interoperability Solutions, 2019)) is used to overcome the restrictions of traditional integration solutions. Currently, Estonian citizens provide 'private and sensitive' data to administrations only once (e.g. marital status). These data are stored and maintained in legacy systems. An API layer was built on top to allow the exchange of information, complying with privacy and security requirement constraints (see also Box 4).

Similarly, the Italian Digital Transformation Team helps many Italian public-sector organisations to produce their own API solutions, supporting digital transformation programmes, where APIs are seen as enablers towards greater adoption of digital government services. The work relates to a legal base in 2017, a national 3-year plan for digital transformation (Williams, 2018). The plan identifies APIs as the key technology to deliver on the government's vision of a whole-of-government shared platform that

“ APIs facilitate the adaptive evolution of legacy systems towards digital government ”

evolves the previous legacy platform. The new platform provides an ecosystem model with private industry actors, non-profits, research institutions and citizens leveraging APIs to create new values.

Moreover, we found cases on which operational API systems are also used to **design, test and try new public services**. For example, the art and technology (eTOPIA) project in Zaragoza (Spain), which combines a physical space in the city (MillaDigital) with the innovative power of an SME incubator, feeds from data provided by the government through APIs. The ambition is to support the design of novel public service solutions, to facilitate decision-making processes (e.g. urban planning regeneration), to test smart city solutions in controlled environments (e.g. mobility as a service) and to investigate new models of 'public spaces' facilitated by digital transformation.

“ APIfication can improve internal government processes and public services ”

4.1.2. Efficiency gains

From the cases we have analysed, there is evidence of efficiency gains related to the **reduction of costs** through API adoption in government. For example, the interviewee of the case of X-Road (Estonia) estimated that if 8 % of the requests are submitted by human users, and assuming that every request saves 15 minutes, the total time saving corresponds to 800 working years every week. In the case of KLIP (Belgium), the API-based solution cost reduction was estimated to be 80 % when becoming fully digital. The Brønnøysund Register Centre, the Norwegian government agency responsible for the management of

numerous public registers (e.g. marriages, companies, political parties, etc.), declared a reduction of costs related to the adoption of APIs of EUR 1.7 million per year.

In addition, APIs set incentives to **improve the quality of** and **reveal deficiencies in digital assets**. The quality of information has many dimensions, including intrinsic characteristics of quality such as completeness, being free of error and consistent representation, but also some additional requirements such as accessibility, an appropriate amount of information and timeliness (Kahn

“ Making open data more accessible has an impact on the transparency, accountability and trust of governments ”

et al., 2002). An example is the case of API-AGRO and the Ministry of Agriculture in France illustrated in section 4.1.5. In this case, all stakeholders participated in the design of the service delivery of agriculture data owned by the government. Specifically, APIs were used to define the interactions among partners to streamline the provision of agriculture data (digital asset); as a result, the quality of the data asset was improved to better fit the needs of the whole digital chain. Regarding the latter aspect, ‘user-centrivity’ plays an important role as ‘government agencies that succeed all place the user at the centre and design services around their needs’ (Siné et al., 2015). A recent analysis of the Lisbon Council recognises that ‘co-creation techniques are being applied across a wide variety of areas’ including ‘developing new services’ (Arundel et al., 2020).

APIs also **improve the performance of both internal government processes and public services**. ‘APIfication’ decouples digital processes into modules. These modules can easily be recombined. Changes in one module should not affect other modules. Together, all of these factors streamline the re-engineering cycles of government processes and services. For instance,

Amsterdam city data (the Netherlands) calculated a 1-to 2-hour per day saving for each civil servant using the API-enabled application designed to use and search city-managed data. This information system connects more than 50 departments, and around 2 000 civil servants use the final application that relies on internal APIs. It was calculated that the use of APIs saves 1–2 hours per day for each user that needs and searches for data. In addition, we can gain an indication of the improvement of government public services through API by cross-fertilising with external digital resources. For instance, the emergency response of Regione Lombardia has benefited from APIs of other regional departments offering relevant information for their service, such as hospital bed numbers and traffic events. As a result, the region declared a significant reduction in the service’s response times.

APIs are also one of the ways in which an EU data provider can improve its control over access to its data. APIs let data providers have more control over the amount of shared data (with respect, for example, to bulk downloads, often used in data catalogues). Besides this, APIs could also be relevant from a policy point of view, as the use of APIs authorises sharing the right data and services with final users, also improving, in some cases, the privacy and security of the original data.

Another opportunity identified was the **enhanced reporting flows in government processes**: in Slovakia, for example, taxes collected from home-based tourist accommodations can be reconciled with tax income thanks to APIs and can potentially identify potential under-reporting and allow more accurate tax collection (Sidor et al., 2019).

4.1.3. Improving access to (open) data

When datasets are openly available, APIs improve the accessibility and usability of these data. Usually, a government agency publishes an API for its dataset to open up new and innovative ways of accessing the data. A developer might create a mobile or web app to display the data intuitively, allow simple queries or automatically generate charts. In the EU, the most relevant example of exposing government datasets is the EDP (European Commission, 2019j). The portal also offers the possibility of accessing its metadata via APIs (both REST and SPARQL). These APIs give access to the documentation (metadata) of the published datasets and

so, in an indirect way, give to access datasets through APIs (see also Box 5).

APIs help to streamline internal processes by easing data exchange among internal and external actors. Our case studies revealed the relatively contained costs and low development efforts involved in making data assets available through APIs (see Table 6).

APIs also increase internal and external data-sharing processes: internal APIs are used to better organise the interface between internal and external data-sharing

Box 5. The EDP

The EDP provides access to 79 different catalogues, most with tens of thousands of open datasets provided by Member State governments. The same site also provides access to over 300 use cases (services or applications) that have been developed using the open datasets available. Some of these applications have been created using APIs to query the EDP.

Access to the portal is provided by a machine-readable API that enables its users to search, create, modify and delete metadata on the portal (European Commission, 2016i). APIs of the portal APIs are available via both the Comprehensive Knowledge Archive Network and SPARQL endpoints (European Commission, 2019k).

The EDP also uses APIs to automatically gather and update its information from the data catalogues from a number of public-sector organisations of each European Union Member State.

processes and internal and external actors. APIs are helping to streamline internal processes, a key aspect of digital government, and to increase the efficiency of digital service delivery to external actors. In some of our case studies, APIs are used to enable the information held in one system or department to be readily and securely available to another without significant and expensive development effort.

Making open data more accessible also has an impact on the transparency, accountability and trust of governments. For example, in the case of transparency, a keystone and driver of e-government, APIs could be seen to offer a clearer view on data and how it can be accessed. If details about such an API were to be made publicly available, this would offer a greater degree of transparency about the information an organisation

holds and how it is allowing others to interact with it, such as in the case of the OSF in the Netherlands (see also Box 6). If the API were to be further documented in terms of the government processes it is used in, then this would offer even more transparency in terms of the **decision-making** in government. To achieve such aims, there is more needed than simply implementing the API; decisions in other contexts are needed to make the API function in a way that would achieve the transparency objective.

The transparency benefits of open data are clear; however, it is difficult to find quantitative evidence of these benefits in socioeconomic terms. While open data are acknowledged as an essential component in open government model, the provision of open data through APIs should be justified in terms of data-asset value. The value of the dataset can be defined in such terms as usability (demand) or

Box 6. The OSF, the Netherlands

The Dutch CBS produces government society-oriented statistics. The CBS API enables statistical visualisation through an online application, as well as exploration and product development of datasets via an API. The API provides access to more than 4 500 datasets in 2020 and keeps growing. The OSF is a Dutch non-governmental organisation based in Amsterdam with the goal to promote governments' digital transparency. To do this, the OSF integrates APIs from each

government authority within the Netherlands, made available by the CBS, to create a real-time visualisation of governments' spending. This is updated regularly, with the goal to provide as short a time lag as possible on government spending transparency. When the OSF started, there were limited data available via API, despite there being a standardised dataset that could be used to create an API. Once a sufficient number of individual cities began making their data available to the OSF, it became the norm to publish open data via APIs. Moreover, APIs were also used as common practice to reduce the need to establish specific agreements to share government data.

transparency relevance. In this sense, if the value of the data asset is not enough, the cost and risks derived from the development, operations and maintenance of the API should not be assumed.

To date, open data APIs have been more easily proven to generate value in key sectors. Static datasets such as museum, venue cultural asset and tourism data (such as on local landmarks), as well as demographic and geospatial data, have been able to generate new value through the creation of new data and services. Real-time data in transport and weather also have proven economic value, which is discussed in greater

detail below. There are some current efforts, such as the French government's Emploi Store model, which seeks to open employment, labour force and skills data as APIs, in order to spur new economic value. A barrier identified is the lack of frameworks, which would have ensured consistency across datasets (format, data model, consistency, availability, accessibility, etc.). Therefore, the actual accessibility and usability of datasets is often low. Efforts from harmonisation initiatives such as Open and Agile Smart Cities (OASC), Synchronicity and 6Aika are currently focused on creating API standards and data models, so that businesses building digital solutions for cities can scale their products to a larger market base.

4.1.4. Enablement of digital ecosystem

There is plenty of **evidence of APIs' digital ecosystem-enabling power**. For instance, at the city level, Zaragoza's digital ecosystem stems from an open data initiative channelled through APIs. Both external and internal stakeholders plug into this API system using government digital assets for designing, testing and socially experimenting with the impacts of innovative public service provision. Specifically, this API-enabled ecosystem engages actors such as civil servants, academia, industry and Zaragoza's government. Another example is Transport for London (TfL), which provides figures of its technical ecosystem: 200 data elements engage some 12 000 developers that produce around 600 applications that are ultimately used by the 40 % of Londoners. Regione Lombardia with its E015 portal is also an example of the organisational approach in the use of APIs to enable digital ecosystem (Regione Lombardia, 2020a).

We have also found evidence of how **APIs contribute to the rewiring of interactions among society actors**. For instance, an example of a government–citizens–government (G2C2G) interaction, the Norwegian Brønnøysund Register Centre, was developed as a result of demand from the private sector to digitally interact with the government's registry services. The Port Authority of Rotterdam sought to modernise and digitise port operations

‘ APIs contribute to the rewiring of interactions among society actors ’

through the use of APIs to improve container management, optimise logistics and minimise environmental impacts (Port of Rotterdam, 2020). However, when commencing the modernisation, there was significant confusion among private company stakeholders, which were reluctant to share shipping data such as container contents, as they wanted to preserve their commercial competitive interests. By facilitating a network in which industry stakeholders could work together, the port authority was able to identify specific data fields that could be opened up from private company data to help in the development of new collaborative business models such as sharing logistics and managing import and export through sharing container services (thereby also reducing environmental burdens of shipping half-empty containers). In this example, a government's port authority did not directly create APIs to stimulate added value to economic activity, but instead assumed a networking facilitator role to drive new economic opportunity.

4.1.5. Economic opportunities

We have found evidence of economic opportunities generated by government API provision. For instance, we observed **entrepreneurship stimulation** (e.g. TfL declared the creation of 600 applications by SMEs (see

Box 7) and Empresa Madrileña de Transporte (EMT) reported the more than 50 registered applications had been developed by SMEs (see Figure 21)).

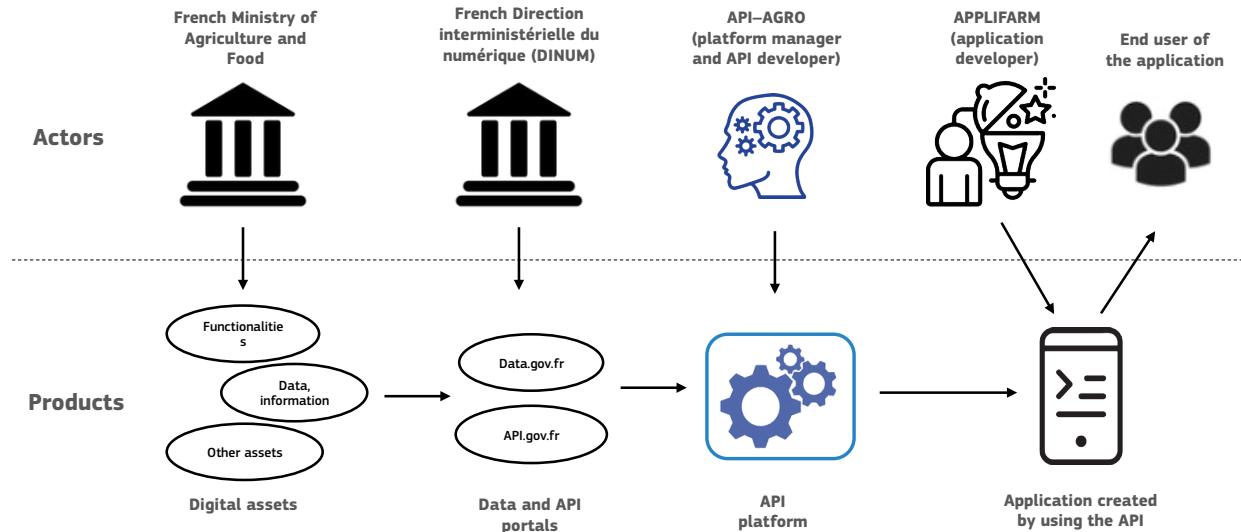


Figure 20: API-enabled data ecosystem in agriculture: a French case at the national level.
Source: JRC, own elaboration.

APIs make **profit generation possible by external partner stakeholders** (e.g. in the case of DAWA (Denmark), the economic benefit of ensuring correct address data through APIs for business, citizens and government itself was estimated to be EUR 33.5 million per year). In addition, the Brønnøysund Register is thought to create major rationalisation benefits for Norwegian consumers, public agencies and the financial industry. It is estimated that the application will bring a financial gain of EUR 1.3 billion over a 10-year period (The Brønnøysund Register Centre, 2020). In relation to this, **the availability of open data and shared services via APIs stimulates new economic development in digital ecosystems**. Third parties may build on government APIs to create new products. These new products generate revenue in their own right but, more importantly, they generate further economic opportunities for other participants in the digital ecosystem. We have selected and analysed some examples in specific domains in detail.

— **Agriculture: specific domain platforms, built by third parties that exchange government data via APIs, have started growing on the web.** This is the case, for example, for API-AGRO, a two-sided online marketplace that brings together data suppliers and data users, in the agricultural domain, via APIs (Siné et al., 2015). API-AGRO provides APIs that can be used by a number of end users to develop applications for final users, such as in the case of APPLIFARM (API-AGRO, 2019). The goal of this application, which displays API-AGRO

datasets, is to increase the data exchanges made available to all stakeholders in the farm industries in a secure manner. The roles of actors in this case are illustrated in Figure 20.

The case study builds on the presentations of and interactions between those invited to the event, namely experts from public-sector agencies that provide data assets and actors outside the public sector that take the data assets and provide APIs via a specific online platform. The invitees delivered presentations during a workshop activity co-organised at an industry event, namely the September 2019 Barcelona APIdays conference. The experts were an enterprise architect from the French Interministerial Directorate for Digitisation (Direction interministérielle du numérique – DINUM), a representative of the French Ministry of Agriculture and Food and a product manager from the API-AGRO data marketplace platform. The roles of these institutions are outlined below, highlighting their interactions.

At the national level, DINUM provides data through its open data portal (data.gouv.fr) and through APIs via the api.gouv.fr portal. Together, these two projects are the main channels of dissemination of public-sector data assets in the French public sector. The open data portal aggregates open data from all of the central administration entities, operating as a platform that matches users with data providers. Each entry in this directory is accompanied by complementary assets such as documentation and a showcase of potential reuse by third parties. The number of visits to this portal has grown exponentially in recent years.

In the data.gouv.fr portal, the Ministry of Agriculture and Food and its agencies contribute and maintain around 400 open datasets. The ministry holds significant data assets, which are derived from the administrative footprint of farm and related businesses that are active in the primary sector in the country. Various policy actions – such as the administration of the Common Agricultural Policy, relief actions to farmers in the case of extreme weather events and regulatory oversight of food safety inspections and agricultural produce – are gathering large data assets at the level of the ministry and its agencies. Indeed, the ministry has more data on individual farmers and farm businesses than can be made public under current legal constraints.

API-AGRO is an online data exchange platform, namely a two-sided market that brings together data suppliers and data users. In terms of the economics of platforms, it is both a transaction and an innovation platform, enabling data exchange in a digital marketplace. The origins of API-AGRO can be traced to a 2-year project partly financed by the Ministry of Agriculture and Food in 2014 with the participation of many diverse actors. The participants in the early project saw a business opportunity, namely to build a platform for data exchange among different stakeholders, namely an ecosystem of actors with different roles and therefore with different data generation processes and different data use requirements. In 2019, the platform had become a consortium of private and public organisations, including the Technical Institute for Applied Research and the Chambers of Agriculture, which are development companies acting in the rural areas, as well as other private companies and individual developers.

The API-AGRO platform publishes various data assets drawn from multiple data sources and for multiple purposes. It attracts data providers who collect primary data originating from farm businesses, agricultural plantations and plot parcels undertaken by IoT and related sensors, as well as from software solutions under an individual agreement of reuse including, most importantly, those relating to informed consent clauses under the GDPR. At the same time, the platform gathers open data from administrative files concerning farmers and integrates in its platform open data from the ministry's APIs posted in the api.gouv.fr portal. Users of these data are accredited participants of the marketplace under individual contracts, which enable the platform to essentially customise its revenue model according to traffic volume, in addition to ensuring trust among platform participants.

The data exchange platform offers customised contracts that include terms relating to the volume and the flow of data offered, which is measured in terms of the number of datasets, the volume in exabytes, the number of API calls, etc. It offers digital amenities such as the possibility to monetise data or the possibility to integrate a third-party provider and thereby form a delegated service in the platform. The revenue model is based on licensing fees that are built based on these contractual agreements, with different tiers offering different terms and advantages suitable for different organisation sizes and origins. Given that the business model includes accreditation akin to a 'know your client' service, it builds de facto trust among participants in the data exchange platform.

The API-AGRO platform integrates all these heterogeneous sources into one single marketplace, through which multiple user categories, such as farmers, technicians and individual consumers, can obtain access, as can B2B software developers and other solution providers. In doing so, API-AGRO operates essentially as a multisided marketplace between data providers and data users that are active in the agricultural sector, giving access to data and agricultural decision support systems.

In 2019, API-AGRO and APPLIFARM settled on an agreement, enabling agricultural stakeholders to benefit from their consent management and data exchange technology for farms (Xavier, 2019). APPLIFARM is a data-sharing and valuation platform for upstream agriculture, whose goal is to make data accessible so breeder performance and animal production can be enhanced within the sector. Created in 2017 by eight livestock farming companies and initiated by a collaborative approach launched by Neovia and Evolution, APPLIFARM grants access to a catalogue of 1 000 different nominative datasets (farmer or animal) originating from 30 000 farms.

API-AGRO helps APPLIFARM display the data drawn from farms on its platform. The goal here is to encourage the secure exchange of data made available to stakeholders within the livestock farming sector. API-AGRO also offers its data exchange services to APPLIFARM's customers and benefits from APPLIFARM's expertise as the first technological service provider to join its network of top partners.

- **Public transport and traffic management.** The availability of open data from governments on public transport and transport infrastructure has generated substantial ecosystem growth across a range of transport and tourism related subsectors.

Open data made available via APIs that document infrastructure such as the location of public transport hubs (bus stops, train stations, etc.) are used to populate mapping, GPS and travel applications. The availability of these data, coupled with government API-enabled data on demographics and private industry data on aggregate spending patterns, is influencing the design and placement of new industries through the availability of more granular market research data. Examples of this include services established at bike and railway station hubs and food security. Data gathered from these services facilitates tourism-based travel, making it easier for travellers who are unfamiliar with a city to move around and spend. The availability of these data has spurred the development of new applications and enhanced ecosystem value chains, which have moved from information-richness to wayfinding to mobile transport payments infrastructure. Along this value chain, new economic activity is expected to arise from the ability to purchase venue and event tickets to further stimulate local economies.

An example from our case study work is the creation of a developer community in Madrid (Spain) around EMT Mobility Labs, which had more than 1 500 registered members who had created over 50 mobile apps (see also Figure 21). This example shows that APIs lead

to new entrepreneurial possibilities and, in terms of the private sector, it suggests that APIs have been harnessed ‘... for a more transformative and disruptive end, giving rise to completely different business models’ (Williams, 2018).

Data made available by TfL have been used to power an independent business, namely the TransportAPI platform (Mark Boyd, 2014). TfL attested to the creation of 600 applications by SMEs (see also Box 7). Mobility apps, built on government geospatial and transport data made available via APIs, have been soaring, with the appearance of more real-time train, bus and underground data, and the emergence of sharing services (cars, bikes, scooters, etc.).

The marketplace of the French national railway company (Société nationale des chemins de fer français – SNCF) APIs includes 30 apps. Captain Train, one of the biggest apps using SNCF APIs (O’Neil, 2013), was founded in France in 2009 and was bought for EUR 200 million by the UK company Trainline in 2016. It had no proper mobility data, mainly offered a good user experience in terms of selling train tickets and soon expanded to distributing tickets from 183 rail and bus carriers in 45 countries, allowing a user to book a trip across different operators. Today, Trainline sells tickets for 172 000 daily trips (Lunden and Dillet, 2016).

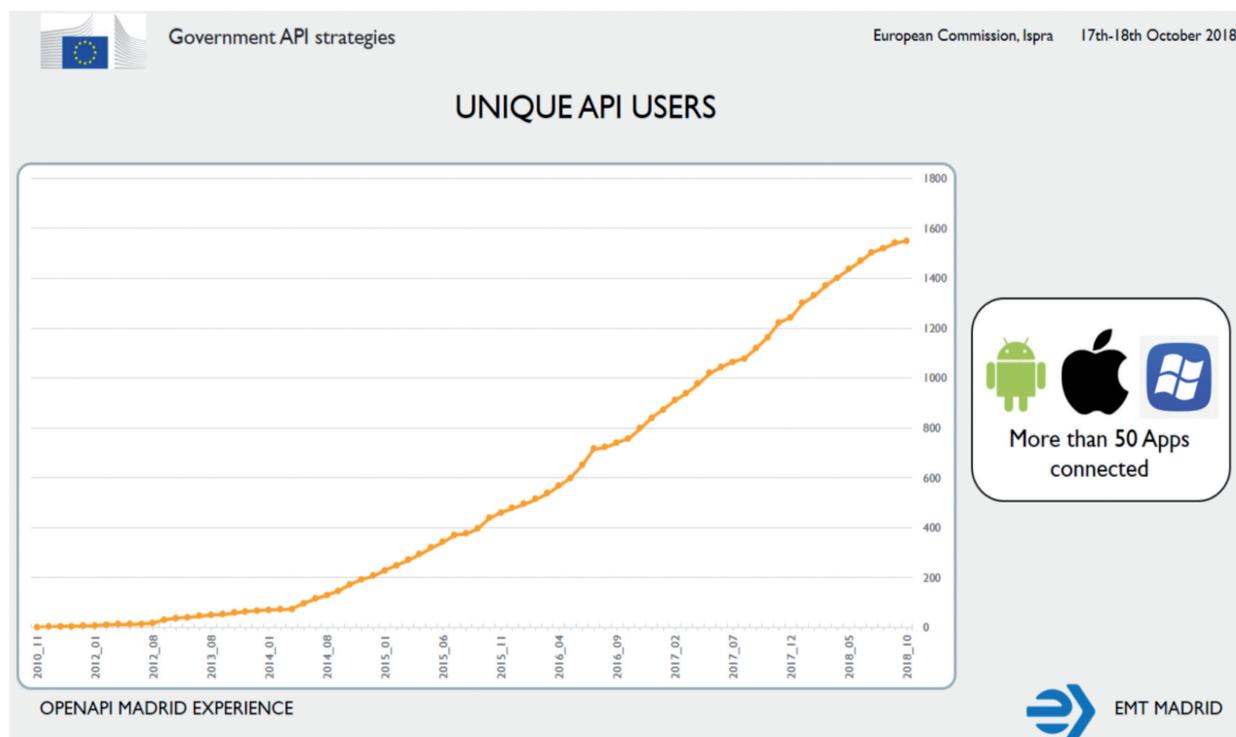


FIGURE 21: More apps from open government APIs (EMT case study).
Source: EMT, Madrid (European Commission, 2018).

Box 7.

TfL

At a recent European conference (European Commission, 2017c), TfL detailed the investment that it had made.

- Through an API, 200 data elements are made available to some 12 000 developers producing some 600 apps that 40 % of Londoners use.
- TfL has formed partnerships with major IT players such as Apple (for mobile payment and the rental of bikes), Twitter (for pushing alerts out), Waze (a 2-way data-sharing agreement enriching the app with data from the road network that TfL manages while benefiting from data collected through Waze) and Google (enriching the map application with real-time data).
- The data can be consumed under the terms of the UK Open Government Licence with some minimal additions for free. This is done under a statutory requirement as part of UK legislation. Mechanisms are in place to ensure that consumption remains at an acceptable level. There is one single set of data at the base that is consumed both by TfL for its purposes and by third-party developers. Developers must give attribution to TfL for the fact that their apps include TfL data.

- In terms of the creation of additional economic activity, it has been calculated that, in total, the TfL open data policy generates GBP 100 million in direct value and has enabled the creation of some 1 000 jobs.
- For data acquired by a third party (e.g. Waze data), restrictions resulting from the partnership agreement apply.
- All of the data made available are data that TfL collect anyway for its own purposes. TfL is not collecting additional data merely to make them available to third parties.
- Mashing data provided by TfL with privately held data can bring additional insights (e.g. answering the question ‘are there correlations between rainfall and collisions involving cyclists?’).

The TfL API aggregator of public transport data is an example of the economic value generated from public transport APIs. This intermediary has not only created a business in which transport data is aggregated for use in wayfinding apps, but also stimulated economic development in other sectors including healthcare (in which maps and transport routes are provided on online booking pages for healthcare services) and in out-of-home advertising (with next transport departures displayed on kiosks and outdoor digital advertising). In turn, out-of-home advertising has stimulated local spending: commuters can spend more at venues until the moment their transport arrives, further enhancing local economies.

- **Location intelligence.** Government geospatial data offered via APIs have helped stimulate a broad range of economic activity. Maps and GPS navigation providers rely fully or in part on government geospatial data. This has stimulated the growth of new mapping businesses such as Carto and the investments of relevant private companies such as Environmental Systems Research Institute (Esri). Government geospatial data have enabled new start-ups such as the Portuguese-based Ubiwhere to create a range of smart city and mobility solutions, including the Urban Platform, which in turn has stimulated the creation of new apps and transport-related services (Ubiwhere, 2020). The location intelligence sector, often based on government geospatial data available via APIs, is estimated

to generate approximately EUR 403 billion in 2020 (Grand View Research, 2018). Government geospatial API data have enabled GPS mapping products such as TomTom and car manufacturing software to develop, creating new economic activity. In turn, these products have been able to link to external infrastructure such as car parking bays. As a result, parking payments can be optimised so that drivers can purchase vacant car parking spaces from their GPS navigation and drive directly to their parking bay. This helps stimulate economic development by removing friction for travellers wishing to drive to spending destinations, and reduces carbon dioxide emissions by reducing the need for drivers to drive around searching for an available parking space. For parking bay operators, it optimises their

spaces in a similar way to how hotels can offer price discounts via booking aggregator apps to optimise their vacant assets (TomTom, 2020).

As the OECD's analysis of Argentina's digital government strategy found, the availability of geospatial data via APIs 'has helped to enable a user-driven and real-time approach for the standardisation of geodata in the country. These efforts have helped to ensure that data are being used both statistically and as a service for public sector systems that can generate quality data from scratch, thereby reducing the cost and burden of building value-added products and services resulting from low quality datasets' (OECD, 2019b).

- **Weather and agricultural data.** Weather APIs cover most parts of the world. Weather apps – which ingest weather APIs from government sources – are a growing business, generating millions in revenue each year from product sales and in-app advertising. Weather data via APIs are also used as a raw ingredient in digital agricultural products. Agricultural datasets and reports are also widely available from governments via APIs. Large ecosystems benefit have been expected from both these data. Following the model of agencies that produce intelligence for commodities markets, a business of agri-intelligence is developing using the datasets available through APIs. Companies such as Gro-Intelligence use available APIs to produce intelligence for actors in the agriculture sector such as (Gro Intelligence, 2018):

- demand models for revenue forecasting, and the food industry and agribusiness;
- planting intentions forecasting for agribusiness and machines and equipment manufacturers;
- yield forecasting for credit risk management;
- drought indices for climate risk management;
- general scenario forecasting of price, climate, trade, supply and demand variations;
- farmers' financial health for banks;
- commodity demand models for insurance demand modelling;
- price forecasts for hedge credit;
- yield, area and production forecast models;
- demand models for investors in storage, handling and processing assets;
- historical and weather forecast data for supply estimates and price impacts.

- **Robo-journalism/quake-bot.** The existence of APIs can favour the development of digital ecosystems

in a given industry – it can also be useful to other ecosystems. In their search for new offers, news media have started to experiment with bots and 'robo-journalism': the *Los Angeles Times'* Quakebot, followed by that of *Nice Matin* (French news media), automated article publication at each earthquake in its zone. The *Los Angeles Times'* Quakebot relies on an API from the US Geological Survey. As soon as a tremor meets set criteria, such as magnitude and geolocalisation, an article is produced automatically; in the case of *Nice Matin*, it is reviewed by a journalist before publication (BBC, 2014).

- **Vehicle registration data.** Vehicle registration data are collected by government authorities for licence plate use and to confirm that vehicles are roadworthy, meet safety standards and are within exhaust emission standards. Vehicle registration that is managed by a web service API can create efficiency gains for governments, citizens and businesses by reducing the friction in registering vehicles. For policing, digital management of vehicle registration can allow citizens to report abandoned vehicles (although, in some jurisdictions, governments have been reluctant to make these open data in the form of an API in case doing so increases the burden on policing services). However, beyond improved efficiency (which can have some ecosystem value added impacts in reducing administrative costs for businesses needing to register their fleet, as discussed above), the availability of vehicle registration data enables a whole range of new businesses and products to emerge that stimulate new economic activity and create new data-based industry ecosystems.

The UK Driver Vehicle and Safety Agency notes that vehicle registration data have enabled new use cases, including providing car details for prospective car buyers at auctions, car insurance companies using these data as an indicator of how well cars are being looked after (and hence influencing the price of insurance), validating car mileage for cars offered for sale, tracing potential mileage fraud, building apps to remind motorists when their registration is due and the reasons why that type of vehicle will most likely fail, and providing compliance data for companies with large vehicle fleets (UK Government, 2018).

- **National identity verification service.** This is an example of a government shared service delivered via an API that has stimulated ecosystem growth. Identity

verification services can enable new financial services, particularly loans, which in turn encourage new economic activity. Identity verification services can support businesses to grow their customer base and deliver more digital services once trust and consent have been established.

For example, the Singapore Government's national identity API, MyInfo, aims to provide all Singapore citizens with a secure, easy-to-use method to authenticate themselves and apply for a range of public and private services. The service is now available via APIs through the 'ndi.api' beta service. The service has been taken up across the banking and financial sectors as part of an initial ecosystem focus. To date, MyInfo has 104 partners, 163 production-grade integrations and 78 integrations that power instant data sharing. Bank users are already noting significant benefits in their use of these APIs including the following (Lee, 2019).

- One banking product for offering car loans was able to speed up the loan approval process, resulting in it taking less than 15 minutes. This, in turn, increased loan approvals by 15 %, bringing in new revenue to the credit providers and auto retail industries.
- Banks indicated they were seeing growth in new digital accounts triple, with 90 % of these accounts opened using MyInfo APIs. This created cost savings of 20 % as a result of reduced operational overheads for the banks.

Moreover, findings from the workshop and the survey reveal the opportunity of **innovative funding mechanisms** (e.g. although not common, there have been attempts to define co-funding models to fund ICT infrastructure among different stakeholders). In addition, there are beginning to be cases of co-payment in which partial and even full cost-recovery models are adopted.

4.1.6. Benefits when government assumes a regulatory role in application programming interfaces

As regulators, governments can mandate the use of APIs for given industries to encourage competition, break down monopolies, ensure consumer confidence and create innovative environments. The use of APIs can assist in the monitoring of regulation by facilitating the exchange of relevant data (e.g. metrics) with the regulating body. Examples from healthcare and banking demonstrate how new economic activity can be generated through government regulation and enforcement of the use of APIs. In Europe, the banking example has been proposed as a model for the future opening of digitised consumer services such as telecommunications, energy and utility services and insurance. The following are brief descriptions of these two cases.

— **Healthcare.** Global agreement under the Health Level Seven international organisation has created the fast healthcare interoperability standard (FHIR). This API standard ensures the security and standardisation of electronic medical health records data so that patients can share health records more seamlessly across borders and with various providers, especially at times of acute care. The FHIR sets a range of API standards for defining the electronic medical record dataset and proposes elements that should be considered compulsory for adoption by all healthcare organisations.

In Europe, the FHIR is encouraged through the Commission recommendation on a European electronic health record exchange format. This recommendation proposes investigating the adoption of the FHIR and the use of APIs more broadly to encourage innovation and citizen data security (European Commission, 2019).

In the United States, the government has mandated the use of the FHIR as obligatory for all software and organisations seeking to work within the government's funded health system. Since 2015, software and other digitised healthcare providers must show accreditation and alignment with use of the FHIR to be eligible for Medicaid funding (Mark Boyd, 2015).

However, the regulatory environment often runs slower than technological advances and, as discussed above, this is a particular risk with APIs, for which the velocity of change and adoption increases exponentially, which quickly brings negative impacts to the forefront. In the United States, private technology companies have begun creating relationships with accredited healthcare providers to access patient data via APIs. Recent news reports show that Google now has access to large swathes of personal healthcare records due to partnership agreements that open data via APIs (Wikipedia, 2020b; Singer and Wakabayashi, 2019).

- **Banking services.** In Europe, PSD2 sought to open up the previously closed banking industry in order to generate new competition, improve customer experience and widen choice (European Union, 2015a). Governments are acting as regulators to mandate that banks must expose data and services to third parties at no cost and in a secure manner (where there is customer consent). This model, referred to as 'open banking', is seen by most as requiring the availability of APIs to ensure that exposing services and data occurs in a standardised and secure manner. Globally, there are some signs that such a move towards an open banking model is also resulting in access to a wider selection of services by those who had previously been underserved by banks, such as migrants, women and small and micro-businesses (an economic added value generated by government-regulated APIs) (Consultative Group to Assist the Poor, 2020).
- At the same time as the creation of a regulated open banking environment in Europe via the PSD2 initiative, the United Kingdom also embarked on an open banking model in which standard APIs for exposing payments, accounts and banking product information

were mandated (Open Banking, 2019). In Europe, legislation and implementation approaches have been less binding. APIs are not specifically mentioned under PSD2, instead requiring only that banks expose services in an automatic and no-cost manner to accredited third parties. Regulatory technical standards released by the European Banking Authority outline the requirements that must be addressed in a digital technology connecting the services, but API standards are not mandated.

LUXHUB is a start-up that has been made possible thanks to the emergence of PSD2 legislation. It is a platform that includes a marketplace for all bank (and Fintech) APIs. Owing to the lack of a regulated API standard for banks under PSD2, LUXHUB must invest resources in exposing and normalising all bank APIs so that they can work across individual idiosyncrasies in their design. At the workshop we organised at the APIdays conference in Paris in 2019, Jacque Pütz, CEO of LUXHUB, noted that **this complexity has created a new product opportunity for LUXHUB:** an integrated API that adapts individual bank APIs to a single uniform API that can be used by any third party to enable scaling and integration of all banks on the platform.

4.2 | Costs and challenges

API adoption carries both **technical** and **organisational costs**. Depending on the role that government takes when adopting APIs, these costs can vary greatly. Moreover, the adoption of APIs implies **challenges** such as those involved in overcoming the organisational mindset shift required, overcoming security vulnerabilities and adhering to current regulations (e.g. the GDPR). This section summarises the qualitative analysis of findings related to costs and challenges.

On the technical side, the sources of costs vary greatly depending on the level of API adoption. The **sources of costs** range from purely operational aspects, such as **software development, deployment and maintenance**, and tactical aspects, such as the **provision of digital infrastructures** and building capabilities, to strategic concerns, such as the **definition of strategic requirements** linked to the achievement of digital government goals.

On the organisational side, depending on the API strategy adopted by institutions, different sets of policy options (see Table 1) may have significant differences

in terms of costs. Examples of these costs can be found in Table 6.

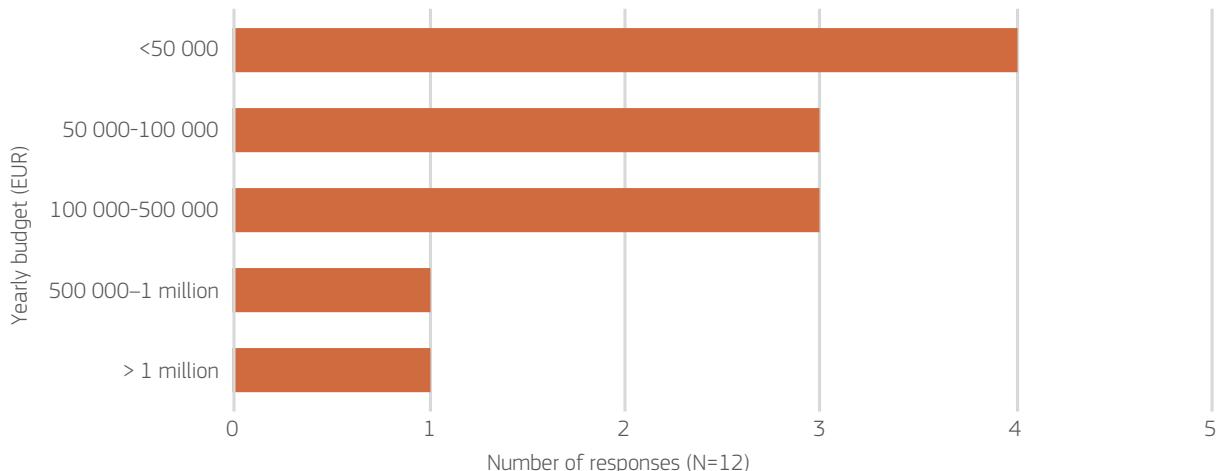
No main conclusions can be drawn at this stage on budgetary quantification owing to the small number of respondents who quantified their budget and the variety of ICT complexity of their API systems. However, from the results of our survey, it seems that the yearly budget used to maintain APIs, as illustrated in Figure 22, was rather low. Moreover, the allocation of the available budget was interesting in economic terms because two thirds of the API systems in the survey relied on the externalisation of resources, either by contracting services or through new public and private partnership models.

API adoption also carries **challenges** both at the organisational and the technical levels. The organisational challenges include the need to change organisational mindsets and to address new interoperability and organisational barriers. To overcome these organisational issues, the practitioners analysed in the study have (i) developed a common vision of their digital ecosystem and (ii) deployed cohesive coordination efforts (e.g. Regione

Name	Costs
Estonia's X-Road	<ul style="list-style-type: none"> — X-Road is a distributed system and therefore it is difficult to understand the true full total cost of ownership — The initial investment was in the region of EUR 300 000 (i.e. 6 full-time equivalent years of development)
FIWARE	<p>Public–private partnership funded by:</p> <ul style="list-style-type: none"> — EUR 300 million from the EU — EUR 100 million from a private enterprise membership model — EUR 100 million from venture capital <p>The FIWARE NGSI is open source and therefore there is no cost for the source code, but the configuration will no doubt be expensive</p>
Amsterdam city data	<ul style="list-style-type: none"> — EUR 6 million over 3 years — Developers are the most significant cost — Infrastructure is less than 5 % of the cost – the hosting cost per month is around EUR 8 000
DAWA	<ul style="list-style-type: none"> — Initial development cost: EUR 270 000 — Operational cost: EUR 135 billion per year (includes Amazon Web Services)
Madrid Mobility Labs	<ul style="list-style-type: none"> — Maintenance: EUR 60 000 yearly (1 person year) — Development: 3 to 4 person months (first version) — Portal development: 6 person months
KLIP (Flanders)	Ongoing costs of EUR 1.9 million per year

TABLE 6: Multiple-case study analysis of costs.

Source: JRC, own elaboration, based on Williams (2018).

**FIGURE 22:** API yearly budget.

Source: JRC, own elaboration based on the study survey.

Lombardia). On the technical side, the main concerns regard increased IT vulnerability, the additional complexity in adhering to existing regulation and the lack of skills. The evidence we have observed in our study on these technical challenges includes the following.

- **Security.** As also highlighted in [Section 3.2.2.4](#), cybersecurity is a major issue when dealing with APIs. APIs expose data, services and transactions to build new services. An API is a ‘door’ to an organisation’s network. If not properly protected, this door could be used to get unauthorised access to the internal network and could be a free ticket to exploit internal vulnerabilities. Therefore, APIs must be appropriately secured to

ensure data privacy and to ensure citizen confidence in the service delivery channel. APIs intended for access to public data must be protected from inappropriate use or abuse such as denial of service. A number of security solutions exist, such as OAuth and certificate-based authentication, which are used in conjunction with a wider cybersecurity strategy and cryptography (see also [Section 3.3.2](#) and Santoro et al. (2019)).

- **Adhering to existing regulation.** For the most part, externally facing public-sector APIs involve the movement of data that are sensitive, as they often, in some way, refer to information about a citizen. APIs can play a significant role in the facilitation of government

transparency (Lathrop and Ruma, 2010); however, further regulatory considerations must be taken into account when adopting them. The publication of APIs, in fact, especially when sharing data, must/should adhere to a number of regulations, such as in the case of the EU GDPR (European Commission, 2018g), PSD2 (European Union, 2015a) and the Open Data Directive (European Union, 2019b).

- **Lack of skills.** The successful implementation of API strategies requires a whole new set of public-sector skills and knowledge. While policy stakeholders may not need to know the technical working of APIs, because of the mindset shift that APIs will generate in how governments function, some understanding of APIs in a wider context will be needed by most leaders

in a digital government era. Stakeholders throughout the study argued for the need for more and better storytelling on the role of APIs and their value. For example, Regione Lombardia (Italy) has prioritised storytelling for all government decision-makers as an essential next step in creating the necessary buy-in to continue rolling out their digital transformation strategy (Panebianco, 2019).

Other essential skills that become imperative in a government in which APIs are widely adopted include the ability to measure value from technology enablers, user-centred design practices and ecosystem facilitation skills. Aligned with the above discussion on funding models, new collaborative work practices that break down entrenched departmental silo models would also be needed.

4.3 | Social impact highlights

In addition to the economic impacts listed in the previous sections, this section will focus on the social highlights that we have identified in our research. Our analysis is structured along the Tallinn Declaration principles (Estonian Presidency of the Council of the EU, 2017). The declaration covers the modernisation and digitalisation of governments and can be reviewed in terms of the possible application to APIs.

- **Privacy and cybersecurity.** APIs facilitate the exchange and sharing of government datasets, including those that could contain private information of citizens and companies. When correctly designed, APIs can provide mechanisms to ensure privacy- and security-related requirements are met. However, if data privacy and security are unattended, governments risk losing citizen confidence in the delivery channel and therefore weakening their authority. In this sense, APIs intended for access to public data must be protected from inappropriate use or abuse.

Some solutions to protect the privacy of citizens have been proposed at the global level, such as the Solid open-source platform and framework for application development, proposed by Tim Berners-Lee (Middleton, 2018). The Amsterdam Data Exchange (AmDex) is another remarkable initiative focusing on the protection of data, which was proposed by the Amsterdam Science Park and the Amsterdam Economic Board in cooperation with multiple partners, including Amsterdam Data Science.

The project aims to provide broad access to data for researchers, businesses, governments and individuals in a secure marketplace for data. AmDex is inspired by the European Commission's Open Science Cloud (AmDex, 2019). Some initiatives, that let final users better protect their privacy have also been proposed. The MyData initiative favours the empowerment and participation of citizens and offers a citizen-centred consent-management API based on systems (MyData network, 2020). Another solution at the city level is that presented by the city of Amsterdam at our workshops. It consists in the creation of an ethics group for data privacy (Tada community, 2020).

- **Digital by default, inclusiveness and accessibility.** APIs help generate social value by making services more accessible, with less friction, as they can be accessed from any location, at any time, via digital means (e.g. on a mobile device or via the internet). This can create additional inclusiveness and accessibility, as citizens are not required to present at government offices in person, call within restricted hours or go to specific locations.
In addition, it can be noted that APIs can help monitor inclusiveness and accessibility. The Open Data Directive proposes that 'high-value' datasets be available as dynamic, real-time APIs and lists demographics as one area that should be pursued. The availability of demographics data via APIs can be a crucial tool in ensuring the inclusiveness and accessibility of a

government from the perspective of its citizens. Any project or service being implemented by a government could use a demographics API to embed population data into service access maps. At any given time, a service manager could see the distribution of access to their services and ensure that all populations are accessing the service equitably.

One of the best examples of digital by default, inclusiveness and accessibility is the availability of government-run public transport data via APIs. These data enable all citizens to access public transport in a way that reduces friction (shorter waiting times and more precise travel planning) (EMT-Madrid, 2019).

— **OOP.** In an API context, this model is being used to create moments-of-life pathways in which citizens and companies can register one aspect of their life or business and have an automated series of supports triggered as a result. For example, after the birth of a baby, a citizen should have the birth certificate registered, followed by automatically being provided with details of early childhood support, any available services for new parents, vaccination details, etc. Governments around the world, including those of Singapore (Smart Nation Singapore, 2020) and Australia (Digital Transformation Agency, 2019), are introducing APIs to address this principle.

— **Openness and transparency.** Open data APIs on government spending are described elsewhere in this report and demonstrate a clear example of the openness and transparency value generated for society by making data available via APIs.

City governments are also beginning to use APIs to enable consultation via digital means. This creates new social value in openness and transparency whereby not only are citizens informed of future plans, but they are invited via digital means to contribute via always-available consultation (combining openness social value with inclusiveness and accessibility social value). For example, in Barcelona, the digital platform Decidim links directly to Barcelona City Council's neighbourhood plans to populate discussion boards. In this way, citizens can provide feedback on upcoming neighbourhood amenity issues and see the feedback from their neighbours and how such feedback was responded to by the city government (Aragón et al., 2017).

— **Interoperability by default.** This principle proposes that citizen social value should be generated

from digital services that function across borders and between various levels of government services. Identity verification is a good example of this principle generating social value via APIs. Identity verification services (accessed via APIs) can allow citizens to access services from various tiers of government or the private sector using the one identity system. This also demonstrates the OOP social value (Lee, 2019). Government regulations that insist that health records use common API standards are also generating interoperability social value for citizens. Citizens can share their health data across various hospitals, including across countries, by using APIs (European Commission, 2019l).

— **Trustworthiness and security.** Citizens expect digital service provision to be secure and trustworthy. Failing to deliver on these requirements may weaken citizens' trust in institutions. APIs can help to enforce the traceability of transactions between government and different actors. For instance, API platforms at national levels, such as FranceConnect (European Commission, 2018f), provide users with a trusted identity, based on one of their existing accounts, to access national public services in a secure fashion.

— **User centricity.** The participants of our workshops saw citizens as an important factor in determining the satisfaction that can be achieved from resources exchanged via APIs. The user-centricity principle is increasingly being recognised by governments around the world when designing digital services for citizens and businesses. User-driven design is the primary principle guiding the OECD's digital government framework (OECD, 2019c). Principles established by Finland (6Aika, 2017b), Italy (Italian digital agency (AGID), 2018), France (Government of France (DINSIC/DINUM), 2020b), the Netherlands (Geonovum, 2019) and others include user-centric design. This follows best practices globally. The Western Australian Government, for example, clarifies the intention of its user-centred principle by stating the following: 'Start with needs: user needs, not government needs. Service design starts with identifying user needs. If you don't know what the user needs are, you don't build the right thing. Do research, analyse data and talk to users. Don't make assumptions. Have empathy for users and remember that what they ask for isn't always what they need' (Government of Western Australia, 2017).

5

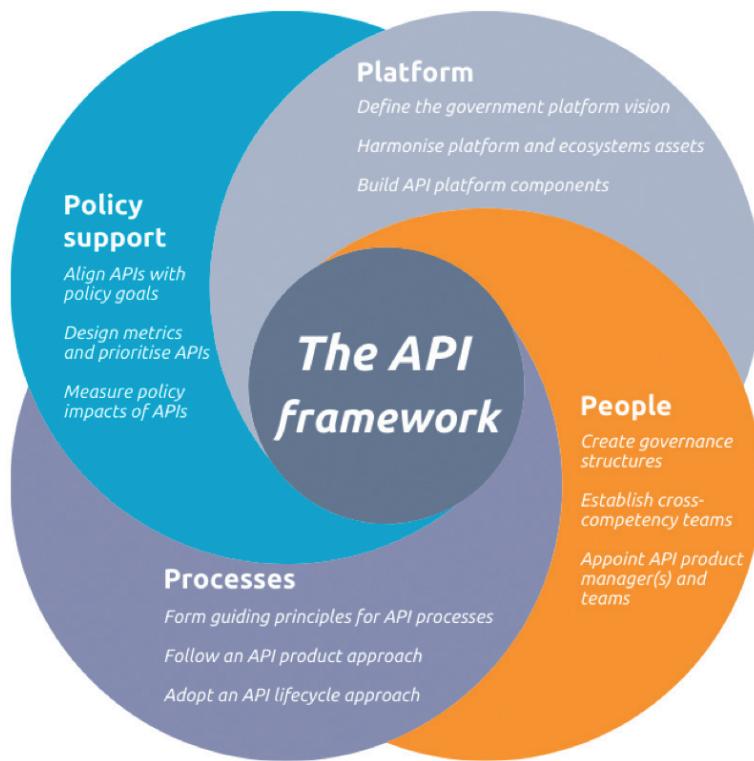
HOW GOVERNMENTS SHOULD ADOPT APPLICATION PROGRAMMING INTERFACES

SUMMARY

Based on the analysis of the landscape (in particular of the best-practice literature), and the costs, benefits and metrics identified in the study, a robust ‘basic digital government API EU framework’ is proposed within the study and presented in this section. The framework comprises three levels of action for different target users (i.e. at **strategic**, **tactical** and **operational** levels). For each level, the framework gives recommendations related to four different aspects, namely (i) **policy**, that is, align, prioritise and measure the adoption of APIs with policy goals; (ii) **platforms and ecosystems**, that is, define government platforms, harmonise actions of different digital ecosystems and build the API platform components; (iii) **people**, that is, create governance structures, establish cross-competency teams and appoint products managers; and (iv) **processes**, that is, form guiding principles and follow API product and API life cycle approaches. To assess the level of maturity in the adoption of the proposed API framework, a self-assessment maturity tool is also proposed. The tool lets governments track the level of maturity of their API framework and identify their next actions to address the maturity gap.

Regarding the more operational aspects (i.e. the selection of the tools to implement APIs in government), the general principles include (i) choosing tools that support agile and iterative development, (ii) choosing open-source tools by default and (iii) choosing modern, cloud-based and commodity tools. Specific components for API life cycle management must cover all stages of the API process, namely strategy, design, documentation, development, testing, deployment, security, monitoring, discovery and promotion, and change management.

Legal and licensing issues were one of the most underdeveloped areas identified in the best-practice literature review, when analysing existing government API use cases and in workshop discussions. For this reason, efforts have been made to classify the legal aspects analysed in our research, by analysing them from strategic (e.g. European Union regulation), organisational/tactical (e.g. SLAs) and operational (e.g. licensing aspects) perspectives.



⑤ HOW GOVERNMENTS SHOULD ADOPT APPLICATION PROGRAMMING INTERFACES

In the previous sections, we have analysed and illustrated the relevance of APIs in digital governments, analysed government API landscapes and tried to answer the first question of our study: why should governments invest in APIs? In particular we have outlined:

- the relationship between the digital government policy agenda and the use of government APIs;

- the methodology for a literature review to identify government API best practices;
- the current policy and implementation landscapes in the European Commission and the Member States;
- the benefits (including added value) and the challenges of adopting APIs by government bodies.

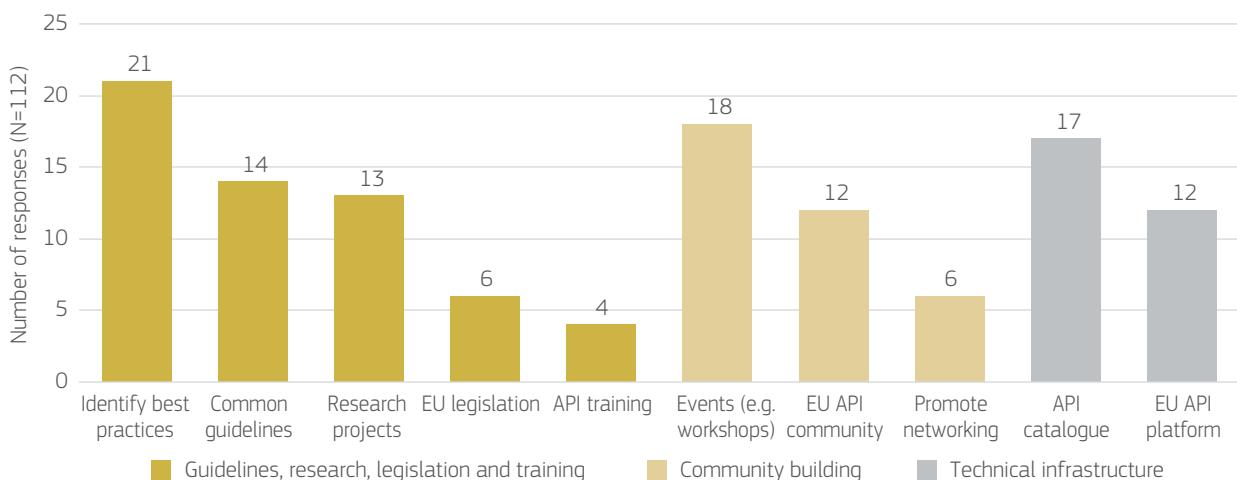


FIGURE 23: European Commission requested actions.
Source: JRC, own elaboration, based on the study survey results.

The overall goal of this section is to answer the second question: how should governments adopt APIs? The importance of this question was confirmed many times during our activities with the API stakeholders. Indeed, from our survey on European Commission requested actions, the stakeholders gave the highest priority to the need to identify best practices (see Figure 23). Together with the request to provide some ‘common guidelines’, this represented a clear indication of where to focus our research.

Based on the analysis of the best practices we collected within the study (see [Section 3.4](#)), in this section we first present our proposal for a robust API framework for governments, including a tool to self-assess the degree of maturity of its adoption. We then summarise the key considerations for governments when selecting API tools. Finally, we analyse a series of current available solutions for potential licence model(s) for APIs.

5.1 | A basic application programming interface framework for governments

While working on the list of best practices that governments should follow when adopting APIs, we found that the majority of best practices related to operational-level concerns. That is, there is a fairly clear understanding of industry best practices that can be utilised to design, develop and publish government APIs, from a technical perspective.

The challenge at the European and Member State levels is that APIs are rarely mentioned in strategy and overarching policy documents. Looking at the private sector, it is worth reflecting on the experiences of industry when the use of APIs began to mature. After single use-case adoption of APIs, private industry found that as more APIs were introduced in an ad hoc manner, they created additional complexity. Governments are now facing a similar experience when implementing APIs. Private industry has shown that, to be used effectively, APIs require implementation that can ensure they maintain alignment with broader business goals. APIs can also be used to increase interoperability within the organisational structures they are intended to support. APIs must also be used consistently as a common technology across operations (Vaughan and Boyd, 2018).

“ The API framework helps governments reorient towards a more coordinated API approach across all of their operations over time **”**

It is also not sufficient to simply rely on private industry practice when designing a framework for government API adoption. For example, while private industry is often driven by a profit motive, governments must create social value and provide services to all citizens. In addition, while private industry companies can focus on relationships that will benefit them the most, governments must focus on fostering economic development and creating level playing fields for all business entities. Moreover, private industry businesses tend to focus on the role of delivering products and services to the marketplace, while governments have to balance multifaceted roles that include being a provider, consumer, facilitator and regulator. Given these unique challenges, we propose an API framework that:

- addresses the risk of generating complexity through ad hoc API creation;
- facilitates EU cross-national interoperability of data and digital services;
- reflects on governments’ broader functions and unique roles.

The framework has been created by using a robust methodology, shown in Figure 24. The methodology began with a literature review stage, moving on to distilling best practices and then organising them into a framework. This framework was then discussed with government stakeholders at three workshops, with the project advisory board and via an online survey. Moreover, a pilot project was conducted in partnership with the government of Regione Lombardia, Italy, to validate the framework in its initial phase. The pilot project tested and refined the framework based on a concrete case. In addition, within the pilot project, we created a self-assessment tool to measure maturity in implementing various framework components (see section 5.2). An extensive description of the framework has also been published (Mark Boyd et al., 2020a).

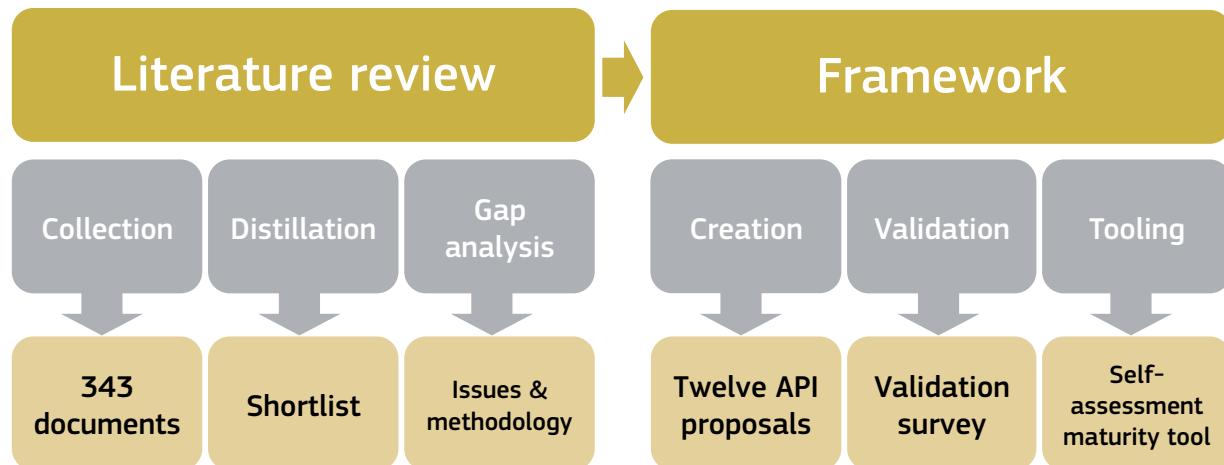


FIGURE 24: Overall methodology for the API EU framework.
Source: JRC, own elaboration.

To build the framework, we have considered four aspects or ‘pillars’ that reflect the capabilities available to governments to carry out action.

- 1. Policy support.** Governments set policies and legislation to guide all actions across their operations. APIs are an enabling technology and approach that can help governments achieve their policy goals. This pillar describes how APIs should support policy goals.
- 2. Platforms and ecosystems.** APIs enable platform models and ecosystem networks to develop. This pillar describes the core platforms and ecosystem components that need to be in place to make government APIs effective.
- 3. People.** APIs require new, or updates to, organisational and team structures within government and new skills among public-service and other stakeholders. This pillar describes how people should be organised and supported to manage API activities.
- 4. Processes.** Best-practice processes are available to design, implement and manage APIs. This pillar describes the processes that can ensure high-quality, effective and useful APIs.

These pillars should be considered at three levels, as proposed by Owyang (2013).

- 1. Strategic.** This level involves identifying clear, broad, goals and visions to advance society and community. The first four proposals within this level describe an ideal scenario in which a whole-of-government approach is taken, even if,

actually, much of this work is not yet done by the governments at international, national, regional or city levels. That is why there is a need to follow the foundational elements in place. Without them, governments will only ever create ad hoc APIs that will eventually generate complexity, reduce interoperability and reinforce existing siloes. This strategic work can be done before APIs are created or while current API activities continue.

- 2. Tactical.** This level involves setting actionable targets to be achieved by allocating resources (time, people and budget). Once there is an understanding of APIs as a technological enabler that facilitates the achievement of government policy goals, with the proposals within this level, governments can then better set actionable targets and allocate resources.
- 3. Operational.** This level involves implementing actions to reach targets using best practices and available tools within the available resources. With policy alignment and resources allocated, governments can work on the technical and day-to-day operational elements of adopting and managing APIs.

Ideally, strategic actions should guide tactical actions and, in turn, operational activities. But, as many situations start within an ongoing digital transformation environment, a bottom-up or, more commonly, a hybrid bottom-up/top-down process can also be applied.

Drawing from the methodology of Figure 24, the **12 proposals** illustrated in Table 7 were developed⁽¹⁷⁾ within the framework.

	Policy support	Platform and ecosystems	People	Processes
API strategy	1. Align APIs with policy goals	2. Define the government platform vision	3. Create governance structures	4. Form guiding principles for API processes
API tactics	5. Design metrics and prioritise APIs	6. Harmonise platform and ecosystems assets	7. Establish cross-competency teams	8. Follow an API product approach
API operations	9. Measure policy impacts of APIs	10. Build API platform components	11. Appoint API product manager(s) and teams	12. Adopt an API life cycle approach

TABLE 7: API framework proposals.

Source: JRC, own elaboration.

5.1.1. Align application programming interfaces with policy goal

There are several key EU-wide and country-, regional- and city-level policies that focus on reorienting governments towards a digital model. There are also clear cross-cutting targets documented in the sustainable development goals and Europe's commitment to these goals is outlined in the document *A Sustainable Europe by 2030* (European Commission, 2019m). An API framework ensures that government APIs can be introduced to support these existing policy goals. A similar process is observed in private industry, where companies are encouraged to 'prioritise API development based on the business's strategy, business and modernisation impact, and ability to execute' (Iyengar et al., 2019).

At present, some European Commission policies explicitly mention APIs as being an enabling technology to achieve goals. However, this leave room for the adoption of alternative solutions and can lead to a duplication of efforts. Policy and funding goals are also distributed across government operations at the European Commission and Member State levels (and also within regional and city government organisations). When policy goals and funding environments are siloed, there is little incentive to encourage collaborative work. APIs can assist in encouraging collaborative work as multiple departments work together to share data and services, for example. An added benefit is that, when two departments are pursuing separate but similar goals, APIs can assist in fostering

joint action. For example, transport departments may be responsible for using data to better manage traffic congestion and environmental goals may focus on reducing consumer-based carbon dioxide consumption. Therefore, APIs that assist governments in developing more direct driving routes or the use of public transport help to achieve both transport and environmental departmental goals.

For each government policy goal, APIs should be considered to support the achievement of these goals. If APIs are implemented, the API framework should be used to ensure the cohesive design, creation and management of APIs.

Once it has been identified which policy goals can be achieved through APIs, an impact assessment can be carried out to ensure that APIs will not have any detrimental impacts when being leveraged as an enabling technology.

“ Policy support, platforms, people and processes have been considered at strategic, tactical and operational levels ”

5.1.2. Define the government platform vision

Without a defined platform model, governments risk simply replicating existing paper-based services as digital services, continuing siloed approaches and reinforcing current market barriers to participation that exist in traditionally organised systems (Margetts and Naumann, 2017).

When governments step back from a purely 'digital government' agenda (in which the government provides 'digital services'), a different approach to government can be considered. For example, in Australia, the national Digital Transformation Agency reimagined government services as being automated and evoked at key life

transition stages (also known as life events-based actions). These events include birth, marriage, the completion of education and starting a business (Digital Transformation Agency, 2019). The Singapore Government has introduced a similar model as part of its API and digital government strategy, entitled the ‘Moments of life initiative’ (Smart Nation Singapore, 2020).

This type of new paradigm of joined-up and automated service delivery by government is not imaginable if the starting point for API creation is to simply convert the paper-based service into a digital service. Evaluations and reflections by policy leaders involved in the digital government transformation agenda have noted that the biggest failure has often been that governments have not been ‘bold enough’ in envisaging new platform models of government (Loosemore, 2018).

Governments introducing APIs are embracing platform-based models in which services and data assets are shared internally between departments and can also be exposed securely to external stakeholders. This approach alters the current government model, including current budgeting processes and cross-collaboration approaches. As discussed above, in an API-enabled government platform model, governments are producers, consumers and regulators at the same time and a consideration of how these roles intersect is an important visioning exercise to undertake before embarking on a whole-of-government API strategy (Koponen, 2018).

By articulating a platform vision for government APIs, new opportunities to leverage APIs to deliver on this vision emerge

naturally (Dastur, 2018). For example, in the European Commission’s digital strategy, one of the goals is to co-create value with external parties (European Commission, 2018b). By acknowledging that this is part of the process of adopting a platform model, it is easier for strategic implementers to see the role that APIs could play in enabling co-creation. This vision could inspire new thinking around common data models and identifying priority ecosystems, which, in turn, could trigger discussions around future viable private–public partnership business models.

The four proposals suggested at the strategic level (i.e. proposals 1–4 of this API framework) do not seek to create policy for governments. Digital government leaders who are responsible for overseeing the implementation of API activities at the whole-of-government and departmental leadership levels are not creating policy. They must ensure that API activities align with strategic decisions. This involves first understanding the whole-of-government policy goals and identifying where APIs can play an enabling role.

In particular, digital government leaders need to understand the level of support for platform models. For example, some governments are focused on reorienting themselves towards a platform model in which internal departments share resources and work more collaboratively. Other governments may have a platform vision in which partnerships are extended primarily to local businesses, research institutions and community groups. Others may be looking at platform models with larger industry partnerships. This proposal asks digital government leaders to research and understand what platform model their government has chosen to pursue.

5.1.3. Create governance structures

Enabling APIs for reuse and interoperability, within a platform approach, requires agreement on how to enhance interoperability, including on adhering to common API standards, considering which shared data models must be commonly defined, defining the common architectural choices and determining which service components can be reused. Oversight needs to ensure that appropriate access is secured for APIs to prevent the exposure of data on citizens and businesses. Governance structures can:

- help ensure standardisation;
- address and manage risks;
- encourage interoperability;
- ensure adherence to wider government policy principles.

The European Commission EIF (European Commission, 2017a) gives a set of recommendations for public administrations on how to improve governance of their interoperability activities, establish cross-organisational relationships, streamline processes supporting end-to-end digital services and ensure that existing and new legislation does not compromise interoperability efforts. The EIF includes four interoperability layers (see proposal 6), an integrated public service governance layer and a ‘interoperability governance’ layer to: (i) ensure holistic governance of interoperability activities across administrative levels and sectors, (ii) identify and select standards and specifications and (iii) ensure that

standardisation work is relevant to the needs of the organisation.

There are several factors that will influence the establishment of appropriate governance structures, including:

- skill sets and an understanding of APIs among potential governance committee members;
- the availability of resources such as risk assessments and API style guides to assist oversight;
- government visions of a platform model, which may influence the degree to which a governance committee

is a facilitator that encourages action or a prescriptive regulator that approves or rejects the API-focused activities of various government departments and teams (OECD, 2019c).

Another challenge will be to create sufficient governance structures to encourage knowledge sharing, prevent duplication and ensure the use of interoperable and standardised methodologies without generating too many additional committees or reallocating project resources to the creation of new governance structures.

5.1.4. Form guiding principles for application programming interface processes

The literature review of government API best practices found that one key best practice when aligning APIs with a whole-of-government strategy is to identify and clarify a core set of principles to guide API action. The European Commission and governments of many Member States have defined charters of core principles to guide their work, either in creating APIs specifically or more generally to guide the development of digital government or digital services.

A set of core principles helps guide government actions when implementing digital government models. Principles help governments maintain accountability and transparency by providing all stakeholders with a clear means of assessing the motives of and commitment to government action. Governments can share and, if

needed, review their core principles and ensure that they are understood by the teams responsible for overseeing digital government, cybersecurity, interoperability and API-focused activities across all of government.

The European Commission EIF can be considered within these principles (European Commission, 2017a). They establish 12 interoperability ‘underlying principles of European public services’ that are fundamental behavioural aspects for driving interoperability actions: subsidiarity and proportionality, openness, transparency, reusability, technological neutrality and data portability, user-centricity, inclusion and accessibility, security and privacy, multilingualism, administrative simplification, the preservation of information, and the assessment of effectiveness and efficiency.

5.1.5. Design metrics and prioritise application programming interfaces

Individual departments or agencies will need to identify which APIs are the priority. Collaboration across them will also need to occur to identify common platforms needs among all of them that can be budgeted for and created collaboratively. Once priorities are set at the whole-of-government level, departments or agencies can allocate resources to adopt API activities or share resources to collaborate across departments on common elements.

To ensure that APIs are achieving policy goals, metrics need to be introduced that measure the policy impact of

APIs. When governments prioritise which API activities they will work on, they need to also define how success will be measured. Metrics need to be defined that will assess and check if APIs are enabling policy goals to be achieved (i.e. figures on connections with external actors (G2B, B2G, G2C), figures on the reduction of the digital divide, figures on the overall efficiency gains of the organisation and, in the case of platform environments, figures on networking effects).

5.1.6. Harmonise platform and ecosystems assets

API platforms require a range of stakeholders to agree on a set of minimum common choices to enhance interoperability (including to adhere to common API standards, considering which shared data models must be commonly defined, and to define common architectural choices) and to agree on which service components can be reused and, sometimes, even the use of common tools. Implementing a government API framework requires the following components.

- Prioritised ecosystems. These ecosystems should be made up of networks of stakeholders that participate in a domain area of expertise, such as transport, agriculture, etc., to identify common use cases and industry needs for APIs.
- Data registries. Shared data should be selected and analysed. A minimum set of common syntactic, (e.g. format) and semantic (e.g. terms, properties and relationships) characteristics should be discussed and agreed upon. To avoid ad hoc outputs, the reuse of existing and recognised models should be considered, such as Schema.org (Schema.org community, 2020). Single-source-of-truth datasets/core vocabularies can be reused to avoid complexity and duplication.
- Shared services. These are common digital services that are reused as components in value chains. For example, an identity verification capability or a payments functionality can be built once and used in multiple departments' websites and mobile apps.
- Single inventory point, such as an API catalogue or an API portal. This allows internal or external stakeholders to access the documentation about shared services and data registries via APIs at a unique point in the web.
- Shared technology standards. Agreements on standards ensure that APIs are easily understood and replicable because they share nomenclature and other design elements (Hong Kong Monetary Authority, 2018).

The European Commission EIF gives fundamental guidance on implementing interoperability among and within public administrations through a set of recommendations on how to improve governance of their interoperability activities, establish cross-organisational relationships, streamline processes supporting end-to-end digital services and ensure that existing and new legislation does not compromise interoperability efforts. The EIF proposes an interoperability model that is applicable to all digital public services and may also be considered as an integral

element of the interoperability-by-design paradigm (European Commission, 2017a). It includes:

- four layers of interoperability: legal, organisational, semantic and technical;
- a cross-cutting component of the four layers, namely ‘integrated public service governance’;
- a background layer, namely ‘interoperability governance’.

Moreover, the European Commission has launched a series of initiatives within SEMIC of the ISA² programme. SEMIC has developed a number of semantic specifications and interoperability solutions that are available to public administrations, namely the e-government core vocabularies⁽¹⁸⁾, the Data Catalogue Application Profile for Data Portals in Europe (DCAT-AP) and the Asset Description Metadata Schema (ADMS). The *Handbook for Using the Core Vocabularies*, in particular, describes how the core vocabularies can be used by public administrations when creating APIs to attain a minimum level of semantic interoperability for e-government systems (European Commission, 2020i).

The French government's modernisation strategy has proposed mobilising ecosystems and using web standards to encourage common data models, standardised APIs, a unique inventory point and collaborative efforts within government departments and with external stakeholders (French Secretary-General for the Modernisation of the Public Action, 2020).

In Italy, domain-driven ecosystems (i.e. networks of stakeholders that share expertise in a common sector subject area, such as transport) are seen as central to assisting with prioritising and delivering API activities. In particular ecosystems:

- support a citizen- and business-oriented vision, leading to the creation of services that simplify interactions with public administrations;
- standardise the approach to the development of public administration services;
- stimulate interoperability;
- capitalise on the experiences gained by individual public administrations through the enhancement of best practice (Agenzia per l'Italia digitale, 2019).

Ireland's Chief Information Officer has noted that challenges with the country's current data architecture have resulted in a lack of data sharing across public bodies. It has also

led to duplication in data storage and collection. Ireland's vision for a more efficient data ecosystem is based on improving government operations by utilising APIs. It is currently introducing base registries (i.e. single authoritative sources of data that are mandatory for public bodies to reuse, accessed by APIs), encouraging discoverability by publishing all APIs to a single catalogue and creating an interoperability platform approach so that data and services can be reused across silos (Warren, 2018).

Approaches to creating domain-driven (vertical) ecosystems are still in their infancy, and best-practice methods have not yet been identified. Furthermore, some governments are focusing on cross-collaborative internal ecosystems that only involve government departments

and public authorities working together in a given domain area, while others are creating ecosystems that involve external partners and stakeholders. The communication A *European Strategy for Data* has identified the importance of establishing domain-level data spaces in areas including industry (manufacturing), the green deal, mobility, health, finance, energy, agriculture, public administration and skills development.

Despite long-standing initiatives such as the INSPIRE Directive (European Commission, 2019n) and Eurostat collaborative work by governments to develop shared data models (Grazzini et al., 2019), the idea of API standards for them could be considered innovative (Geonovum, 2019) and this framework suggests to further develop it..

5.1.7. Establish cross-competency teams

API adoption requires multidisciplinary teams. Typical team compositions should include an API team leader who can act as a product manager to drive usage and ensure alignment with user need. The team leader can also communicate with policymakers to ensure that APIs serve policy goals. When APIs are built, engineers can make decisions based on appropriateness or technical best practices. However, sometimes, these inadvertently change the focus of the API slightly.

A product manager ensures that these changes both satisfy the requirements in a flexible, efficient and effective way and ensure that APIs remain aligned with the original policy-oriented intention.

Other team members required include an IT architect and developers/engineers. As the team grows, a developer advocate or evangelist will be needed to encourage use and to create resources that help internal and/or external users to integrate the government APIs into their workflows and digital services.

Multidisciplinary teams and an API approach will also require new public-sector skills. APIs need to be built to meet needs, so design thinking or user-centred design skills will be needed (Fujitsu, 2015). Other skills needed will include negotiation and collaboration skills, as team members will increasingly need to reuse and share APIs across departmental silos (Varteva, 2016).

Training resources on understanding APIs and their role in government policy and service delivery will need to be prepared and delivered across government operations. Digital skills competencies will also need to be updated to better reflect API knowledge (6Aika, 2017a). For example, it could be useful to further develop and use initiatives such as the Interoperability Academy, which is an 'eLearning platform, accessible 24/7, aimed at improving the knowledge of public servants on the reuse of ISA² solutions and supporting the implementation of the EIF' (European Commission, 2019a).

5.1.8. Follow an application programming interface product approach

Governments often deliver services in the form of programmes. Short-term pilot projects or time-limited projects are also conducted to meet specific targets or address other short-term needs. When introducing APIs into government, departments need to think of APIs as being akin to programmes or, in private industry terms,

products. This means that they are treated as medium- to long-term assets that must be maintained, rather than as one-off or pilot projects with a definitive end date. They will require documentation for a range of user groups. They will need to be regularly reviewed, improved and updated. Their usage will need to be tracked to ensure

they are providing value and meeting organisational goals. If they are not proving useful or creating value, they will need to be deprecated.

Clear permissions and rights of use for an API are also part of API product management (6Aika, 2017b). Once APIs are available as reusable components for workflows, products and services (either within government or exposed to third parties), users need to be confident that the API is available, performant and permissible: availability means that it is able to be found, for example, in a government's API catalogue and that it does not stop working unexpectedly; performant means that it feeds data or services in a timely and consistent manner; and permissible means that end users understand their responsibilities and have an appropriate level of security and authorisation to use the API functionality for their use case. For example, external users will need to know if they are allowed to use government APIs in a commercial product and will need to be strictly checked and authorised to access private or internal government data.

Few governments are resourcing and managing APIs in an ongoing, programmatic way at present. While there are some examples of mature APIs being delivered by

governments, the main issue at present is that, for some governments, creating and making APIs available is seen as a 'pilot' project that is not yet resourced rather than as a programme/product approach that is managed through ongoing and budgeted resources.

All government APIs should first be used internally. When identifying use cases for creating service and dataset APIs, internal use should be prioritised. That is, the API should be used internally to drive information flow or enable functionality within or between departments. This will help to ensure that APIs deliver value and that they are robust and performant.

Each API should define service-level objectives or expected standards of performance for internal stakeholders and, eventually, when opened to wider audiences, how they are expected to perform and be used when exposed to third parties. Service-level indicators can be used as measures to ensure departments are achieving their objectives or are addressing shortfalls when they are not.

APIs should be budgeted and resourced for ongoing use, including budgeting and resourcing for a product manager and associated tooling.

5.1.9. Measure policy impacts of application programming interfaces

At a tactical level, it is proposed that governments work with ecosystem stakeholders and across government to identify API activity priorities and to define the high-level value that is expected to be generated from the APIs being created (see proposal 5). Following this, at an implementation level, it is important to ensure that there are ongoing mechanisms that allow governments to monitor and measure that value. This monitoring can also ensure that no harms are inadvertently being introduced. As industry use of APIs has matured, analytics have been introduced to monitor the impacts of APIs. The three main types of metrics introduced for APIs are as follows.

1. Performance. Metrics for APIs were initially introduced to ensure that APIs were robust and performant. Uptime, security and response rate, for example, helped API technicians ensure that their service-level objectives were met. This is the most common form of measurement and is often carried out by businesses, as well as in government.

2. Strategic value. As APIs increasingly became recognised as a way for businesses to deliver on their strategic goals, key performance indicators were introduced to better measure API impacts on business goals, such as the ability to bring in revenue or to increase engagement with particular target markets. This is emerging in private industry as an important metric for ensuring that APIs are built with organisational value but there is not, as yet, a similar common approach within government.

3. Ecosystem impact. In line with a product management approach to APIs, alongside measuring the business benefits of APIs, new measures were introduced to ensure third-party adoption, for example measuring the time it took for a new developer to start using an API (referred to as the time to first hello world or TTFHW). Other measures included developer satisfaction and the likelihood of developers recommending an API to their peers (i.e. the net promoter score). These

metrics are often collected by both businesses and government, particularly by measuring adoption uptake of an API or by sharing examples of how the APIs are being used by external stakeholders.

Government API teams can measure these three types of metrics, but must also consider a fourth area: are APIs avoiding causing any detrimental impacts?

For example, when governments use APIs to expose large datasets to machine learning, they need to measure if the

resulting algorithms are introducing any bias that creates inequality or marginalises any particular population. Also, if APIs are being used to create new digital services, there is a need to analyse usage data and ensure that populations without digital literacy still have available forms of access to government services. Sharing external unrestricted APIs should also be carefully considered to create a fair digital economy that supports SMEs. Monitoring the potential for negative impacts of APIs should be an essential part of a government API policy impact measurement system.

5.1.10. Build application programming interface platform components

A key challenge for the European Commission when encouraging the uptake of digital government goals is to find the right balance between being overly prescriptive on technology choices and building common interoperability platform components, such as the CEF building blocks. The CEF approach reinforces the necessity to build standardised IT infrastructure components that can ensure interoperability and sustainability.

In the case of national governments, there are some cases that are developing in that direction. The Estonian government, for example, identified several necessary steps, including (Kütt, 2016):

- adopt an API-first policy of enabling things rather than providing things;
- take control of the architecture;
- build an authorisation solution to enable APIs to handle sensitive data;
- invest in data protection, audits and fraud detection;
- discuss with end users;
- treat open data as APIs;
- build open data into new systems;
- develop prototypes and reference architectures.

When needed, platform components should be built following more flexible and sustainable approaches, such as, for example, the REST architectural style. The Italian government's Digital Transformation Team has affirmed the use of RESTful APIs based on government experience and interaction with third-party users. In 2005, Italy created the SPCoop standard for interoperability in the public sector. This was a SOAP-based, four-corner integration approach, and, 12 years after its introduction, 200 agencies were able to deploy and afford this common infrastructure, while smaller organisations and cities were not. The largest

barriers to widespread adoption were the closed nature of this approach, that it required 1:1 contracts to be signed for each implementation and the fact that this 'mandatory infrastructure' was designed only around government-to-government use cases. The government reviewed the technical literature and noted that REST was the 'de-facto standard in the private market' and that various agencies started implementing REST-based APIs in 2013, which were opened to the private sector (Italian digital agency (AGID), 2018). They found this to be a successful pilot project, as REST was easier and cheaper to implement of the SPCoop solutions, and enabled engagement with private-sector actors. In 2017, this model became central to the Italian government's 3-year whole-of-government strategy, which included REST APIs written with OAS, where possible; market-driven API standards; iterative upgrades and versioning of government APIs; a public API catalogue; and self-serve access to appropriately secured APIs. The architectural model remains bimodal and allows existing SOAP services to continue operating (Piunno, 2017).

The Belgian government has created REST guidelines in recognition of the following factor: 'The main benefit for choosing RESTful services is to increase flexibility and to offer web service support to client platforms not able to communicate using SOAP web services' (Belgium Government, 2020). It noted that:

- REST is the de facto standard to communicate with web services from JavaScript and native mobile applications;
- while SOAP is strictly linked to XML and needs complex standards (a message transmission optimization mechanism, SOAP with attachments) to work with other media formats, RESTful services can support this natively;

- web service specifications added to SOAP are often overly complex;
- REST has become the industry standard for developing APIs on the web.

The Netherlands government has released an API strategy that states that the government ‘aims to describe a set of design rules for the unambiguous provision of RESTful APIs. This achieves a predictable government so developers can easily start consuming and combining APIs’ (Geonovum, 2019).

While governments may be challenged to mandate REST APIs for all government operations, best practices suggest

that developers should consider building new APIs using modern web standards such as the REST architectural style. Regular monitoring of existing legacy architecture can then calculate if there are any efficiency or cost gains that could be achieved by moving existing SOAP approaches to REST, or if this would introduce unnecessary costs.

Leadership governments are creating style guidelines that document internal practices and standards for the creation of APIs. These style guidelines often propose REST, the use of an API specification file, naming conventions, security requirements and approaches to versioning.

5.1.11. Appoint application programming interface product manager(s) and teams

After an API-as-a-product mindset has been adopted at the departmental level, department staff members will need to be appointed as API product managers to help decide resource allocation (see proposal 8 above). These product managers will be responsible for creating developer resources (e.g. documentation) and for ensuring that support for developers consuming the government APIs is delivered in line with service-level objectives. The product manager would work closely with the API technical lead to ensure that APIs can achieve the intended policy goals and match use cases. The product manager would implement processes to collect and report on metrics (see proposal 9). An API product manager could also assist with maintaining communications with the domain ecosystem of stakeholders (see proposal 6).

The optimum organisational structure within government for such an approach is not unique. For example, some governments have multiple APIs that are managed together by a service manager (i.e. someone who manages or ‘owns’ multiple APIs together by focusing on how they

work in combination as a whole). Also, a service manager could manage multiple APIs or an individual API could need a product manager. In any case, each department offering government APIs would need to appoint a staff member to be product manager for each API or group of APIs. Job descriptions, tasks and performance indicators will need to be prepared that reflect the product management duties to be performed.

The product manager should have overall responsibility for ensuring that APIs are discoverable, easy to use and documented, and see increasing adoption among those who can receive value from the APIs. The product manager works with technical leads and technical teams to ensure that APIs are performant, are used efficiently within resource constraints and maintain high security and data privacy standards. The product manager communicates with policy managers to identify use cases and new features, and monitors how the APIs are creating value in line with expected policy goals, without increasing detrimental impacts on communities and local economies.

5.1.12. Adopt an application programming interface life cycle approach

API life cycle management components should cover all API aspects, namely: strategy, design, documentation, development, testing, deployment, security, monitoring, discovery and promotion, and change management (Mehdi et al., 2018).

An API life cycle approach ensures that government APIs are built in line with best practices for authorisation and authentication, security, versioning and test-driven development.

API life cycle approaches also ensure that best-practice web development and software design is followed (Google, 2019). Moreover, API life cycle approaches ensure that API design matches policy needs and use case descriptions (through metadata specifications) throughout an iterative development cycle. API testing ensures that APIs function as intended and are robust and performant. API security and privacy measures can be included within the development stage and ensure that whole-of-government cybersecurity practices are followed (e.g. using the privacy-by-design principles documented in World Bank (2018)). Finally, API

life cycle approaches ensure that APIs can be monitored and maintained at the desired efficiency, sustainability and performance-level requirements.

Work on API design guidelines is one of the most advanced areas of API activity by governments worldwide. Several governments within Europe have defined their API life cycle approaches. Design (or style) guidelines, once agreed, can then be used by governance structures to assess new APIs and ensure that they meet organisational requirements (see proposal 3).

5.2 | Application programming interface framework self-assessment

The above API framework is proposed to support governments in continuing and extending their current API activities in a cohesive and structured manner. The framework seeks to assist governments in aligning to a broader policy context, introducing metrics that measure the value and impact of APIs, and making use of best practices at all levels of government work (including policy and strategy, tactical decisions and individual API implementation). Reorienting existing government work to make use of the proposed API framework raises two key questions:

1. How does a government department build on its own API-initiating efforts while also moving towards adopting government-wide best practices and a more cohesive model that aligns with the whole-of-government and with the local, national and international agendas?
2. How does a government continue its API activities but also move towards a more structured model that avoids duplication and fosters collaboration, reuse, interoperability and industry innovation?

To answer these questions, within the study, we created a self-assessment maturity tool. The tool lets governments track their level of maturity against the API framework and identify next actions to address any gaps. Maturity models are used by governments in the European Union and around the world to help guide a reorientation process towards new paradigms for government operations. In designing and developing this maturity tool, we have considered some of them, namely (i) the open data

maturity model (Cecconi and Cosmina, 2019), proposed by the European Commission; (ii) the DIGIMAT – eGovernment Maturity Assessment (CITADEL H2020 project, 2018), proposed by the CITADEL H2020 project; and (iii) the South Australian government's digital maturity assessment tool (Government of south Australia, 2019). These models aim to help governments assess their progress in transforming their key digital capabilities.

These three instruments each propose a set of dimensions by which maturity can be measured. A similar approach has been taken with the API framework maturity tool, which requires that government actions be aligned across the following dimensions:

- organisational infrastructure
- organisational leadership
- resource allocation
- skills
- metrics.

“ “ A self-assessment tool support governments tracking their level of maturity wrt the API framework and identify next actions to address gaps ” ”

The self-assessment maturity checklists provided by the tool are intended for the digital transformation policy and IT leader(s) of a government's digital transformation, digital strategy, digital government or interoperability agenda who need to align APIs with wider policy goals and prepare common IT architecture and platform components for delivery of APIs, open data and shared capability services across the whole of government. This/these leader(s) may choose to complete the checklists with the cross-departmental collaborative body champion or other members of their whole-of-government management team.

For each of the proposals, we have prepared a checklist of a maximum of 10 questions. Depending on the answer, a weighted score is assigned and totalled for each proposal. This overall score represents a self-evaluation of the degree of maturity that that government has with respect to the suggested proposal. The tool and the checklists have been extensively described in (Mark Boyd et al., 2020a) and published online (Mark Boyd et al., 2020b).

5.3 | Tools selection in application programming interface life cycle

This section describes the key technical considerations for governments when selecting API tools. These tools often reflect operational concerns and could be utilised as part of the implementation of proposals 11 and 12 of the proposed API framework, when taking an API life cycle and product management approach.

The API industry offers a wide range of tools that support every aspect of the API life cycle, including design, deployment, implementation and management. Some are proprietary, while others are free and open source. Some tools are tailored towards single API deployments, while others are built to facilitate the development of an organisation's entire API ecosystem⁽¹⁹⁾. As the API industry increasingly matures, governments may use a range of tools available to assist them in creating, deploying and managing APIs.

Several governments around the world have created technology codes of practice and procurement policies that guide them when selecting these tools and technologies for operational tasks⁽²⁰⁾. From our analysis of a set of documents about these practices, we have identified the following recommendations.

— General principles.

- **Choose tools that support agile and iterative development.** APIs should be deployed using modern software best practices, including version control and continuous integration. Tools that support APIs should therefore easily plug into a continuous integration and delivery pipeline (US Digital Service, 2020).

- **Default to open source.** Governments often make decisions to choose open-source tools whenever possible. Many companies offer products and services while the code they run on remains open source. Defaulting to open means governments can contribute back to the code to make the changes wanted, allowing internal engineers to understand how the tool works and maintaining infrastructure that is public, accessible and collaborative (Government of Canada, 2019b).

- **Choose modern, cloud-based and commodity tools.** A government's API engineering team should be able to work efficiently and an API should be able to scale quickly. Therefore, tools should be selected that are widely adopted by successful consumer-focused private-sector companies. Governments can seek to avoid vendor lock-in by choosing open-source, cloud-based and commodity products (Government of Canada, 2017; US Digital Service, 2020).

— API life cycle management tools should cover the following life cycle stages (Mehdi et al., 2018).

- **Strategy.** Like for other products, having a strategy for APIs is fundamental to guarantee that APIs are successfully adopted. In the API framework illustrated in Section 5.1, we have clearly identified how a government should proceed when adopting and implementing APIs. The framework suggests 12 proposals at three different levels for driving the activities of governments in their API journeys. In particular, at the strategic level, the framework identifies four main actions to be considered: (i) align

APIs with policy goals, (ii) define the government API platform vision, (iii) create API governance structures and (iv) form guiding principles for API processes.

- **Design.** When developing a new API, a design-first approach enables a team to focus on building solutions for end users from the beginning. A government's API life cycle should involve sketching out an API idea, designing resource and endpoint structures, and choosing response formats before beginning development. Lots of decisions must be taken when designing an API. At least the following aspects should be considered: semantics (e.g. vocabularies and data models), styles (e.g. protocols and patterns), interactions (e.g. the workflow of the API calls), safety (e.g. procedures to avoid use mistakes) and consistency (e.g. with other institutional APIs) (Mehdi et al., 2018). Tools exist to help design and prototype APIs, which allow engineers to write the API in a less technical language such as Markdown or YAML, generate interactive documentation and create mock servers, all without writing a line of code for the API itself.

Governments can engage with end users using these tools and can get early feedback on the design of APIs, with real users testing out the usability by reading the documentation and writing client code against the API. APIs can also be explained using an API definition (e.g. OAS, API Blueprint or RAML) and sharing that document with users for feedback (Mark Boyd, 2017a). The API definition can be used as the backbone for much of this testing. Incorporating an API definition in the design process enables to use that definition in later stages of the API life cycle, such as documentation and testing. Many tools also integrate into the continuous integration pipeline, so that the API can be tested as part of the build process.

- **Documentation.** A machine-readable API definition should be part of the documentation because of the ubiquity of tools helping developers use API definitions/metadata to discover, understand and consume APIs, and because that definition can be used for other aspects of API management such as design and testing. However, the documentation should not just be the definition file. Documentation represents the

learning experience for an API and therefore should also contain content explaining the context and purpose of your API, set expectations for versioning and support, and provide use cases or tutorials for getting started or achieving common workflows (Mark Boyd, 2017b).

Documentation is extremely important for discoverability purposes. Currently, many web registries, directories and marketplaces are available to allow API providers to describe their APIs and to let API users search for and use the APIs that fit their needs. At the moment, all of these initiatives are based on manual contributions from both the publishers (which have to expose and register their APIs) and the users (who have to search for and select the APIs they are interested in). However, to our knowledge, there is no automatic way for a final user to discover the right API that fits his/her requirements ⁽²¹⁾. Documentation is the key element that could allow current practices to develop towards a situation in which APIs are automatically proposed to end users by, for example, matching his/her research criteria.

It is important to note that documentation needs may be different for internal and external users, and should be created for each user type. For external users, documentation is just one part of the developer experience, which also consists of discovery and promotion, which are covered below. In a government context, it is often helpful for all users to make sure documentation includes context on policy and compliance.

- **Development.** The development of an API includes all of the decisions that a developer must take when implementing an API. This part is behind the interface the user of the API considers for the development of her/his application. Thus, it is invisible to him/her. To make the development of the API fast and flexible and so to be able to respond to user feedback and market needs, government engineering teams need to adopt good software development patterns, practices and principles, such as maintaining the 'separation of concerns', 'low coupling' and 'information expert' (Larman, 2004).

Code should be version controlled, with Git being the most popular version control system. Version control not only is a software development best practice, but is helpful for governments bound by

policy or legislation to keep archives of technology or content (Australian Government, 2019a).

The API source code should also be hosted on a platform that allows collaboration, team access and continuous integration. Continuous integration is the practice of automatically running tests, linters or other build tools with every change to code that is pushed to the source repository. This ensures that all new code is tested and adheres to the team's conventions and requirements (Victorian Government, 2020).

- **Testing.** The quality of an API strongly depends on it being tested. Tools must be selected to test the API on multiple levels, namely the following:
 - usability testing – identify usability issues in the interface, documentation and discovery;
 - unit testing – test the software code (both the interface and the implementation) itself;
 - integration testing – test the implementation and interface issues by invoking the API for each of the use cases;
 - performance and load testing – test the non-functional requirements of an API such as the simulation of the use of the API under particular conditions (e.g. a huge number of applications that call the API);
 - security testing – identify cybersecurity vulnerabilities in the interface, implementation and instance of the API;
 - production testing – identify usability, functionality and performance issues in the production environment;
 - standards and compliance testing – verify that the API conforms to standards or technical specifications, that can be required, for example, by a European Union directive.

This list is certainly not exhaustive, as lots of other tests could be performed in any software development life cycle. For example, in addition, some tests could be performed to satisfy formal agreements, such as SLAs.

- **Security.** As highlighted in this report many times, cybersecurity is the major risk when publishing APIs. A new 'door' is opened onto the assets and related IT systems of the institution that shares them through an API. Therefore, the management of security must be the first priority of the

institution that is implementing APIs. Security must meet the following goals: (i) protect the system, API client applications and end user from threats, (ii) guarantee that the API works for authorised and, when needed, authenticated users and (iii) protect the privacy of the shared assets (e.g. on personal data).

Meeting these goals not only is linked to technical solutions, but also requires a holistic approach that involves a decision-making process for all of the API life cycle aspects. In addition, it requires a cultural change towards a 'security first' mentality among all of the actors involved in this cycle.

- **Monitoring.** Once an API is live, government teams should carefully analyse and observe its usage and behaviour. Indicators of API use, status and security vulnerabilities should be regularly monitored. The metrics used to monitor API should include:
 - problems (e.g. errors, failures, warnings and crashes),
 - system health (e.g. the central processing unit, memory, input/output and container health),
 - API health (e.g. API uptime, API state and total messages processed),
 - message logs (e.g. request and response message bodies, message headers and metadata),
 - usage data (e.g. number of requests, endpoint/resource usage and requests per consumer).

As also observed in the 'Development' bullet above, an API gateway tool could provide a solution to collect, analyse and use many of these metrics.

- **Discovery and promotion.** Government APIs should be available in a single institutional portal or at least indexed in a single catalogue for discoverability. Multiple public-sector organisations and national governments require new APIs to be added to a central registry; this process can be done in many ways: manually by using specific API documentation editors or with more sophisticated and semi-automatic ways, such as a pull request in GitHub.

When making catalogues available, to facilitate the search, it is recommended that multifaceted searching functionalities be enabled that let the final user search, for example, by keyword, asset (e.g.

data), API provider, etc., as application developers often need to know the asset they are seeking but may not know the API provider responsible for publishing a particular API (Government of New Zealand, 2016).

As also observed above, documentation is key element to improve the discoverability of an API. However, only documenting an API might not be sufficient to make it discoverable by the right users. External registries and catalogues can be used to publish and advertise the existence of the API. In addition, adopting an internal discovery solution and utilising internal newsletters or events to promote APIs to other teams within the organisation may be helpful.

Making an API discoverable does not necessarily mean that developers will discover it: promotion is also a key part of an externally facing API strategy. Investing in a developer relations programme and assigning a dedicated developer evangelist role is incredibly valuable in ensuring government APIs are found and used. This includes identifying government projects and initiatives that can be related to the use of the API, collaborating in the publication of reports, speaking at conferences, hosting events, using the institutional social network facilities, building communities around the API (Van Hoytema, 2018) and getting coverage in the press (Mark Boyd, 2017c). APIs should also be promoted via additional actions, such as their

description with storytelling, and this will also promote them both internally and externally to the providing institution (see, for example, the work of Regione Lombardia (2020f)).

- **Change management.** An API is likely to need to change at some point in its lifetime and the chances are that some of those changes will be breaking changes (i.e. changes that require the client application to be changed). Usually, even if designed with great attention, an API must be changed or even deprecated for valid reasons, such as changing business requirements, industry standards or user needs. Iterating based on user feedback early in the design and development stage and appropriate management of the versioning of the API will help mitigate breaking changes that will be required later down the line. Principles to keep in mind when managing change (Government of United Kingdom, 2016) include the following.
 - Avoid backwards-incompatible changes whenever possible.
 - Use semantic versioning or only version major releases with backwards-incompatible changes. A good practice is to put the version number in the URL ⁽²²⁾.
 - Create new endpoints for significant changes.
 - Provide notices for deprecated endpoints.

5.4 | Legal aspects of application programming interface adoption in governments

In general, there is no legal framework specifically dedicated to APIs, but this does not mean that APIs function in a legal void. In considering the legal aspects relevant to APIs, in this section we look at the potentially applicable laws and analyse the arising issues, aspects, problems and/or questions from the API point of view. The frameworks and laws from areas such as privacy, cybersecurity, interoperability, standardisation and ownership seem to be directly relevant to APIs.

We highlight that legal and licensing issues are one of the most underdeveloped areas identified by the different methodological approaches, namely in the best-practice literature review, when analysing existing government API

use cases and in workshop discussions. Focused work is needed to identify the best models and approaches that governments should adopt to ensure a balance between enabling API adoption and minimising risks and adverse impacts from government API availability.

In [Section 4.3](#), we identified the legal aspects linked to privacy (i.e. sharing datasets via APIs that could contain private information of citizens and companies). We listed some solutions that can mitigate this risk, such as the Solid open-source platform and framework for application development (Middleton, 2018), AmDex (AmDex, 2019), the MyData initiative (MyData network, 2020) and the ethics group for data privacy (Tada community, 2020).

In addition, in [Section 3.3.2](#), we identified and analysed standard approaches to licensing. In this section, even for cases in which no particular legal approach was applied,

we highlight the diverse legal aspects of APIs from strategic, organisational/tactical and operational points of view (Jacobson et al., 2011).

5.4.1. Legal and licensing issues at the strategic level

As far as the strategic level is concerned, the alignment of different legal policies in the context of APIs should be considered. Binding laws on government APIs can help ensure the interoperability of APIs within a government's jurisdiction. Some Member States have already chosen legislation as a key enabler to ensure industry-wide commitment to API standards. Finland, for example, has established a law to ensure that transport providers all share data via APIs and has also enacted a law to oblige government services to share one IT architecture (Government of Finland, 2017).

Protecting personal data is one of the main concerns in the European Union. As presented in [Section 3.1.1](#), the European Union has regulated such data protection through the **GDPR**. When using APIs to share personal data among different parties, specific measures need to be implemented to record which parties have obtained these data. But APIs can also help in maintaining the consistency of this information among different information systems, as they can be used among the parties if information needs to be corrected or removed.

Moreover, the highly decoupled nature of APIs could be key to GDPR compliance as personal information begins to be shared both within and outside the boundaries of the European Union. Therefore, organisations should be looking to accelerate their plans to break their monolithic stacks into reusable API-led services (Berlind, 2018).

The EU has also leveraged legislative frameworks in order to manage its role as a regulator mandating the use of APIs. **PSD2**, as transposed and enforced by Member States, ensures that banks use integrative technologies (i.e. APIs) to open payments and account information services, in order to drive greater competition, facilitate

economic development and enable greater consumer choice (see [Section 3.1.1](#)).

In general, from an organisation point of view, legislating for the mandatory use of APIs is a strict approach that forces stakeholders to make use of APIs. In private industry, some API strategies have faltered in large enterprises because individual lines of business chose to take their own approach. This is often reflective of a business culture in which lines of business might compete with each other for enterprise resources, budget and internal influence. Whole-of-business API strategies have been most successful when a CEO has mandated that all lines of business must use internal API standards, when governance structures are established to guide whole-of-government action or when the management team has introduced key performance indicators for APIs that ensure each line of business reports on API progress (Axway, 2019). This mandated approach in private industry could be considered analogous to a government legislative approach that enforces the use of APIs by government departments.

From our interviews and workshops, we have observed that legislative instruments need to be accompanied by more specific resources to support the adoption of APIs. Governments mandating that specific internal departments must expose datasets and services using agreed API standards, as in Finland, often do so alongside providing support to make it easier for departments to follow this approach, with clear explanations of the value of doing so (Panebianco, 2019).

The successful implementation of API legislation is usually tied to providing incentives for private stakeholders. For example, in the United States, while healthcare agencies are legally forced to use API standards for sharing electronic health-care records, they also benefit from getting access to specific government funding programmes (Mark Boyd, 2016a).

5.4.2. Legal and licensing issues at the tactical level

At this level, legal tools can help oversee the allocation of resources to manage and implement APIs. In private industry, SLAs are used to create commercial arrangements

that reflect business budgeting processes. Individual lines of business may 'buy' the internal API services offered by other lines of business and agree to an SLA. The cost to one

department is compensated by penalties if the API does not match the SLA terms, such as agreed performance standards and the uptime level of access. This model is then also replicated with external stakeholders, whereby APIs are made available either to trusted partners and suppliers or more openly in an ecosystem model to any third party that pays for access.

APIs could require governments to work in new collaborative models to share data registries and shared services across government departments. A model in which departments ‘pay’ the department custodian via budgetary reallocation may be one way to understand the future requirements of new departmental funding models for a digital government infrastructure in which the reuse of API resources is prioritised and encouraged.

For example, the most recent Italian government IT plan has considered some of these issues and the relevance of SLAs for internal government APIs. As this model is still in its early stages, the government is implementing a model in which it focuses on service-level objectives (23). SLAs, as demonstrated by private industry, focus on penalty

schemes for deficiencies in performance and uptime, which can lead to the need for conflict models to resolve challenges in the availability of APIs.

At present, the majority of government-provided APIs available to third parties do not have SLAs that confirm what third parties can expect in terms of performance, availability, consistency and/or uptime. Governments are increasing their work in fostering ecosystems in which government APIs are made available to third parties. The lack of SLAs for government APIs may limit interest in adoption in the future. In addition, the lack of clarity on and confidence in businesses and non-profits making use of APIs can be considered a cost of external usage.

A product management approach to government APIs is encouraged in a number of best-practice documents (6Aika, 2017c). Product management tasks include managing service-level expectations by API consumers. New models for establishing, negotiating with, monitoring and reporting on service-level objectives and SLA with internal and external users should be adopted by governments.

5.4.3. Legal and licensing issues at the operational level

At the operational level, when making individual APIs available for consumption, terms of service agreements are required to ensure that API consumers are using government digital assets as intended. For internal government APIs, authorisation and authentication mechanisms should guide access to governments’ assets (e.g. datasets and fields within datasets) or rights of access, such as read-only or the ability to transact or edit data. Privacy (as required by the GDPR), citizen rights and other legal requirements can be ‘baked in’ to the APIs rather than documented in a terms of use agreement between internal government stakeholders (Poikola et al., 2015).

As far as the role of an API provider is considered, public organisations will need to ponder APIs in terms of both the resources they share among themselves and the assets (e.g. data) to which they provide access. This includes issues such as licensing and (personal) data sharing. Final API users (which could also include governments) will need to carefully examine these licencing issues but also their obligations in maintaining (personal) data-sharing requirements.

Government APIs that are exposed publicly may require, depending on their degree of openness (see Figure 7), licensing agreements at different levels: the data layer, the API source code and the API access layer.

— **Licensing data.** Regarding sharing APIs that expose internally produced open datasets, some government API catalogues specifically define the terms under which the data and APIs are available and accessible (6Aika, 2017d). Others have open data catalogues that have built-in, automated APIs available for each dataset, and these are often offered under blanket licensing terms that apply to all of the data portal’s underlying data.

Licensing API data collected by contractors can present additional issues. Several governments are currently facing challenges in historical contracts with third-party suppliers that are now able to collect data on government-funded service delivery without sharing the underlying data with the government contracting them. As a result, the contractor is able to create new services and products targeting citizens or businesses, or otherwise maintain a competitive advantage over

its competitors. Some city governments in particular are rewriting government contract templates to ensure that contracted suppliers make service data available via unrestricted APIs (Catapult – future city, 2018).

Licensing API data collected by private businesses using government infrastructure should also be considered. At a city government level in particular, several governments are introducing new requirements for emerging technologies to share data with the cities and the public via APIs (Hardinges, 2019). Contractors in transport and utilities often note there is a need for balance, as some of these data reflect competitive advantage or risk security exposures (European Commission, 2018h). Tourist apartment rentals, ride sharing, and scooter and other integrated mobility operators are, at times, required to share data on service usage with local governments. As Daniel Sarasa Funes from Zaragoza City Council stated at the APIs4DGov Paris workshop and information-sharing event, these providers are often fundamentally changing the dynamics of a city and, without licensing agreements for API-enabled access to data, city governments are unable to plan city amenities and safety (Sarasa Funes, 2019). At regional and national government levels, energy and utilities data will be increasingly needed to help plan and manage climate risks and ensure adaptation to climate crises.

- **Licensing the API source code.** In addition to the abovementioned approaches to managing terms of use, there is also the need to consider exactly what part of an API is being exposed. An API is an integration that enables a consumer to link to a resource. For example, when a government has published open data, an API can allow those open data to be integrated into an external system. However, this presents a challenge for API licensing. While the open data may have their own licensing arrangements allowing reuse, there is not necessarily any evidence to show that the API is not manipulating the data and changing the original dataset through the integration capability. Government publishers may consider opening the source code, or software, that defines how the API works or consider using APIs that have the source code openly released. This will ensure that end users can track what the API does and that the underlying dataset is preserved during the integration process and is not manipulated in any way at its source. This is also useful, for example, to check the content of AI algorithms in various fields, such as in e-democracy, facial recognition and autonomous cars.

There are a number of licences that can be used to release a software code (Open source initiative, 2020). For example, the European multilingual classification of skills, competences, qualifications and occupations has licensed the libraries or software that have been used to develop its API (European Commission, 2020j).

- **Licensing API access.** Because APIs often make data also available in bulk format, it may be necessary for APIs to have specific usage constraints in terms of service. This may be necessary to encourage the efficient use of APIs so that government data system infrastructures are not flooded with API requests for data and services, which would increase the costs of government infrastructure management. Open and free access to data and services may also inadvertently create market barriers for SMEs competing against global multinational companies and technology giants. Larger enterprises may have the resources to consume a greater API pipeline from government, which gives them competitive advantage to create products, such as machine-learning algorithms, at a faster rate, than local SMEs. While terms of use licensing agreements may need to differ depending on the legal jurisdiction, private and government stakeholders are seeking to create uniform approaches where possible. Across emerging markets, the World Bank's Consultative Group to Assist the Poor (CGAP) has published a guide on legal risks and concerns for financial service providers opening APIs to foster the creation of new financially inclusive services and products (Lovells, 2020). This guide recognises the European Union's GDPR and PSD2 legislative environments and makes recommendations for common terms of use agreements that could be used by providers, even in jurisdictions outside Europe. Similar work is needed for government agencies. The Swedish government has supported and funded a similar model and released an API licence template that can be used by all Swedish government departments when releasing APIs. The licensing template explains the valid uses of an API for external stakeholders (Swedish Governmental Agency for Innovation Systems, 2020). New risks are emerging in relation to APIs that may need to be considered when formulating terms of use. The growth of misinformation is a key concern for many democratic governments. Terms of use licensing agreements may, in the future, need to deny the use of APIs to those using data and services to spread misinformation. While this may be difficult to enforce, the licensing provision may give future prosecutors a new avenue to address misinformation agents.

Choosing a licence

A relatively complete collection of licences, and information on how to specify them in a structured way, is provided by the Software Package Data Exchange (SPDX) (SPDX Workgroup-Linux Foundation, 2019). SPDX is an open standard for communicating software bill of material information (including components, licences, copyrights and security references). The uniqueness of this approach is that it is possible to codify the appropriate licence in each module of the software code. It also reduces redundant work by providing a common format for companies and communities to share important data about software licences, copyrights and security references, thereby streamlining and improving compliance.

The European Commission provides a couple of assistants for choosing the right licence: the JLA and the EDP licensing assistant. The JLA is a tool that allows everyone to compare and select licences based on their content (European Commission, 2019h). The EDP licensing assistant provides a description of the available licences. It also gives an overview of how to apply licences as a re-publisher/distributor of open data and how to combine multiple licences (European Commission, 2020k). Creative Commons (Creative Commons, 2019b) also proposes a web tool that allows the user to select the appropriate Creative Commons licence. The user can specify many licence features, including sharing adaptation of the work and allowing commercial use of the work. The system returns the licence that best fits the user's needs (Creative Commons, 2019a).

Regarding open-source licences in particular, a community of GitHub developers has proposed a guide for understanding the legal implications of open source and explaining which open-source licence is appropriate for a specific project (GitHub, 2019b). In addition, GitHub supports developers in choosing an open-source licence for their source code (GitHub, 2019a). The website does not provide a comprehensive directory of open-source licences but instead lets the user choose from a set of the most commonly used software licences and has an appendix that allows the list of licences it proposes to be checked.

The Open Source Initiative proposes a set of frequently asked questions that help the user to choose the right licence from a set of open-source software licences. Questions are related to choosing the best open-source licence and how to apply the source licence to the software released. It also gives some advice on what to do if the user violates a copyleft licence and on the meaning of 'contributor agreements' (Open Source Initiative, 2019).

The Free Software Foundation recommends steps for and illustrates differences when choosing licences for software developer work. It recommends choosing different licences for different projects, depending mostly on the software's purpose, and in particular for small programs, libraries and server software (Free Software Foundation, 2018).

WHERE GOVERNMENTS SHOULD PRIORITISE APPLICATION PROGRAMMING INTERFACES

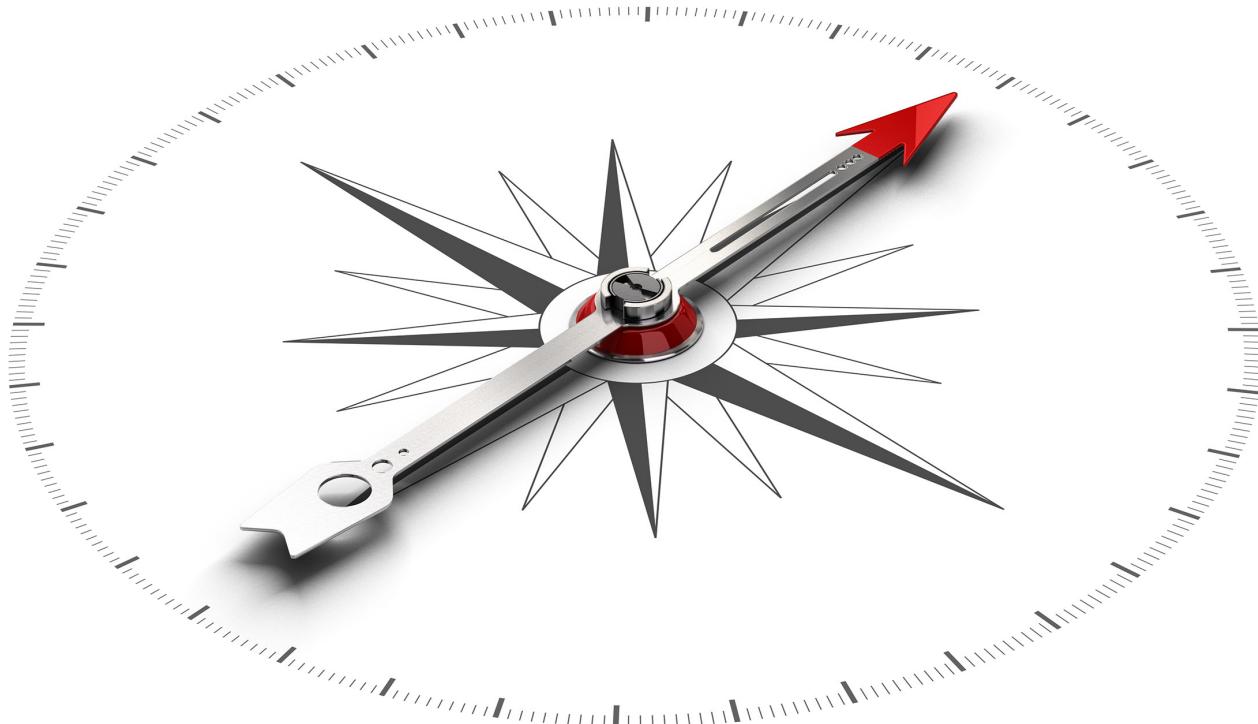
SUMMARY

APIs are a general purpose, domain-neutral technology that support the machine-to-machine exchange of data and services in digital governments. They can be applied to a huge number of thematic areas and can support many technological domains.

The European Commission broader policy goals highlight the need for priority setting for APIs. Policy directives such as the Open Data Directive are explicit about ensuring that 'high-value' datasets be treated as priorities. These 'high-value' datasets comprise the following: geospatial, earth observation and environment, meteorological, statistical, company and company ownership, and mobility datasets. In addition, the communication *A European Strategy for Data* announced the creation of sector- and domain-specific 'data spaces' in the following areas: industry (manufacturing), the green deal, mobility, health, finance, energy, agriculture, public administration and skills. These sectors should be treated as priorities when moving towards an API-enabled infrastructure for government. Particularly, for key high-level priorities, any opportunity to build APIs that help achieve the related policy goals should be considered.

To be noted that health APIs have been largely adopted but it must be considered that prioritising health as a domain for API activity will require specific measures to strongly protect citizens' privacy, implement cybersecurity and adopt correct licensing systems.

As regarding the technological domain, emerging and early adopted technologies or, currently, disruptive technologies (even if well known) that use APIs to perform and reach their goals include AI, autonomous things, the IoT, big data, smart cities, citizen science, blockchain and microservices.



⑥ WHERE GOVERNMENTS SHOULD PRIORITISE APPLICATION PROGRAMMING INTERFACES

6.1 | Thematic areas

Existing and recent European Commission policies show an increasing move towards working in an ecosystem model, in which internal stakeholders collaborate across European Union institutions, European Commission directorates, individual governments and departments, and external stakeholders, including private-industry, research and community groups. There is an increasing need for ecosystem approaches, given the need for much more collaborative action, to implement the programme of work outlined in the Commission priorities (European Commission, 2020l) and also in the light of the need for environmental protection and the recent health emergencies.

Two key European Commission policy documents, in particular, highlight the need to leverage domain-level ecosystems. The Open Data Directive focuses on internal government (public-sector) datasets and explicitly sets out that the use of APIs for 'high-value' and dynamic datasets is mandatory (European Union, 2019a). 'High-value' datasets include geospatial, earth observation and environment, meteorological, statistical, company and company ownership, and mobility datasets. In addition, the communication *A European strategy for data* announced the creation of sector- and domain-specific 'data spaces' and focuses on the interplay between public, private, research and community datasets. The data spaces

include those in the areas of industry (manufacturing), mobility, health, finance, energy, agriculture, skills and public administration (European Commission, 2020a).

Even though this report focuses on government APIs, which mainly share government digital assets, all of these sectors must be treated as priorities when moving towards an API-enabled infrastructure for government.

The study identified some overlapping domains that will require collaborative action to reach governments' goals. Therefore, we consider these domains in our list of thematic areas, which we classify into two categories: 'transversal' thematic areas, which cover and can be used in many societal sectors, and 'vertical' thematic areas, which cover specific societal domains.

6.1.1 Transversal thematic areas

Besides the provision of digital public services and the publication of government open data, the prioritisation of APIs should focus on the areas illustrated below.

Smart Cities

From the analysis we have conducted, we have identified web APIs implemented by a number of cities, and networks of cities, around the world. We have strong evidence that APIs are a fundamental building block in supporting smart cities in publishing open data, in providing better digital public services, in making flexible and interoperable digital government platforms and in improving the digital economy of countries, regions and cities. They also provide mechanisms to guarantee the ethical use of personal and private data, and they help to fight against cyberattacks.

The JRC's Future of Cities initiative identifies the challenges influencing the future of cities in Europe and beyond. The main aim is to raise open questions and steer discussions on what the future of cities can, and should be, within both the scientific and the policymaker communities. Examples from the associated publication suggest that web APIs have been implemented by a number of cities, and networks of cities, around the world (Vandecasteele et al., 2019; European Commission, 2020m).

Relevant examples from the abovementioned initiative include the cities of Helsinki, Santander and Madrid. They shared with us their experience (European Commission, 2018f), which is summarised here.

- The city of Helsinki, which is part of the OASC community and the 6Aika strategy for sustainable urban development, highlights the role of APIs in increasing interoperability and supporting the OOP, open data initiatives and data catalogues.
- For the city of Santander, which is part of the Synchronicity IoT network of 49 cities in Europe, the publication through APIs of data coming from the IoT can be an important contribution to data markets within the broader European DSM.
- The Madrid Mobility Lab ecosystem of APIs and portal brings information to citizens through multiple channels and transportation applications for buses, parking, public bicycles, traffic levels, city hall sensors, third-party sensors and data. The case of Madrid also shows interesting non-financial benefits, such as the ability to use data from sensors to inform citizens about the levels of pollen and other allergens that exist on various transport routes, thus enhancing people's comfort and health when on the move.

“ Specific sectors must be treated as priorities when moving towards an API-enabled infrastructure for government ”

Geospatial

Motivations for public-sector organisations to publish and consume APIs may be linked with geospatial data sharing and related developments. Among all public-sector data that can be made available through APIs, geospatial data may be particularly important as Geospatial data are, together with statistical datasets, the ‘backbone’ of datasets in the public sector. There are particularities of geospatial data due to their means to integrate, and be integrated with, data from other sources and their means of providing complementary information that other data sources or processes would not be able to do, or would do so somewhat inefficiently. This can be seen from the perspective that ‘everything happens somewhere’ and can be represented in information systems for analysis and presentation, for example through geographical information systems.

The INSPIRE Directive identifies 34 main themes that datasets throughout the European Union Member States need to address in a harmonised way to implement the directive (European Union, 2007a). The INSPIRE geoportal (European Commission, 2020g) shares thousands of datasets gathered from each EU Member State. The deployment and exchange of spatial web services operated by the Member States of the European Union are at the foundation of INSPIRE. Because of the latter, increasing numbers of research projects have been performed at the JRC to consider APIs as a central building block not only for the future of INSPIRE itself but in general, for the evolution of spatial data infrastructures, as they allow for better data-sharing practices in terms of availability and accessibility (Kotsev et al., 2018; Lutz et al., 2019).

The ELISE action, also part of the ISA² programme, is a package of legal, policy, organisational, semantic and technical interoperability solutions to facilitate more efficient and effective cross-border or cross-sector digital public services and processes involving location information and the insights gained from that information (location intelligence) (European Commission, 2016j). Combining layers of location data and other data provided via APIs can provide powerful use cases. For example, knowing the location of an individual or device connected to the internet (or via another locational tracking system, e.g. a global positioning system (GPS)) is now commonplace. The known location can be associated and combined with geospatial, meteorological and sensor data to enhance both administrations’ and citizens’ interactions with the world around them. Location intelligence, which combines

the use of analytics, geospatial information and location-based services, has many use cases in government (Williams, 2018).

Another example of such data sharing can be seen in Eurostat’s map services via the data distribution API of the geographical information system of the Commission (GISCO). This service allows any user (public services, policy units or external developers) to use these data in combination with their own data to help display those data on a geographical base or produce new data products (European Commission, 2020n).

Geospatial data are also particular in their potential relevance for decision-makers. In some instances, access to real-time and up-to-date geospatial data can be pivotal in reducing the ‘uncertainty of decisions’ by visualising the extent of a phenomenon or supporting the management of particular events, such as a natural disaster or major man-made incident. For example, the European Facilities for Earthquake Hazard and Risk (EFEHR) provides its data and documentation for APIs and web services, allowing users to build their own applications directly on top of them (EFEHR, 2017).

Geospatial data may also power online services, whereby data and mapping APIs are integrated into many online services, offering users relevant local information related to the services they consume. Some common examples include parking applications for citizens (e.g. parking space availability), checking the availability of retail items in certain locations and checking the location of specific shops.

Significant work has been identified on managing open geospatial data as APIs in the public sector. The OGC API family of standards is being developed to make it easy for anyone to provide geospatial data to the web. These standards define resource-centric APIs that take advantage of modern web development practices. During the 2019 Inspire event in Helsinki (Inspire Helsinki team, 2019), the trend was to move from the traditional geospatial services required some years ago by the INSPIRE Directive (European Union, 2007a) to the new API specifications proposed by the OGC (OGC, 2020).

Geospatial APIs are also used significantly in the private sector. One of the most popular examples are the APIs

provided by Google, which are now used by a large number of applications, as also indicated by the number of developers (currently 2 574) that follow them in the ProgrammableWeb directory (ProgrammableWeb.com, 2020b).

Geospatial APIs are also used in geospatial communities. The OpenStreetMap initiative has also counted many

developers who use APIs to access and update the OpenStreetMap datasets (OpenStreetMap foundation, 2009), download datasets (OpenStreetMap foundation, 2020a) or investigate usage statistics (OpenStreetMap foundation, 2020b).

Statistics

Many public-sector statistical institutions make their datasets available via APIs. The European Commission Eurostat data contain many indicators (short-term, structural, theme-specific and others) on the EU-28 and the euro area and the Member States and their partners. The Eurostat database always contains the latest version of the datasets, meaning that there is no versioning on the data. Datasets are updated twice a day, at 11.00 and 23.00, in case new data are available or because of structural change. The JSON and UNICODE Web Services offer programmatic access to Eurostat data, with the possibility of downloading a subset of a given dataset. This operation allows requests for data to be customised, whereby a user can filter the data based on certain dimensions to retrieve specific data subsets (European Commission, 2020o). Grazzini et al. (2019)

highlight that ‘the proposed approach revolves around the provision of “Do-It-Yourself” (DIY) services on top of open data (e.g., disseminated through online database, web-services and/or REST Application Programming Interfaces’).

The creation of APIs that assist with improving the analysis of different outcomes based on socioeconomic background should be prioritised. For example, some jurisdictions, such as Victoria in Australia, have aligned high-value datasets with their government policy priorities and distributed them via APIs. In Victoria, this includes being able to analyse data by the gender of populations to ensure that goals to address violence against women are maintained across all government action areas.

Citizen science

Citizen science, powered by a series of digital devices, offers an effective way to connect citizens and policymakers. Citizens can get involved by taking part in science-related processes and by understanding and guiding the changes taking place around them. The potential benefits that citizen science can bring to policy formulation and implementation range from providing evidence for assessments and supporting regulatory compliance to community empowerment and awareness raising. In the environmental policies domain, for example, the number of citizen science activities is huge, covering an extensive range of policy areas and being implemented in many parts of the world (Nascimento et al., 2018). At the European Commission, a partnership between the Directorate-Generals for Environment, Research and Innovation, Eurostat and Climate Action, the European Environment Agency and the JRC particularly addresses the relationship between people and data (European Commission, 2020p).

The JRC is also examining the use and practices of citizen science for EU policies (European Commission, 2019o). This initiative aims to contribute to the understanding of possible roles of citizens and the (power) relationships that are emerging owing to data governance and the ongoing digital transformation of society. While keeping a holistic view across the different possible types of citizen-generated and citizen-contributed content, this work should help to advance our understanding of people’s intentional engagement in authentic scientific investigations (citizen science) and the possible interplays of this with European policy. One of the recommendations resulting from the workshops organised by the participants (citizen science practitioners with experience in mobile application and web platform development and implementation) was that, in governments, ‘platforms, portals and apps should have an API to share data, and API standards should be followed where possible’ (Sturm et al., 2018).

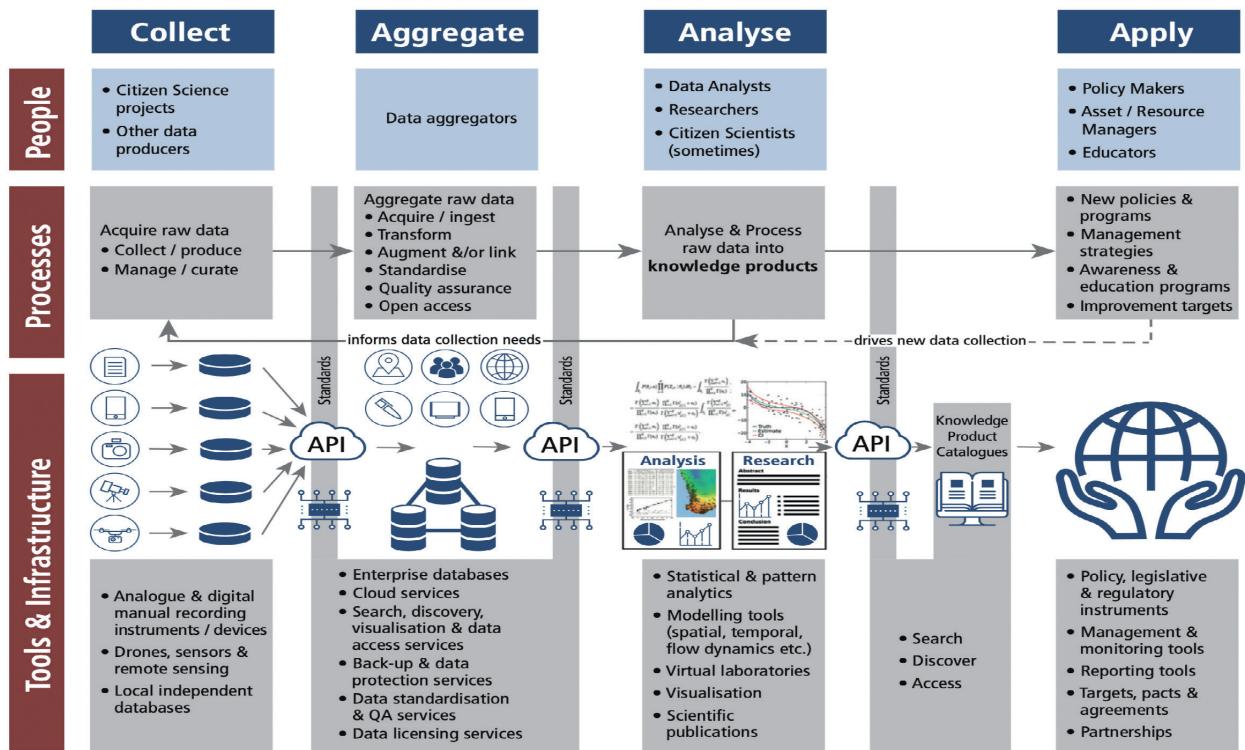


FIGURE 25: A conceptual model for a digital information supply chain.
Source: Brenton et al. (2018).

The JRC has also launched a web community page on citizen science, which includes the identification and development of methodologies and tools that connect citizen science with selected policy areas and demonstrates their use and usefulness in the different phases of the policy cycle (European Commission, 2019o). One of the JRC projects within this initiative is MYGEOSS (European Commission, 2016k). MYGEOSS has developed a mobile application for monitoring alien species. It investigates the use of the app in the field and the validation processes required to allow it to feed data into the official European Alien Species Information Network (EASIN) (European Commission, 2020q).

Applications like MYGEOSS rely on a series of distributed networks of information that must be supported by a proper IT infrastructure. Historically, data generated by citizen science projects were often used only within the context of the project for which they were collected.

Public sector

This thematic area is quite large, as it could easily include all of the APIs that are discussed in the other thematic areas. However, within this area, it could be useful to restrict attention to the APIs that share digital assets specifically related to public-sector administration. These APIs can contribute to

Because, nowadays, projects on citizen science (as well as others) gather and aggregate data from many and heterogeneous sources, IT infrastructures that support citizen science in a broader and distributed context need to be considered. Brenton et al. (2018), for example, propose an infrastructure based on 'a conceptual information supply chain model in which citizen science projects are involved in data acquisition and analysis processes' (see Figure 25).

Data and procedural standards provide a common language that allows similar information from disparate sources to be efficiently aggregated and exchanged, thus giving raw data potential value, utility and impact beyond the purpose for which they were originally collected. APIs provide a simple mechanism for exchanging data between different electronic systems, facilitated by growing access to high-speed internet technologies (Brenton et al., 2018).

enhancing the dissemination of these digital assets (and thus to improving transparency, accountability and trust), to addressing law enforcement needs, to supporting the effective application of EU law and to enabling innovative 'gov tech', 'reg (compliance) tech' and 'legal tech' applications.

This report has already given some mature examples of the use of public administration data for improving accountability and enabling new ‘reg (compliance) tech’. In particular, the OSF’s use of APIs to display local government budgets and expenditure to enable transparency has been detailed in this report. Another example involves tax systems. Globally, tax systems around are moving towards API-first infrastructure to enable automated financial reporting by businesses and citizens. While the goal is to reduce friction and automate tax reporting, additional benefits include a reduction in corruption and fraudulent tax reporting and a reduction in government costs in auditing and regulation (OECD, 2019a).

It should be noted that governments have also begun experimenting with using APIs to expose decision-making processes. In law enforcement environments, for example, the use of facial recognition AI will require an underlying API infrastructure (European Commission, 2020r). For example, the Innovative Public Services project is a joint activity of the Directorate-General for Informatics (DG DIGIT) and the JRC, run as part of the framework of the innovative public services action of the ISA² programme. Its purpose is to gain an understanding of the innovation potential and framing conditions of emerging disruptive technologies such as blockchain and

distributed ledgers, AI- and IoT-related infrastructures, and technological solutions and platforms that are already at a mature stage in the private sector, such as APIs (European Commission, 2018d). In this way, it aims to better assess the impact of these features, namely if they lead to more efficient and improved public services and improved interaction between governments, citizens and business.

Another JRC initiative is the Digitranscope research project (2018–2020), which was established at the JRC Centre for Advanced Studies, focusing on the governance of digitally transformed human societies (European Commission, 2018i). The project has two main streams of work related to the following questions: Is there a European-specific pathway to digital transformation and, if so, what should it look like? What are the new forms and scales of governance enabled by digital transformation? Digitranscope contributes to the EU policy agenda by studying the different data governance models emerging for sharing data between the public sector, the commercial sector and civil society. It also analyses different ways in which the value generated through the integration and analytics on these data is distributed among the stakeholders, which can also be enhanced by the use of APIs (Micheli et al., 2019).

6.1.2 Vertical thematic areas Health

Health is a complex domain area that requires managing the consumption of data, heightened security as regards access, standardisations to ensure interoperability, and regulation. Personal healthcare records, for example, which often start as written notes in a doctor’s office or on an ambulance form, need to be passed to diagnostic testing professionals, back to primary care physicians and on to insurance agencies, then specialists, then allied healthcare professionals. These records are then integrated with data from medical and fitness devices and used in hospital discharge or to fill prescriptions (Mark Boyd, 2015).

Some governments are experimenting with making data and content available via APIs for health benefits. For example, the Victorian government in Australia notes that it is unable to provide all niche diabetes information services to all populations in the area. By opening up health information content and research data via an API, the government is allowing innovators to create additional digital resources specifically targeting

subpopulations with specific needs. Such resources are often beyond the resourcing capacity of governments, but allow niche market entrants to either provide a commercial offering add to existing work by working with community groups to serve specific population needs. Government-provided healthcare information that is available via APIs acts as a raw input for the creation of the digital product.

In 2015, US government policy advisors Huckman and Uppaluru noted in the *Harvard Business Review* that ‘Efforts to “liberate” health care data for third-party applications have progressed slowly, because the sector lacks the robust APIs and app developer programs common in other industries’ (Huckman and Uppaluru, 2015). This is often still the case today. They noted a range of beneficiaries of health APIs, including:

- patients and caregivers, who benefit from interoperability and easier access to services, as data are shared with appropriate health professionals;

- healthcare providers, who can create innovative solutions on top of common healthcare data;
- researchers, who can engage in citizen science or analyse health trends using large population sets of anonymised data – this already occurs with the use of privately held data; for example, social media API feeds and bulk search results can help epidemiologists identify routes of transmission and exposure (Fung et al., 2015).

The health domain draws in elements from economics, policy and regulation. Regarding economics, in this section, we have briefly presented the healthcare domain as an example of the economic value that can be generated through governments taking a regulatory role.

From a policy perspective, the European Commission's *Recommendation on a European Electronic Health Record exchange format* (European Commission, 2019l) proposes the use of APIs to share health records across various systems. Globally, work is progressing on defining standard APIs for electronic health record exchange as part of the FHIR initiative. This would enable interoperability of health data when a citizen consents to his/her health records being shared between service providers. The European Commission has recommended that API standards be investigated as a priority mechanism for the sharing of data automatically. In addition to the emergence of API standards, which can be pursued at the European

Commission and Member State levels, some jurisdictions have also created social service catalogue APIs that track the availability of related health and community services and eligibility criteria. These APIs could, in the future, interact with health data to automatically allocate services to citizens in need. This has implications for AI and machine-learning initiatives and ethical algorithms will need to be developed whereby, if APIs feed data into such resource decision-making systems, rights of appeal and insight into the decision-making processes are clarified.

From a regulatory perspective, global challenges in using APIs for health data are creating new concerns. In the United States, large technology giants have made agreements with healthcare providers with limited citizen consent, with large tracts of individual health records being shared via APIs (Pilkington, 2019). The US National Public Radio (NPR) also reported on the danger of private providers, such as dating apps, exposing health data of their users (including HIV status data, which are shared openly with third-party partners in some apps), while fitness applications apply a range of terms of use that may result in health activity data being shared with third parties (NPR.org, 2018).

Therefore, prioritising health as a domain for API activity will require specific measures to address interoperability priorities, ecosystem priorities and regulation for managing emergent technologies, but also to strongly protect citizens' privacy and adopt an appropriate licensing system.

Earth observation and environment

This domain would align well with European policy-wide priorities, particularly the green deal, which recognises that European policy must address the single greatest issue facing society today: the impact of the climate crisis, which is seeing increased temperatures and more extreme weather events, more population health challenges and the depletion of available energy and production resources. The European Commission's green deal (European Commission, 2020s) recognises the importance of Europe becoming a carbon-neutral continent by 2050 to avoid the 'greatest challenge of our times': the risk of major catastrophic impacts from the climate crisis. Given the gravity of the potential negative impacts of the climate emergency, governments must consider the potential to use their full operational resources in new ways. APIs represent one opportunity to use an enabling technology to support these wider policy goals.

Such a move would also align well with proposed actions outlined by the UNEP, which proposes the creation of a digital data ecosystem supported by common APIs to drive data collection, sharing and exposure (David Jensen and Campbell, 2018). The UNEP has also published a discussion paper on building a digital data ecosystem to encourage new global collaboration using real-time evidence of environmental impacts in order to better address climate crisis needs. The UNEP's discussion paper highlights the potential of leveraging APIs to encourage knowledge sharing and reduce duplication. It recognises that 'compliance with open APIs and other emerging standards is important. For this reason, all actors contributing to the digital ecosystem will be obliged to publish information on the infrastructure they are using together with information about their open source and commercial software' (David Jensen and Campbell, 2018).

Satellite data are one of the main assets in reaching these goals. APIs are important for accessing worldwide satellite data, such as the data published by the Copernicus programme (European Union, 2020b). The Copernicus Open Access Hub provides complete, free and open access to Sentinel-1, Sentinel-2, Sentinel-3 and Sentinel-5P user products, starting from the in-orbit commissioning review (IOCR). Sentinel data are also available via the Copernicus Data and Information Access Services (DIAS) through several platforms. The API Open Access Hub is recommended to those users that access Copernicus data on a regular basis (ESA, 2020). As part of the EU's Copernicus earth observation programme, the European Centre for Medium-Range Weather Forecasts (ECMWF), the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT) and Mercator

Ocean have joined forces to implement a DIAS platform called WEkEO (ECMWF, 2019) that offers appropriate APIs to access its data and services (European Union, 2020c).

There is also major potential in the use of data to support of the green deal priority actions on climate change, the circular economy, zero pollution, biodiversity, deforestation and compliance assurance. The UNEP's paper on creating a digital data ecosystem is also highlighted in this report's shortlist of best-practice documents, given the role that APIs will play in ensuring the flow and exchange of data to enable action in this priority policy area.

Earth observation and environment APIs and data are also closely aligned with energy APIs and data, as discussed further below.

Mobility

Public transport data are often one of the first real-time, dynamic datasets opened as an API (Mark Boyd, 2014). There are many examples of governments offering various kinds of APIs in the transportation domain (Vaccari, 2020), all for many different reasons. Traffic congestion data and related transport datasets including on parking bays are often opened, although more work could be done to open traffic congestion data that are aligned with air quality impacts. One of the biggest challenges for many cities is that mobility data are increasingly owned by private companies and technology giants including Google, as well as start-ups in ridesharing and electronic scooter and bicycle sharing, that do not then share data with cities, creating an uneven view of key city urban planning challenges (Sarasa Funes, 2019).

Our case study on the transport in the city of Madrid (EMT) was specifically selected within this domain. The EMT is an ecosystem of APIs and a portal bringing information to citizens through multiple channels and applications for transportation-related APIs such as buses, parking, public bicycles, traffic, city hall sensors, third-party sensors and data. One of the key findings of the case is its success in the economic value created by the adoption of APIs (see [Section 4.1](#)).

Transportation is also one of the FIWARE interoperability data models, which adopts NGSI for linked data APIs to exchange information among data providers and consumers (FIWARE Foundation, 2020).

Meteorological

While they are closely linked to earth observation data, it is worth mentioning meteorological data specifically. Meteorological data are often already exposed as APIs, driving the creation of a consumer app economy. Weather conditions have an impact on nearly every area of our lives, including commutes to work, other travel and our health and safety. Thanks to satellites, radar, remote sensors, our own mobiles and other weather-monitoring technologies (e.g. national weather service alerts), we now have a better understanding of weather conditions and phenomena. APIs allow applications to connect to large databases of weather forecast and historical

information and also to smartphones with built-in GPS. Thus, we have access to mobile applications that provide hour-by-hour forecasts, severe weather alerts and other relevant weather information for just about every place we go. There are many examples of private-sector APIs available on the web (RapidAPI, 2020). However, the public sector also represents a good source of information to be incorporated in applications via APIs. For example, the ECMWF produces and disseminates weather forecast data for the national meteorological and hydrological services. Its web API enables data to be programmatically requested and retrieved from the ECMWF data archive

for use in web, mobile or desktop applications (Setchell, 2019). However, there are also some initiatives at the local level, such as the one of Regione Lombardia, that

require a specific agreement to be accessed (Regione Lombardia, 2020g).

Agriculture

Agriculture data and APIs can enhance the sustainability performance and competitiveness of the agricultural sector through the processing and analysis of production and other data, allowing for the development of precise and tailored applications of production approaches at the farm level. APIs will be an essential component of such systems in order to draw in real-time data feeds from a wide range of sources (including weather, pesticide use, IoT sensor

data for soil and air, produce market prices and equipment availability, among others). Some national governments are already prioritising agriculture as an area for API-first approaches, as described in this report in the example of API-AGRO, illustrated in section 4.1.5. Emerging start-ups across Europe are also leveraging FIWARE's NGSI API CEF building blocks to create agricultural products (Rodriguez et al., 2018).

Energy

Energy data and APIs can promote a stronger availability and cross-sector sharing of data, in a customer-centric, secure and trustworthy manner, as they can facilitate innovative solutions and support the decarbonisation of the energy system. It has been suggested that the knowledge gained from leveraging APIs to open highly regulated, consumer markets such as banking can be used to drive similar models in energy. For example, the availability of identity verification and customer onboarding systems via APIs can enable greater utility switching among the market and enable consumers to move towards more sustainable energy providers more quickly. Access to aggregated energy consumption data via APIs, when used in apps, has also been shown to be effective in reducing household energy consumption. APIs can be an enabling technology

in helping EU Member States reach decarbonisation goals by enabling open innovation (allowing a variety of organisations to better work together to support a transition to a low-carbon energy system); by creating new approaches to optimise increasingly complex (and decentralised) energy networks; and by creating better outcomes for consumers by encouraging innovation in the marketplace, through the delivery of new products and services. To date, one known example in Europe is the Finnish government's public-private enterprise Fingrid. It has created APIs for the energy sector, releasing real-time feeds for a range of electricity consumption datasets, including the use of renewable energy, and has forecast usage patterns (Fingrid, 2018).

Companies and company ownership

These datasets will be imperative for the European Commission and Member States to ensure that SMEs are supported through policy action. In addition, work on open business registration and tax services via APIs will require alignment with company data. Company ownership data are an important dataset for transparency and anti-corruption, as evidenced by the work of key agencies such as OpenCorporates, which shares its own APIs (Opencorporates, 2020)

Some Member States also offer this kind of API. This is the case, for example, of Estonia, which offers a company

registration API and a set of X-Road services that, upon implementation, enable users to submit applications to the business register for establishing a private limited company through a simplified procedure (Government of Estonia, 2020).

This domain overlaps with the public administration API and data domain area in two significant ways: they both work to avoid corruption and promote transparency and they both enable automated taxation and other regulatory oversight to be managed optimally.

Industry (manufacturing)

To support the competitiveness and performance of the EU's industry, ecosystem work in this domain would better capture the potential value of use of non-personal data in manufacturing, which is estimated to be EUR 1.5 trillion by 2027 (European Commission, 2020a). It will be crucial that APIs help manage the flow of information in industrial and manufacturing spaces. In the study examples were found of APIs already being used to help manage manufacturing processes. For example, the European Chemicals Agency uses APIs to share data among industry and government stakeholders

on the use of chemicals that potentially have hazardous impacts. Often, these APIs are created for one-off use cases. Work to ensure IoT API standardisation, the use of APIs in autonomous things technologies (both discussed below) and the availability of FIWARE interoperability building blocks could be the backbone of an effective industrial data space. Under strategies proposed in the European green deal, there will also be a regulatory role for governments in supporting industry to move towards cleaner manufacturing processes.

Financial data

Financial data can stimulate, through enhanced data sharing, innovation, market transparency, sustainable finance and access to finance for European businesses and a more integrated market. Governments are beginning to take steps towards opening finance ecosystems following the initial successes of PSD2. The PSD2 initiative has encouraged global action to open banking and financial systems so that more stakeholders can offer secure digital financial products, and has inspired other countries to create similar regulations (Mehdi and Boyd, 2019). Canada, Israel, Mexico, New Zealand and the United Kingdom are all currently considering open banking and finance models (Muir, 2019).

In an open finance approach, financial services and other stakeholders open up financial services and data via APIs in a way that enables new products to be built. It is similar to the open banking model of PSD2, but encourages integration of services and data between other financial actors. This has proven effective in emerging markets in creating new financial inclusion opportunities and assisted in enabling third parties to create consumer-facing and small-business-facing financial products that help users to generate savings, apply for loans and/or create wealth (Consultative Group to Assist the Poor, 2020). Already, some examples from transport ticketing are emerging in which commuters can pay for parking, public transport travel and venue entry tickets when planning their travel routes (Almeida Santos, 2018).

Skills and employment

Skills and employment APIs and data can reduce skills mismatches between the education and training system, on the one hand, and labour market needs, on the other. The API catalogue and portal of the French governmental agency Pôle emploi is an excellent example of how governments can act as a central repository for both training and employment data in a single platform. Emploi's

model seeks to share API from datasets owned by external partners in the education space. This enables partners and external stakeholders to create new products, services and calculation methods to address disparities between labour market needs and the workforce population's skill sets (Pôle emploi, 2020).

6.2 | Technologies

In this section, we will give a short overview of the advantages of a selected set of emerging and early adopted technologies or, currently, disruptive technologies (even if well known) that use APIs to perform and reach their goals. As in the rest of the document, the focus here

is on government API adoption. Nevertheless, some of the areas identified in the previous section (e.g. the geospatial domain) have been considered, and those technologies can be used to support the new industrial strategy of Europe: AI, cloud computing and 5G.

Artificial Intelligence

AI is an EU strategic domain within the priority *A Europe Fit for the Digital Age* (European Commission, 2020t; Craglia et al., 2018; European Commission, 2020u). AI refers to any machine or algorithm that is capable of observing its environment, learning and, based on the knowledge and experience gained, taking intelligent action or proposing decisions (Craglia et al., 2018).

Many AI functionalities are now offered on the web via APIs (ProgrammableWeb.com, 2019a). AI is not a new concept, as its origin dates back to the 1940s and 1950s, but it is only recently that it has passed out of academia and specific research fields and arrived into our everyday life. Roughly, we could classify AI into at least two categories.

1. Machine/symbolic reasoning. This refers to semantic modelling AI and logic, in which data are represented as a discrete set of facts about concepts, their instances and their relationships. These objects can be semantically modelled and, by using well-defined logic languages and graph theories, logical deduction is used to derive new knowledge from the initial status. Machine reasoning AI systems are systems that deconstruct ‘tasks requiring expertise into two components: “knowledge base”⁽²⁴⁾ and a general-purpose “inference engine” that described how to manipulate and combine these symbols’ (Kaplan, 2016). Reasoning and semantic AI solutions can be utilised in many fields, such as the creation of ‘digital universities’ (Maltese and Giunchiglia, 2017) based on the use of a semantic technology (Giunchiglia et al., 2014).
2. Machine learning. This refers to a technique in which a program or system can dynamically change its behaviour based on ever-changing data. For this reason, the system has the ability to learn without being explicitly programmed. In doing so, algorithms enable systems to make data-driven decisions or predictions by building a model from sample inputs. A system then does not just simply memorise the samples but recognises patterns and regularities. The goal of machine-learning algorithms is to find specific patterns in (large) datasets, such as the use of machine-learning systems in the medical field that can diagnose skin cancer better than dermatologists (Haenssle et al., 2018).

Jerry Kaplan summarises the pros and cons of machine reasoning versus machine learning as follows: ‘... symbolic reasoning is more appropriate for problems that require abstract reasoning, while machine learning is better for situations that require sensory perception or extracting patterns from noisy data’ (Kaplan, 2016). To obtain better results from the techniques that these two categories of AI offer, the trend is now to combine them (Bottou, 2011). APIs can efficiently share the AI services of both categories that have been developed by third parties, making a set of powerful and updated solutions available to API users allow them to build their final application or service (ProgrammableWeb.com, 2019a). These functionalities can be used but also published by governments and can be used to create new innovative business. Avoiding ad hoc API solutions for AI and instead adopting standards and best practices to implement them is also essential for the development of AI in the DSM. The adoption and sharing of these functionalities via APIs offers the possibility (and probably a unique way) to combine them in a number of different ways and to build completely new and innovative future-oriented solutions.

However, the reverse is also true: not only can AI digital assets be shared via APIs, but also AI techniques can be used to improve the current API challenges faced. Intelligent algorithms could provide solutions to automatically discovering APIs on the web. Reasoning and matching systems can also be used to combine web APIs without, or with limited, human intervention, to create, for example, multiagent systems that use interaction protocols to deal with emergency situations (Vaccari et al., 2012) or to build complex collaborative swarms (Barret, 2018).

Ongoing research on the impact of AI on society is being performed by the European Commission. The JRC’s AI Watch initiative aims to monitor the development, uptake and impact of AI in Europe: ‘AI is experiencing a period of intense progress, due to several key technological enablers: faster processing, increased amounts of data, and better algorithms’ (European Commission, 2018j). APIs can be a fundamental key enabler for the development of AI in Europe and beyond. If correctly implemented, APIs allow AI-empowered applications to exchange information with each other in a flexible and loose-coupled way.

Internet of things

ISO defines the IoT as ‘an infrastructure of interconnected physical entities, systems and information resources together with the intelligent services which can process and react information of both the physical world and the virtual world and can influence activities in the physical world’ (ISO and IEC, 2016b). In the digitalisation age, the growth in the IoT is going to affect all aspects of the digital society in a significant way. The IoT is a key enabling technology for building local data ecosystems.

Through the use of standards, smart cities can use the IoT as an important technology to perform and implement their digital transformation. Nelson et al. (2017) highlighted this relationship: ‘The pervasive instrumentation of the physical world with sensors and actuators provides an unprecedented level of information granularity that is useful in decision-making processes. As municipalities and the public sector at large begin to leverage the Internet of Things (IoT) for civic solutions, there exist greater necessity and impetus to maintain a certain level of standardization in the platform and data architecture.’

Today, it is possible to distinguish between the old IoT generation, taking care to connect as many ‘things’ as possible, and the new IoT generation, namely IoT 2.0, which deals with generating actionable intelligence from devices and their data. Empowered by billions of connected devices, sensors and actuators, IoT 2.0 will be bigger, more powerful and much more settled than the old IoT generation. IoT 2.0 will allow for the digital transformation of a hyper-connected society and, for this reason, it is also called the ‘internet of transformation’. IoT 2.0 will deal with related IT technologies, processes, people, benefits, outcomes and significant real-life opportunities, rather than just device technology and gateways aspects. Naturally, they include microservices and API technologies as solutions.

IoT data offer the potential to consider the real world and better manage resources. This includes activities involving the automatic update of data. For example, devices make use of APIs to connect mobile apps to the provider, sending data for storage/processing and/or retrieving information. Similarly, sensors communicate through a provider’s backend infrastructure using API calls. Specific data-management techniques and technologies may be needed to ensure that such data are well organised and accessible for other purposes, especially the geospatial component of sensor data.

To manage processes and provide access to data from devices and sensors, some support is provided by IoT API-based platforms, with the following five core capabilities: the connection between the device and the internet; securing IoT devices, data and identity; managing and controlling the provisioning, maintenance and operation of IoT devices; analysing and transforming the data into timely and relevant actionable insights; and building and sharing applications that can be integrated with third-party systems.

Most of these capabilities are achieved using APIs and require solid API management, where IoT interoperability comes through based on widely accepted standards (API-based services). As interoperability is likely to be one of the most important barriers to the widespread integration of IoT ecosystems between domains, standards and technologies, projects such as FIWARE (one of our case studies, see also Williams (2018)) and VICINITY (VICINITY consortium, 2020) are building platforms linking various ecosystems providing ‘interoperability-as-a-service’ for infrastructures in the IoT. An API helps develop an adapter to the platform and other APIs manage data access for others outside the platform.

The European Commission’s communication on ICT standardisation (European Commission, 2016l) also prioritises the creation of API standards for the IoT: ‘Foster an interoperable environment for the Internet of Things, working with ESOs and international SDOs. This will develop consensus under the umbrella of the Alliance of IoT innovation (AIOTI17), targeting reference architectures, protocols and interfaces, the promotion of open application programming interfaces (APIs), support of innovation activities related to reference implementations and experimentation and the development of missing interoperability standards’. This will be essential to ensuring that IoT data are able to feed into AI initiatives such as digital twin projects, smart cities’ infrastructure and predictive modelling algorithms that serve a variety of use cases.

The proliferation of the IoT and the success of rich cloud services are pushing the boundaries of the new computing paradigm, including edge computing, and new virtual applications, such as digital twins.

Edge computing

Edge computing calls for processing data at the edge of the network. Edge computing is very important because it has the potential to address the following concerns: response time requirements, battery life constraints, bandwidth cost savings, and data safety and privacy (Shi et al., 2016). API supports the implementation of edge computing, which is seen either as decentralised AI (Rausch and Dustdar, 2019) or more generally as an emerging technology that lets operators host content and applications close to the edge of the network. The European Telecommunications Standards Institute (ETSI) is currently producing standards for multiaccess edge computing (MEC) (Natalie Boyd, 2017). Figure 26 illustrates an example of the deployment of a MEC enterprise network consisting of several ‘zones’ (ETSI, 2018):

- the headquarters, where the core business services are located;
- satellite offices, with local enterprise networks being connected with the headquarters cloud through secured backhaul networks, which allow enterprise employees to access the enterprise services – an enterprise network may use 4G/5G small cells for outdoor coverage, Wi-Fi networks for indoor coverage and fixed access for static devices;

— remote employees, who access enterprise services using a virtual private network (VPN) over public Wi-Fi or cellular networks.

5G networks are expected to significantly reduce latency and vastly increase capacity for delivering high-bandwidth data streams between high densities of people and things at low energy and with high reliability. 5G will allow a huge amount of data to be transported much faster, reliably connecting an extremely large number of devices and processing very high volumes of data with minimal delay (ITU, 2018). According to Ericsson, programmability in 5G core networks will allow providers to open up telecommunications network capabilities and services to third-party developers, allowing them to create new use cases thanks to standardised APIs on the new network architecture for 5G (Manocha, 2019). 5G can bring disruption to the network level by opening up the mobile network’s operating system and exposing core network capabilities to external parties, so they can program their applications to use mobile connectivity and edge computing. In 2017 and 2018, ETSI released a set of edge API standards and announced a collaboration with the OpenFog Consortium to build fog-enabled edge technologies for 5G and the ‘Cloud-to-Things continuum’. Seven standards define mobile edge APIs: principles,

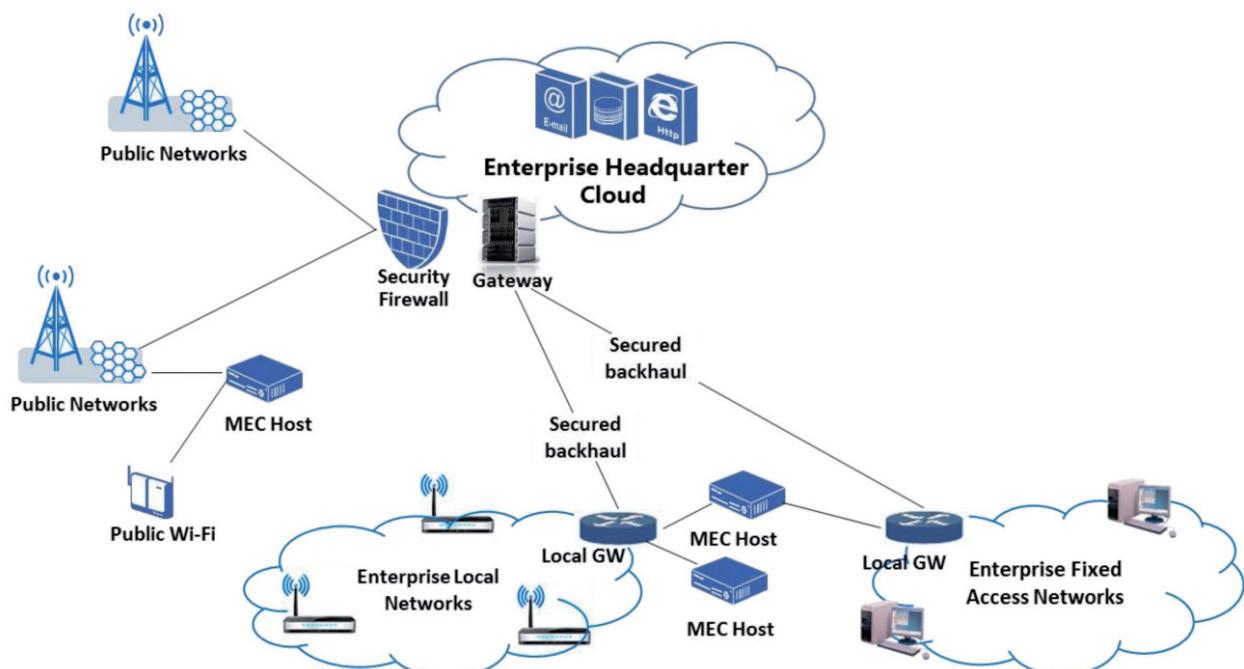


FIGURE 26: MEC deployment across different enterprise networks.
Source: ETSI (2018).

management, platform application enablement, a radio network enablement API, a location API, a user equipment

identity API and a bandwidth management API (Natalie Boyd, 2018).

Digital twins

The idea of a digital twin is to create a digital replica of a physical object and use the twin as the main point of digital interaction. A well-defined digital twin becomes the interface and integration point for an IoT solution. A digital twin platform could provide an API that allows systems to interact with the digital twin. For instance, machine learning and analytics services should be able to interact with a digital twin through an API.

The role of digital twins has recently been recognised by the European Commission and digital twins are considered one of the key trends for the IoT (Gartner, 2018). According to the Commission communication *A European Strategy for Data*, the ‘investment track for the Commission initiative for data spaces will bring together private actors with public support to develop common platforms offering access to a large diversity of cloud services for secure

data storage and sharing as well as applications ranging from artificial intelligence to simulation, modelling, digital twins and high performance computing (HPC) resources’ (European Commission, 2020a). The communication clearly commits to concrete actions on these investments. For example, within the common European green deal data space, the Commission will launch the ‘Destination Earth’ initiative. This initiative will bring together European scientific and industrial excellence to develop a very high precision digital model of the Earth. This ground-breaking initiative will offer a digital modelling platform to visualise, monitor and forecast natural and human activity on the planet in support of sustainable development, thus supporting Europe’s efforts for a cleaner environment as set out in the green deal. The digital twin of the Earth will be constructed progressively, starting in 2021, and will rely on the use of APIs (European Commission, 2020a).

Autonomous things

Autonomous things technology represents a link between AI and IoT technologies. Indeed, AI-powered IoT elements, such as industrial equipment and consumer appliances, are a type of autonomous thing. Autonomous things are often in the form of a physical device operating in the real world. Examples include robots, drones and autonomous vehicles.

Autonomous things also include things that operate solely in the digital world without any physical manifestation. Autonomous things were identified in 2019 by Gartner as the top strategic technology trend of the year (Gartner, 2020a). Gartner predicted, for example, that ‘by 2021, 10 % of vehicles will have autonomous driving capabilities, compared with less 1 % in 2018’. Gartner also predicted that, as communication become multidimensional and multimodal, new forms of interactions, including virtual assistants and independent agents, will facilitate the exchange of data. Autonomous things also rely on the use of the web as a programmable platform to connect things on the web or the ‘web of things’ (WoT).

An analysis of research has been done to predict the future of services on the web (i.e. the vision of the WoT) that leverage web standards to connect all types of devices and real-word objects. ‘Smart web services’, for example, could provide remote access to resources and functionalities by relying on standard communication protocols, but also by encapsulating ‘intelligence’ (Maleshkova et al., 2016). This intelligence includes capabilities in terms of context base adaptation, cognition, inference and rules to implement autonomous decision logic in order to provide services that automatically perform tasks on behalf of the user, without requiring the user’s specific involvement. Regarding providing remote access to functionalities and resource over the web, the trend is to develop and use APIs, a simpler approach with respect to the traditional web services approach. Automatic composition and a combination of services on the web, including APIs, can be then enhanced in general through the use of semantic matching techniques (Vaccari et al., 2012) and semantic web services (Fensel et al., 2007).

Big data

Big data and big data analytics contribute to the API economy in three main ways that are of interest to the public sector. First, the generation of additional volumes of data has meant that APIs are not the exclusive territory of developers but that laypersons are now using APIs indirectly through API-powered apps. This increase in the usage of data through apps has accounted for a huge growth in big data (Kaushik, 2016). Second, social media platforms make data publicly available through APIs, resulting in third-party developers contributing more apps and data (Vis, 2013). Such data and applications, again powered by APIs, may be of use in policy development or to improve service delivery activities by public-sector actors. Third, as noted above, service-generated data are becoming of particular interest to digital platforms and big data analytics, as trace logs, quality-of-service information and service invocation relationships can be used to enhance system performance and increase technical efficiency. APIs can also be provided to users to access service-generated big data and the associated results (Zheng et al., 2013).

Analysis possibilities can also become much more efficient through APIs. For example, AI cognitive APIs rely on the use of a huge quantity of data and are capable of processing complex, unstructured data and delivering related analytics. Many organisations use such APIs to create their

own products and services. In addition, APIs can provide big data applications with faster access to stored data, thus offering more efficient processing and computing resources.

In most sectors of society, including the public government domain, data interoperability has traditionally applied the ‘discovery and access’ paradigm, which consists of discovering/finding a remote dataset, downloading it to a local server and using it locally (e.g. by visualising it or processing it to generate new data or information). In extreme synthesis, datasets have been moved through the network to be ingested in local data systems that support independent and monolithic applications. Digital transformation and its ‘datafication’ paradigm disrupted this model, introducing a new IT approach that was more efficient, addressing the challenges that emerged with the advent of big data (i.e. large and/or heterogeneous data, characterised by diverse levels of maturity, quality and velocity). This new model, commonly called ‘distributed application’, aims to implement the full datafication value chain (depicted in Figure 27) by utilising the web as the computing and analytics platform for building applications that are then distributed. This approach builds on the capacities offered by the significant developments in virtual computing and the hyper-connectivity that characterises our society (Nativi et al., 2020; Giuliani et al., 2019; Craglia et al., 2018).

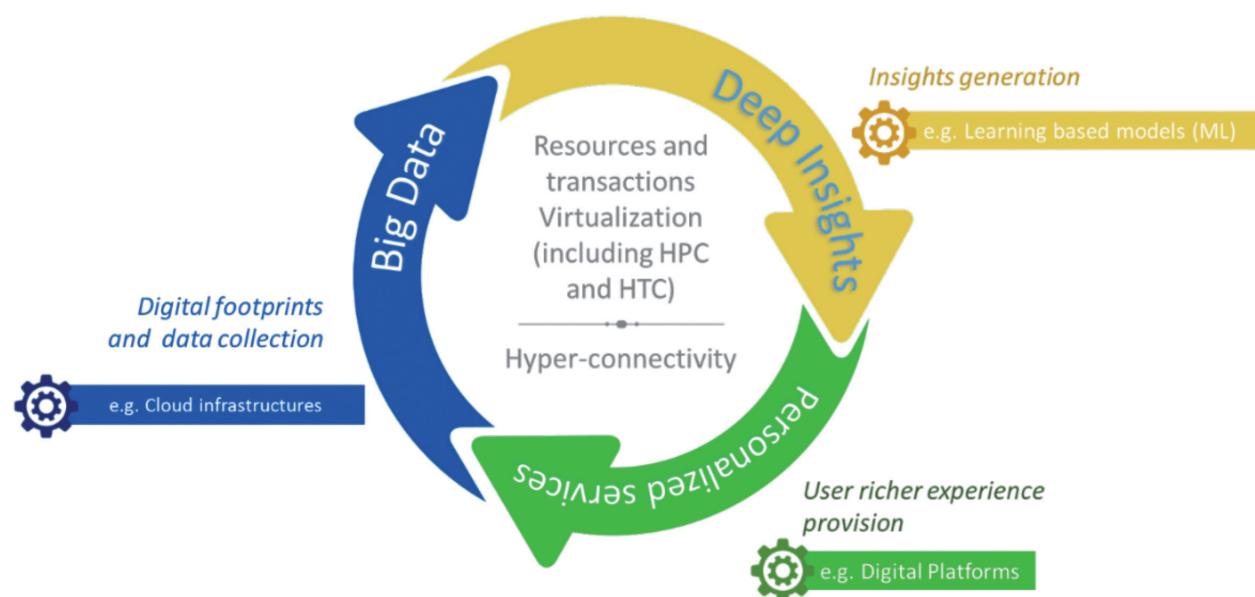


FIGURE 27: Datafication paradigm.
Source: JRC, own elaboration.

From an engineering viewpoint, the distributed application model applies software ecosystem architectures. As regards interoperability technologies, the model implementations make use of microservices, container-based solutions and APIs to connect distributed components and services and develop applications. In this instance, datasets are not moved around, but application algorithms are deployed in place of datasets, working out a virtual collection of independent services that work together. On the other hand, the orchestration of the components is controlled ‘locally’ by the application owner. The key technology for such a complex application environment is an API, as it lets all the components exchange information in a modular way.

The rise of the datafication paradigm (in all sectors of our society) introduced big data challenges, including the need to use high-performance computing for generating intelligence. This moved applications from our powerful personal desktops and local servers to the digital cloud, making irrelevant the location of the components/services utilised to develop an application, instead using the web-as-a-platform paradigm (Shelly and Frydenberg, 2010). While this allowed application developers to theoretically utilise thousands of possible components/services, it introduced a serious problem of interoperability. APIs, along with other technologies such as microservices, address most of these problems by (i) exchanging machine-to-machine information from multiple sources for content collection and (ii) chaining heterogeneous services managed by different platform infrastructures on the web.

Microservices

The case of microservices is different from the previous cases. While, in the previous cases, APIs play a role in supporting them to improve their efficiency and efficacy, microservices support the creation of APIs.

No official definition of microservices is available. In Fowler and Lewis (2014), the authors define microservices as ‘an approach to developing a single application as a suite of small services, each running in its own process and communicating with lightweight mechanisms, often an HTTP resource API’. This definition implies the idea that microservices provide a way of structuring an application into loosely coupled, independently deployable components that communicate over the web utilising lightweight interfaces, such as APIs. Therefore, microservices deal more with how an application is structured internally than with how it is presented externally to its potential users.

We observe, however, that the ideas of modularity and loose coupling, as well as the concurrency with which microservices are built, are also inherent to the so-called Unix philosophy, one of the most successful paradigms in modern software engineering. Microservices can be seen to be the networked, web-enabled analogue

of specialised applications running over an operating system, in this case the web or any other network built over a specific protocol. Following this philosophy, microservices-based APIs are useful in helping to design government applications in a more efficient and flexible way.

In addition, microservices become valuable only when they can communicate with other components in a system (i.e. when each of them has an API as its interface). These interfaces also play an essential role in emerging architectural application styles such as the one proposed by using microservices. It is important that, to maintain some fundamental characteristics of the software code (including separation, independence and modularity), APIs are also loosely coupled. The key design practices required to reach this goal are well described in Nadareishvili et al. (2016) and include the hypermedia-driven or HATEOAS implementation.

Owing to the important role that microservices architectures play in API implementation, governments should invest in an analysis of if APIs can be supported with the adoption of microservices architectures and, if so, how this can be done.

Blockchain

Blockchain is the most well-known and -used distributed ledger technology. Blockchain is the type of ledger in which value-exchange transactions are sequentially grouped into blocks. Each block contains a signature that is based on the exact content (string of data) of that block. The next block contains this signature as well, linking all previous blocks to each other until the first block. Blocks are immutably recorded across a peer-to-peer network, using cryptographic trust and assurance mechanisms. In the context of digital government, blockchain technology has the potential to facilitate direct interactions between public institutions, citizens and economic agents. At the most basic level, this implies improved public services in information registration and exchange processes (Allessie et al., 2019).

The use of blockchain APIs (i.e. APIs that let users access blockchain functionalities) presents both advantages

and drawbacks and, for this reason, their use has to be evaluated, depending on the specific use case. Use cases of blockchain APIs include enhanced connectivity and security, allow processing to be orchestrated and improve collaboration, accountability and trust (Sandoval, 2018). Standard blockchain can be used to make adopting blockchain technology more flexible, in terms of the wide range of competing blockchain options today. As proposed by Aikon, for example, blockchain APIs can be used to standardise the interface for multiple blockchains to make the access to different solutions flexible (Aikon, 2019).

However, the use of blockchain APIs also presents some drawbacks, such as the fact that blockchain is often very wasteful, as many nodes repeat a task over and over for a single verification. In addition, once a transaction is registered in the ledger, it is immutable. This makes it impossible to correct errors.

6.3 | Prioritisation strategies

The examples illustrated in the previous sections suggest areas in which government APIs should be prioritized. APIs should also be prioritised when they help avoid duplication in the creation and delivery of digital services, something that is often observed during ecosystem building and in collaborative work by governments across departments. National identity verification, application form filling (in line with the OOP) and payment infrastructures are examples of services that are often replicated by each government department (Eaves and McGuire, 2019; Thomson, 2015).

The innovation S-curve concept (Sawaguchi, 2011) suggests that innovation occurs in waves, in which new ideas are first taken up by small-scale innovators while existing trends reach their peak. As existing trends become optimised based on existing innovation, their impact falls. This occurs at the same time as the new innovation by small-scale participants grows and reaches mainstream trend acceptance. This observation can also help in making prioritisation decisions, namely encouraging a focus on investment in fast-growing, mainstream ideas while also seeding investment in small-scale innovators.

Applied to government APIs, this concept could see the bulk of priority decision investment being allocated to

current high-value, high-impact domains such as health, geospatial and transportation, while also initiating investment in the near future wave of innovation such as in AI, digital twins and IoT.

Governments' regulatory role suggests yet another set of API priorities. Governments' regulatory role can also help in setting API priorities. The European strategy for data notes the following: 'Sector-specific legislation on data access has also been adopted in some fields to address identified market failures, such as automotive, payment service providers, smart metering information, electricity network data, or intelligent transport systems. The Digital Content Directive contributed to empowering individuals by introducing contractual rights when digital services are supplied to consumers who provide access to their data' (European Commission, 2020a).

These areas may suggest the need for API prioritisation based on regulatory needs. Key informants to the APIs4DGov study, as well as other studies (High-Level Expert Group (HLEG) on Business-to-Government Data Sharing, 2020; European Commission, 2020v), noted the importance of creating business-to-government data sharing via APIs for particular domains. For example, mobility start-ups and tourist accommodation platforms

have an impact on city planning, civic amenities, traffic congestion and population levels (Sarasa Funes, 2019).

Regulatory frameworks and legal enablers such as standard contract templates mandating the sharing of business data with governments via APIs may assist in enabling cities to better plan for local populations. In addition, emergent technologies such as IoT sensor and camera surveillance data may be funnelled into a data pipeline via APIs to enable AI and machine-learning programs. These may also need regulatory frameworks that regulate API access in order to manage the potential negative impacts of API adoption.

To summarise, there are a number of ways that governments can set priorities on exposing APIs.

- Governments can prioritise the exposure of data.
- Governments can focus on exposing horizontal functionalities for reuse in government services.
- Governments can try to find a balance between high-impact domains and investment in the next wave of innovation.
- Governments can regulate industry sectors and mandate API standards.



7

POLICY RECOMMENDATIONS

SUMMARY

APIs are a key enabler for supporting the European Commission priority *A Europe Fit for the Digital Age* and support the priority of Europe being a leader in the data economy. Indeed, APIs help to exploit the potential of data by allowing them to be accessed in an easier, a more coordinated and a faster way. They are also a crucial technological solution in the development of next generation digital infrastructures that will empower the EU to grab the opportunities of the data economy.

The evidence collected from our research for this study recognises the significant value of APIs in enabling governments to deliver on digital transformation goals, to enhance interoperability and form digital ecosystems, and to move towards more platform-based models in which value is co-created with a range of external and internal stakeholders. To achieve these benefits, our recommendations include:

- explicitly adopting APIs to support the new Commission priorities and policies at the EU level, specifically governments at different levels in the European Union and the European institutions, in particular the European Commission;
- increasing the ‘API culture’ in governments;
- becoming digital ecosystem aware and engaging public- and private-sector stakeholders (e.g. by creating specific working groups and mixed public/private workshops);
- creating best-practice operational guidelines and standards to assist governments in implementing product management and life cycle approaches – the focus should be on the following aspects: giving significant attention to cybersecurity and privacy aspects, analysing API legal and organisational aspects, and providing a set of technical recommendations on API discoverability and access;
- reorienting government API and digital government strategies to consider the adoption of the proposed API framework.



⑦ POLICY RECOMMENDATIONS

APIs are a key enabler for supporting the new European Commission priority *A Europe Fit for the Digital Age*, which aims to make data more accessible while bringing the benefits of digitalisation to European society. The Commissioner for the Internal Market, Thierry Breton, said: ‘Our society is generating a huge wave of industrial and public data ... I want European businesses and our many SMEs to access this data and create value for Europeans – including by developing Artificial Intelligence applications’ (European Commission, 2020w). As APIs can facilitate access to data, they greatly increase the possibility of reaching all of these goals.

Within the communication *A European Strategy for Data*, the adoption of APIs in EU governments also supports ensuring the EU’s leadership in the global data economy, in which ‘The amount of data generated by businesses and public bodies is constantly growing. The next wave of industrial data will deeply transform the way we produce, consume and live. But most of its potential remains unfulfilled ... That data should be available to all, whether public or private, start-up or giant’ (European Commission, 2020w). Once again, APIs help to exploit the potential of data by allowing them to be accessed in an easier, more coordinated and a faster way. Moreover, APIs have to be considered as a key element in ‘the development of the technological systems and the next generation of

infrastructures, which will enable the EU and all the actors to grasp the opportunities of the data economy’ (European Commission, 2020w).

These new policy initiatives are already supported by the fact that APIs are being recognised as essential to implementing the requirements of the Open Data Directive on ‘high-value’ and dynamic datasets. In addition, the recently published communication *A European Strategy for Data* (European Commission, 2020a) indicates that ensuring that the datasets of data spaces are shared within and among the diverse domains is crucial, as this helps to avoid them becoming ‘siloed’ environments, pointing to a role for APIs.

To achieve these benefits and support ongoing policy efforts, some key recommendations, presented in the following sections, are made. Following the trends illustrated in this document and these recommendations, we imagine that API adoption in governments will explicitly be sustained in the next policy provisions, with investments probably made under the next digital Europe programme (European Commission, 2018e). As we also propose in [Section 5](#) and following the abovementioned recommendations, this could be a good opportunity to adopt APIs across the whole of the European Union in a uniform, consistent and coherent way.

7.1 | Explicitly adopt application programming interfaces in governments

Our main recommendation is to explicitly adopt APIs to support the new Commission priorities and policies at the EU level. We recommend that governments at different levels in the European Union and the European institutions, in particular the European Commission, adopt APIs.

The Commission should lead by example, namely by building on the European Commission digital strategy, which already includes APIs among the elements listed for the collection, acquisition, management, storage, curation sharing, reuse, publication, archiving and preservation of data. It is suggested that the Commission opts for an API-based architecture in the design of internal and trans-European applications. Where possible and applicable, microservice- or API-based design should also be encouraged wherever software systems are created as part of Horizon 2020 and future Horizon Europe research projects.

APIs can also be an integral part of the European government interoperability strategy proposed for 2021. The use of APIs is essential to implementing the requirements of the Open Data Directive on ‘high-value’ and dynamic datasets (European Union, 2019a). In addition, guaranteeing that the datasets of the data spaces identified by the communication A European Strategy for Data (European Commission, 2020a) are shared within and among the diverse spaces is crucial, as this helps to avoid them becoming ‘siloed’ environments. Both policy initiatives offer a chance for the first steps to be taken towards a European governance framework for APIs.

From the analysis of these documents, we observe that APIs are explicitly mentioned by the most recent policy legal instruments. In many cases, these documents require the mandatory use of APIs to implement their specific goals (European Union, 2019a; European Commission, 2020a). However, the implementation of instruments such as the programmes and activities identified in [Section 3.1.2](#) still rarely explicitly mention the adoption of APIs in governments. This might mainly be the result of the recent formulation of the policy legal instruments and the time needed for the implementation phase of these policies.

When developing legislation applicable to reuse, data and metadata formats, technical arrangements for the

dissemination of ‘high-value’ datasets (as set out in the Open Data Directive) and the design of the proposed common data space for the public sector, the adoption of APIs will allow the proposals of the framework proposed in [Section 5.1](#) to be followed. The following recommendations will help to make this process more efficient, cohesive and structured and, thus, will help to avoid ad hoc implementation.

We recommend that a number of areas and technologies be prioritised, namely those that are expected to generate the largest positive effects. Key high-level priorities, such as the health domain, provide a significant opportunity to build APIs that help achieve the related policy goals, and we have identified these priorities in Section 6. They include some horizontal domains (e.g. smart cities, the geospatial sector, statistics, citizen science and the public sector) and vertical thematic areas (e.g. health, earth observation, mobility, meteorology, agriculture, energy, companies, industry, finance and jobs/skills). Emerging and early adopted or disruptive technologies that use APIs to perform and reach their goals should also be prioritised. These include AI, autonomous things, the IoT, big data, smart cities, citizen science, blockchain and microservices.

Administrations at all levels of government are encouraged to start looking beyond the use of APIs in managing data. APIs are equally well suited to managing other digital assets (e.g. transitioning from ‘electronic’ forms to real digital interactions): ‘Connectivity through the ecosystem makes it easier for citizens to comply with their obligations while making it harder not to. APIs facilitate conditionality, making sure a transaction can only progress when certain conditions are met, such as a valid business registration. Data can flow through to multiple endpoints ensuring integrity and consistency across

“ APIs should be adopted to support the new Commission priorities and policies at EU level ”

the system' (OECD, 2019c; OECD, 2019a). Only through such 'transaction APIs' can the public sector fully connect to future ecosystems in which machine-to-machine exchanges, where possible, replace, to make them faster and reduce errors, some of the current human to human, human to machine or machine to human interactions (a recent example would be the transmission of positive test results for infectious diseases directly from laboratory software to the health authorities). European cooperation or regulation on standards for such APIs can help establish a common market for conformant software. APIs can also usher in new models of service delivery, enabling the integration of digital public services into targeted offerings for special user groups or situations.

We also suggest that governments focus on the risks and challenges identified in the study, including cybersecurity threats, cultural barriers (e.g. the need to increase the recognition of the importance of APIs at the senior management level), operational and technical barriers (e.g. the change management of the legacy existent IT systems and the need to adopt common guidelines at the whole-of-government level), legal barriers (e.g. the need to define common legal instruments to define licences and SLAs for the use of APIs) and economic barriers (e.g. the fact that APIs are more expensive than plain/bulk data exchange, and the long-term commitments that API systems require). Overcoming these challenges requires further recommendations and the adoption of a proper API framework for governments, as discussed in the following sections.

7.2 | Create and improve the ‘application programming interface culture’ in governments

The majority of stakeholders do not need to know the particulars of APIs, but understanding the basics is important. As APIs are a key technology enabler for policy, for citizen and business interactions with government, for the creation of platform approaches and for enabling technologies such as AI and IoT, there are many government stakeholders who need to understand both the value and the risks of APIs. This implies improving a specific set of (advanced) digital skills among public-sector actors, including speaking the right language to ensure that projects and public procurements achieve the results demanded of service providers and contractors.

Adopting APIs also requires changes to departmental budgets and organisation, and adjustments to resource allocation. Policymakers and key decision-makers therefore need to understand the importance of APIs in digital government models at a high level. Departmental leaders need to understand the value, challenges and resource implications of APIs and operational teams need to understand privacy, security and best-practice implementation approaches. All of this will require API introductory and specific training.

In addition, many of the benefits that are sought from APIs require new ways of working within government. In particular, negotiation and collaboration skills for public-service workers to allow them to work across

departmental siloes and with other tiers of government are needed. In other situations, user-centric skills such as design thinking and user experience approaches are needed to focus development on demand-driven approaches that avoid overinvesting in infrastructures that are not fit for purpose, even when agile approaches are in active use. The abovementioned emphasis also implies improvements in external facing skills, including working with external stakeholders in ecosystem models. Such skills will be essential for a digital public-sector workforce in which APIs are used to achieve interoperability, reuse services and develop new digital services. Moreover, the partnership working involved in such ecosystem approaches may also lead to fundamental transformations in the organisations themselves and this will require management from the relevant leaders within those organisations.

Training should also focus on storytelling, sharing some of the examples of success documented throughout this report as a way to encourage understanding and action, especially through those activities that draw on real experiences and help to develop a European Union API community. We suggest that these activities be implemented in strict alignment with the European Commission Interoperability Academy and the European Support Centre for Data Sharing to create training materials on APIs.

7.3 | Create best practices and guidelines

Best-practice operational guidelines and standards should be created to assist governments in implementing product management and life cycle approaches. This study found that a range of best practices were being implemented by governments and the private sector. There is sufficient agreement on architectural styles, security minimum standards and API design that they can be collected into standards and shared across European governments. While there is almost total agreement among governments and the private sector that a product management approach should be taken, fewer resources are available to guide government stakeholders when implementing best practices and tools to help support this new skill set. We recommend that the focus should be on the following aspects:

- technical aspects:
 - the provision of a set of recommendations for governments to manage the semantic versioning of APIs;
 - tools to improve the discoverability of government APIs and the composition of government API services – ways to improve the discoverability of APIs by using established methods (e.g. API catalogues) and technical specifications for API publications (e.g. the OAS) need to be identified and trialled;
- cybersecurity and privacy aspects:
 - investigate security solutions and security standards for handing security requirements, including the authentication and authorisation of users;
 - investigate specifications for ensuring data traceability that would help support citizens' trust in public-sector APIs, while ensuring the ability to document compliance with legal requirements;

“ Best practices, guidelines and standards should be created and shared to assist government in implementing product management and lifecycle approaches ”

— legal and organisational aspects:

- an analysis of the legal conditions for handling ownership, rights of use and liability for data in/from different governments related to handling the transfer of responsibility for data across organisational, sectoral and national borders, which could include checking if access-management solutions have been set up for data access and any digital rights management in key Open Data Directive areas (relevant studies have been developed by various Directorate Generals of the European Commission, including the studies on 'high-value' datasets of the Open Data Directive);
- an analysis of the current available and possible solutions for SLAs for APIs to help API providers take all of the relevant considerations into account and to improve the consistency and recognisability of terms across different API providers – this should be done by also engaging key users to ensure that possible solutions have a lightweight/appropriate level of complexity.

7.4 | Adopt the application programming interface framework proposed in this study

In our study, we provide a framework on how to adopt APIs in governments, which will help them to better reach their policy goals, including the aforementioned priorities of the European Union. This framework provides a cohesive, coordinated approach to APIs that overcomes the challenges of complexity that can result

from ad hoc implementations. The framework model recognises that governments are already implementing APIs and digital government strategies in a variety of ways, as the proposals aim to accommodate existing efforts.

The framework is based on a robust analysis of the best-practice literature on APIs, on the discussions with and feedback received from the participants of our workshops, on the interviews with a number of API experts from both the private and the public sectors. Moreover, it has been tested in a pilot project with the government of Regione Lombardia in Italy. Nevertheless, we still consider it as a tool in its early stages that must be further tested, validated and refined, as well as continuously adapted to presently unexplored current and future requirements. This is why we suggest that the adoption of the framework be considered and that, if it is adopted as a tool by the European Commission, its implementation as a tool supporting the CEF building blocks or supporting the implementation of policy instruments such as the Open Data Directive.

In support of this effort, it would be useful for the European Commission to further develop our (online) maturity toolkit to allow governments to perform self-assessments and to guide them through the API framework's implementation. In this study, the pilot project involved preparing a set of

“ Digital government agendas should consider the proposed API framework for designing their API strategies ”

maturity assessment checklists for all of our proposals, and also included a testing pilot. This resource could be further tested and refined, aiding governments in changing their approach to become more cohesive, while still gaining value from their current API-related activities. The online tool could be used both to score maturity and so help governments to prioritise future actions, and to benchmark governments' status and find organisations facing similar challenges or that have already developed reusable solutions.

7.5 | Become digital ecosystem aware

Knowledge transfer from/to the private sector has been found to be fundamental in supporting the findings and conclusion of this study. It is suggested that private-sector involvement in digital government efforts related to APIs be continued, including in partnerships with company-neutral organisations similar, for example, to the APIdays series of conference (APIdays global, 2019). The following ideas could be applied in future API industry and Govtech events to augment the reach and the depth of sharing knowledge.

- Webinars on APIs could be organised on digital government topics and public-sector API managers could be encouraged to share their stories as compelling short articles. Conferences could be held to host the webinars to increase the number of online community members and reach a wider audience while encouraging collaborative working between groups at onsite events. The articles could be published on platforms such as ProgrammableWeb.com, apiscene.io, nordicapis.com or a dedicated blog hosted by European Commission platforms, such as JoinUp.
- Other government APIs workshops on specific topics could be organised. While previous workshops have

dealt with general topics about how to build and manage APIs, a future series of events could be dedicated to APIs and data-sharing technologies for public policy-relevant topics such as healthcare, personal data, smart cities, security data or cultural heritage, among other topics appropriate to the location and the local ecosystem. These events could also be organised based on the best practices adopted in other European Commission initiatives related to APIs. The events would attract speakers from the private and public sectors and would allow them to learn from each other and discover new ways of partnering on data collection, refining and exposition, API-related best practices and community engagement.

- A specific government API conference event could be organised, focusing on digital government and public-sector APIs, possibly located in Brussels and organised by the European Commission. This event would attract speakers from the most advanced public-sector initiatives and attendees from the public and private sectors.

It is also suggested that a specific working group be created with experts from the Member States working

on the specific topic of APIs and, if possible, that this be connected with the CEF building blocks initiatives of the European Commission (particularly the e-delivery building block). The working group could also focus on specific, concrete pilot activities on the topics of interest of the participating members.

A European knowledge hub on the web is also needed. It could be implemented as one of the collection hubs of the JoinUp initiative and linked with the Science Hub of the JRC and with the European Support Centre for Data Sharing. Transforming the one-off activities performed by the APIs4DGov project into a periodical set of activities

that involve the whole European Union government API community should also be prioritised. The presentations given at conferences and other work identified during this study (or further future studies) could also be widely distributed. The Science Hub could also act as a centre of excellence of government and industry knowledge about APIs. European and international governments at all levels could share examples of their API activities, so that everyone can learn from emerging best practices and collectively solve some of the more challenging aspects of API adoption in governments. The platform could also be used for cross-border project scoping, so that testbeds could be put in place and reusable solutions developed.

8

CONCLUSIONS

⑧ CONCLUSIONS

Digital transformation has affected the entire public sector in many ways. Governments have passed from digitalising their back-office tools, to using the internet to make their processes and services more efficient (e-government), to integrating digital technologies and user preferences in the design and receipt of services (digital government). The digital government transition, in particular, requires a noteworthy investment of public resources. Therefore, technological solutions that trigger, enable and facilitate this transition must be adopted, considering their maturity, their impact and the best way they can be implemented. APIs are one of these solutions and have had growing attention from governments in the last few years. An API is, in brief, a machine-to-machine interface, different from a machine-to-human interface, such as a web browser. Through APIs, the information managed by digital governments can be exchanged and governed with a large number of stakeholders including other governments, companies and citizens. APIs can be used by governments, similarly to (but with different

goals from) what happened in the private sector for both small and large players such as Amazon, Google and Twitter. To better understand how to follow this trend, 2 years ago, the European Commission initiated the 'APIs4DGov' study, the aim of which was to analyse the state of the art in, the value added by and the way forward in adopting APIs in governments.

This final report has presented the main outcomes of the European Commission APIs4DGov study. This document provides a concrete tool for governments to use to determine the status of their API strategies and, eventually, how these strategies should be designed or adopted. The document focuses, in particular, on the role of governments as API providers, whereby they share their APIs with different target groups that are both internal and external to the organisation. Other documents published as part of the study present the case studies analysed, API web standards and the proposed API framework for governments.

8.1 | Main results

From our research, we have identified that the definition of **API strategies** can assist governments in their digital transformation by regulating the necessary organisational change management process. APIs can provide crucial information on the use of resources, on actors and dynamics of digital interactions and on processes' performance and, ultimately, can support budget allocation decision-making. APIs can help automate access to government digital assets, including data and service transaction, and increase their reach potential.

Access to digital assets is key to designing the transformational roadmap and ultimately improving government efficiency and effectiveness by means of **increasing the innovative potential of public service provision**. Moreover, APIs enhance policymaking by facilitating access to virtually any relevant information required in all phases of the policy cycle.

Inherent **features of APIs**, such as their **reusability and modularity**, fundamentally **increase the reach potential of digital assets to both internal and external players**. Digital solutions can be composed of a

highly flexible assemblage of APIs involving several actors. Owing to these enabling characteristics, **the definition of API strategies is crucial for the wiring of a functioning digital ecosystem**.

For many years, the European Commission has worked on a series of initiatives and activities that deal, in general, with the digital transformation of governments and that could be supported, through improved efficiency, by the adoption of APIs in governments. The **Open Data Directive** makes the adoption of APIs for 'high-value' and dynamic datasets mandatory. In addition, the communication **A European Strategy for Data** specifically requires the use of APIs in digital governments. To concretely implement the adoption of APIs in governments, current initiatives, such as the EIF, the ISA² programme, the EU e-government action plan 2016–2020 and the CEF building blocks, and future initiatives within the next digital Europe programme should then explicitly consider the implementation of APIs as suggested in this study.

The main finding of the preliminary analysis of the cases studied is that **APIs strongly support the digital**

transformation of governments and that **when API strategies and solutions are implemented, their uptake is rapid and extensive**. Nevertheless, **API strategies in EU governments are in their early stages, with the oldest having only been implemented in 2014, and a significant number are planned to be deployed within 2020.**

Regarding API technical standards, this study has clarified some disputed topics, such as the **difference between web services and APIs**, the **definition and adoption of the REST architectural style** and the classification of the degree of maturity of the technical adoption of APIs. Moreover, this study has collected, analysed and classified the most relevant documents for supporting governments in their technological API journeys, also considering the advantages and drawbacks of the adoption of standards.

The deployment of functional API systems has positive effects on performance in private organisations, such as increasing flexibility, reducing costs, allowing easier access to digital assets and, with marginal costs being close to zero, allowing the reach potential to be virtually unlimited. All of these characteristics have intrinsic economic implications, however, and it is not yet clear how these effects would transfer to government environments. As noted above, APIs support government goals and public service provision. In addition, internal and external benefits have been identified for governments when sharing their digital assets. **Internal benefits include innovation triggering, efficiency gains and improving the access to and use of government (open) data digital assets. External benefits include the enablement of digital ecosystems, the rewiring of interactions with society actors, new economic opportunities and the possibility of orchestrating digital ecosystems.** API adoption also carries both technical and organisational costs. No main conclusions can be drawn at this stage on budgetary quantification. Nevertheless, from the results of our survey, it seems that the yearly budget used to maintain APIs is rather low. Moreover, the adoption of APIs implies challenges, such as those involved in overcoming the organisational mindset shift required and the potential lack of skills, overcoming cybersecurity vulnerabilities and adhering to current regulations (e.g. the GDPR). Social implications include the possible impact on **privacy and cybersecurity issues**, the augmented

exchange and use of government datasets, and the help provided in generating social value by making services more accessible, which, in turn, can create additional inclusiveness and accessibility.

This study looked at emerging government best practices and guidelines from around the globe, with a specific focus on the EU. Over 3 900 links were found and scanned for their relevance to APIs, in addition to the best-practice documents and guidelines. Of this combined pool of documents, 968 documents were reviewed and 343 were chosen as relevant for government API best practices. Based on the analysis of this literature, discussions with many stakeholders and a pilot project, a robust **basic digital government API EU framework** is proposed within the study. The framework gives the following recommendations: (i) align, prioritise and measure the adoption of APIs with policy goals, (ii) define a government platform, harmonise actions of different digital ecosystems and build the API platform components, (iii) create governance structures, establish cross-competency teams and appoint product managers and (iv) form guiding principles and follow API product and API life cycle approaches. Regarding the selection of the tools to implement APIs in government, general principles include the following: (i) choose tools that support agile and iterative development, (ii) choose open-source tools by default and (iii) choose modern, cloud-based and commodity tools. Specific components for API life cycle management must cover all stages of APIs, namely strategy, design, documentation, development, testing, deployment, security, monitoring, discovery and promotion, and change management.

APIs are a general purpose, domain-neutral technology that can be applied to a huge number of areas. Nevertheless, based on the evidence found through our research, we suggest prioritising the following domains: health, earth observation, mobility, geospatial data, statistics, meteorological data, agriculture, energy, company registrations, industrial manufacturing, financial data and skills/jobs data. Moreover, the following thematic areas would greatly benefit from API adoption in governments: smart cities, citizen science and all of the public sector data in general (e.g. open data). Because of their disruptive impact, APIs of the following technologies should also be prioritised: AI, the IoT, big data, edge computing, digital twins, autonomous things, microservices and blockchain.

8.2 | Recommendations

Our concrete key recommendations include the following.

- **Explicitly adopt APIs to support the new Commission priorities and EU and Member State policies.** APIs should be adopted to implement the European Commission digital strategy (including the design of internal and trans-European applications). APIs should be adopted by EU governments to implement the Open Data Directive and the European government interoperability strategy, as well as legislation on technical arrangements for the dissemination of 'high-value' and dynamic datasets and the design of the European Union data spaces of the European strategy for data.
- **Create and improve the API culture in governments,** including the creation of best practices and guidelines in specific fields. The alignment of training activities with the Interoperability Academy and the European Support Centre for Data Sharing must be considered.
- **Adopt the proposed API framework to orient government API and digital government strategies.** The API framework presented considers the adoption of APIs not only at the operational level, but also from tactical and strategic points of view. The framework is based on a robust analysis of the literature on API best practices, on the discussions with and feedback received from the participants of our workshops and on the interviews with a number of API experts from both the private and the public sectors. Moreover, the framework has been tested in a pilot project with the government of Regione Lombardia in Italy (Mark Boyd et al., 2020a).
- **Become digital ecosystem aware.** Engaging both EU governments and the private sector is fundamental to developing and designing interoperable government IT platforms that link multiple stakeholders.

8.3 | Limitation of the study

We tried to extend our investigation into many aspects related to API adoption in governments, but we are conscious that the research area in this field is vast. Some aspects, such as the quantitative socioeconomic impact of APIs, are currently quite difficult to analyse for various reasons, including the relatively recent and rare adoption by governments of API strategies, the problems in discovering available government APIs on the web and the difficulty in objectively measuring the impact of APIs on the distinct institutional goals of governments (which are society oriented) compared with their impact on private sector goals (which are profit oriented). For these reasons, there is a lack of data that can be gathered and analysed and so the results of such analyses cannot be considered solid enough to produce quantitative results. This study investigated and presented these aspects in a qualitative way, but our wish is that, in the near future, API strategies will be embraced more by governments than is currently the case. In this way, there will be an increasing availability of data about government APIs and so their discoverability will increase enough to allow researchers

and policymakers to better evaluate the use and impact of the adoption of APIs in the public sector.

In the study, efforts were made to classify the legal aspects analysed in our research, by classifying them from strategic (e.g. European Union regulation), organisational/tactical (e.g. SLAs) and operational (e.g. licensing aspects) points of view. Legal and licensing issues were some of the most underdeveloped areas identified in the study. More focused work is needed to identify the best models and approaches for governments to ensure a balance between enabling API adoption and minimising risks and adverse impacts from government API availability.

The proposed API framework is at an early stage. It has to be further tested, validated and refined, as well as continuously adapted to currently unexplored present and future requirements. For this reason, it could be useful to consider its further implementation as a tool supporting the CEF building blocks or supporting the implementation of policy instruments such as the Open Data Directive.

8.4 | Future lines of work

A maturity toolkit would allow governments to conduct self-assessments and guide them in implementing the proposed API framework. In this study, a pilot project and online tool (Mark Boyd et al., 2020b) were undertaken to help governments identify their progress towards implementing the full API framework. Further testing and refinement will occur after the publication of the framework (Mark Boyd et al., 2020a) so that governments can reorient themselves towards a more cohesive approach, while still gaining value from their current API-related activities. We plan to work on the refinement of the basic online tool to help governments score their maturity and identify and prioritise future actions.

Short-term activities as part of the study will focus on the following aspects: engaging public- and private-sector stakeholders (e.g. by creating specific working groups and mixed public/private workshops), focusing on cybersecurity and privacy aspects, analysing API legal and organisational aspects and providing a set of technical recommendations on API discoverability and access.

As the technological and architectural landscape is evolving very quickly, investigating new digital government platform solutions might also be considered in the short-term activities as part of the study. For example, the Estonian X-Road platform (one of the cases studied within the study) is evolving towards a new-generation

government platform architecture that considers ‘proactive services’ and includes an intelligent virtual assistant, microservices, event-driven messaging environments and ‘chaos engineering’ to build messages ‘rooms’ called ‘X-Rooms’ (Vaher, 2020).

Medium-term and sustainable activities and possible follow-up studies should also consider providing support to raise awareness through training initiatives on APIs, such as those prompted and organised by the Interoperability Academy and the European Support Centre for Data Sharing and proposed by or with the support of the European Commission.

Moreover, the role of APIs in digital ecosystems should be better analysed and considered. APIs are a technological solution that apply to and have an impact on a number of domain areas and technologies. A number of horizontal domain areas (e.g. geospatial data, earth observation and statistics) and vertical areas (e.g. agriculture, transportation, health and emergency management) are currently using API-based solutions. A general effort to open and use APIs to improve the connection of these digital ecosystems and to allow the private sector to have access to digital government is required, and the impact of this effort should be investigated. This study anticipates some relevant impacts, but the effect of APIs in these areas is still unknown and, probably, underestimated.

8.5 | Closing remarks

We thank readers for dedicating time to reading this document. All in all, we hope that this study can concretely support governments in their journey towards the adoption of API strategies and in their digital transformation. The evidence collected from our study should help improve understanding of the current API landscape and the importance of APIs in triggering the enablement of digital ecosystems in some priority domains of the public sector.

We hope that our findings orient government API strategies towards cohesive, efficient and effective API-based

digital platforms, as suggested with the proposed API framework. Our final goal is to better support the policy targets of governments and the priorities of the European Commission, in particular the priority *A Europe Fit for the Digital Age*.

We know that there are still many unresolved issues presented in the study and the report and so we would gladly receive any feedback that will help us to improve our future work on the digital transformation of governments and technological solutions such as APIs.

Notes

- ⁽¹⁾ This is just an example; the structure of a request of an API can be much more complex.
- ⁽²⁾ This might depend on the size of the dataset for which the bulk download is needed for performance reasons.
- ⁽³⁾ The i2010 e-government action plan 2006–2010, the e-government action plan 2011–2015 and the e-government action plan 2016–2020.
- ⁽⁴⁾ See also the last architectural study on SDG, which specifies the ‘Application services/interface with the most salient application components and interoperable enablers, which shall be considered in order to facilitate technical interoperability when developing an Interoperable European Solution’ (Section 4.4.2 of Everis (2018)).
- ⁽⁵⁾ Current CEF building blocks include big data infrastructure, a context broker, e-archiving, e-delivery, e-identification, e-invoicing, e-signature, e-translation, the OOP and blockchain.
- ⁽⁶⁾ The programme will build on the DSIs achieved under the current CEF programme and will support the further evolution and wider implementation of policy elements such as the EIF.
- ⁽⁷⁾ For a definition of the ProgrammableWeb.com API directory data model, see <https://www.programmableweb.com/news/programmablewebs-new-api-directory-data-model-explained/analysis/2016/07/08>.
- ⁽⁸⁾ See also Santoro et al. (2019).
- ⁽⁹⁾ It should be noted that, independently from the catalogue APIs that give access to the metadata, many of the entries of the catalogues may not be good enough to be accessible and used by a data consumer (Berners-Lee, 2012).
- ⁽¹⁰⁾ At the time the EUSurvey was launched, the new Open Data Directive (European Union, 2019a) had not yet been published, so some respondents asked for a revision of the Public Sector Information Directive to also introduce APIs for open data and public-sector information. Indeed, the latest version of the directive explicitly requires APIs for ‘high-value’ and dynamic datasets, thus dealing with this suggestion.
- ⁽¹¹⁾ See Article 5(c): ‘Principles relating to processing of personal data’.
- ⁽¹²⁾ Please note that, in the rest of this section, the term ‘data model’ is used to refer to both the data format and content encoding.
- ⁽¹³⁾ ‘A resource is a conceptual mapping to a set of entities, not the entity that corresponds to the mapping at any particular point in time’ (Fielding, 2000). The components (e.g. clients and servers) perform actions on resources by using representations of them. A representation captures the current or intended state of a resource and can be expressed in any message format supported by any two interacting components (e.g. XML and JSON).
- ⁽¹⁴⁾ Communication protocols are formal descriptions of digital message formats and rules. They are required to exchange messages in or between computing systems and are required in telecommunications.
- ⁽¹⁵⁾ It is important to note that, because this would require an entire study itself, we will not present domain-specific standards or technical specifications. In addition, we aimed to be as neutral as possible (i.e. by not expressing preferences for a certain technical specification or standard) in the selection of and definitions used in relation to the topics presented.
- ⁽¹⁶⁾ The list of documents is available online as open data (Mark Boyd and Vaccari, 2020).
- ⁽¹⁷⁾ The list is numbered from 1 to 12, but this does not imply a rigid sequence of actions; it is simply internal (to this report) enumeration.
- ⁽¹⁸⁾ Such as the *Core Public Services Vocabulary* (European Commission, 2019c).
- ⁽¹⁹⁾ See, for example, the private company API landscape at Medjaoui (2020).
- ⁽²⁰⁾ See, for example, the set of best-practice principles for designing and delivering government services published by the Digital Transformation Agency of the Australian government.
- ⁽²¹⁾ Previous research has been conducted by IBM in a project called ‘API harmony’ (Wittern et al., 2016).
- ⁽²²⁾ See, for example, the practice of the city of Tampere, Finland (Government of the city of Tampere, 2018).
- ⁽²³⁾ Service-level objectives are defined as follows: ‘Targets for a given attribute of a cloud service that can be expressed quantitatively or qualitatively. Therefore, they seek collaborative communication models in which service levels are negotiated with department users and act as target goals to guide implementation. Service level indicators can then be used to report regularly on implementation results’ (European Commission, 2014b).
- ⁽²⁴⁾ A collection of facts, rules and relationships about a specific domain of interest represented in symbolic form.
- ⁽²⁵⁾ The report by Williams (2018) contains an exhaustive description and analysis of the cases.

List of abbreviations

AI	artificial intelligence
AmDex	Amsterdam Data Exchange
API	application programming interface
APIs4DGov	application programming interfaces for digital government
CBS	(Dutch) Centraal Bureau voor de Statistiek
CEF	Connecting Europe Facility
DAWA	Danmarks Adressers Web API
DG CNECT	Directorate-General for Communications Networks, Content and Technology
DG DIGIT	Directorate-General for Informatics
DIAS	Copernicus Data and Information Access Services
DINSIC	Direction interministérielle du numérique et du système d'information et de communication de l'État
DINUM	Direction interministérielle du numérique
DSI	digital service infrastructure
DSM	digital single market
ECMWF	European Centre for Medium-Range Weather Forecasts
EDP	European Data Portal
EFTA	European Free Trade Association
EIF	European interoperability framework
ELISE	European Location Interoperability Solutions for e-Government
EMT	Empresa Madrileña de Transporte
ETSI	European Telecommunications Standards Institute
EU ODP	European Union Open Data Portal
FHIR	fast healthcare interoperability standard
FIWARE	Future Internet Ware
GDPR	General Data Protection Regulation
GPS	global positioning system
HAL	Hypertext Application Language
HATEOAS	hypermedia as the engine of application state
HTTP	Hypertext Transfer Protocol
IANA	Internet Assigned Numbers Authority
ICT	information and communications technology
INSPIRE	Infrastructure for Spatial Information in Europe
IoT	internet of things
ISA/ISA ²	interoperability solutions for public administrations, businesses and citizens
ISO	International Organization for Standardization
IT	information technology

JLA	JoinUp Licensing Assistant
JRC	Joint Research Centre
JSON	JavaScript object notation
KLIP	Cable and Pipe Information Portal
MEC	multiaccess edge computing
NGSI	next-generation service interface
OAS	OpenAPI Specification
OASC	Open and Agile Smart Cities
OECD	Organisation for Economic Co-operation and Development
OGC	Open Geospatial Consortium
OOP	once-only principle
OSF	Open State Foundation
PSD	first Payment Services Directive
PSD2	Second Payment Services Directive
RAML	RESTful API Modeling Language
RDF	Resource Description Framework
REST	representational state transfer
RPC	remote procedure call
SAML	Security Assertion Markup Language
SDG	single digital gateway
SDN	software-defined networking
SEMIC	Semantic Interoperability Community
SLA	service-level agreement
SMEs	small and medium-sized enterprises
SOAP	Simple Object Access Protocol
SPARQL	SPARQL Protocol and RDF Query Language
SPDX	Software Package Data Exchange
SWOT	strengths, weaknesses, opportunities and threats
SWS	semantic web services
TfL	Transport for London
TOOP	The Once-Only Principle Project
UNEP	United Nations Environment Programme
W3C	World Wide Web Consortium
WoT	web of things
XACML	Extensible Access Control Markup Language
XML	Extensible Markup Language
YAML	YAML Ain't Markup Language

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ANNEXES

- GLOSSARY
- APPLIED METHODOLOGY
- APIs4DGov OUTPUTS QUICK REFERENCES
- POLICY INSTRUMENTS QUICK REFERENCES

Annex 1 | Glossary

This section presents the definitions of the terms collected so far as part of the APIs4DGov study. Apart from the few expressions proposed by this study, an effort has been made to reference the authoritative/official resource for the definition of each term, including the definitions taken from standardisation bodies, the CEF documentation (European Commission, 2019p) and the glossary published in a preliminary report of this study (Williams, 2018).

Application programming interface (API)	An API is defined as follows: 'The calls, subroutines, or software interrupts that comprise a documented interface so that an application program can use the services and functions of another application, operating system, network operating system, driver, or other lower-level software program' (Shnier, 1996).
API-first model approach	An API-first model is an approach in which the organisation reviews its goals and asks if an API is the best way to achieve each goal (Medjaoui, 2014; McKendrick, 2019; Mehdi et al., 2018).
API gateway	HTTP enables the use of intermediaries to satisfy requests through a chain of connections. There are three common forms of HTTP intermediary: proxy, gateway and tunnel (Fielding and Reschke, 2014). An API gateway is a software component that was initially popular within the microservices world, but is now also a key part of an HTTP-oriented serverless architecture. An API gateway's basic job is to be a web server that receives HTTP requests, routes the requests to a handler based on the route/path of the HTTP request, takes the response back from the handler and finally returns the response to the original client. An API gateway will typically do more than just this routing, also providing functionality for authentication and authorisation, request/response mapping, user throttling and more. Depending on the gateway features, API gateways are configured, rather than coded, which is useful for speeding up development, but care should be taken not to over use some features that might be more easily tested and maintained in code (Chaplin and Roberts, 2017).
API versioning	API versioning is one of the steps of an API life cycle (Jacobson et al., 2011). There is no common agreement on the definition of API versioning. If, from one side, an API is the embodiment of a technical contract between a publisher and a developer and this contract should stay intact, then, on the other side, there is sometimes the need to begin with a completely new version. So, even though we have found that API versioning is 'The ability to change without rendering older versions of the same API inoperable' (Deloitte, 2018) or that 'Non-backward-compatible changes break the API (i.e. a new one has to be released, and consumers must migrate from the old to the new one)' (Mehdi et al., 2018), we could accept the fact that, in the life of an API, starting over with a new version that might not be fully backward compatible with an older version or that might make the older version deprecated is unavoidable. Therefore, retiring an API is often an unacknowledged part of the API life cycle (Mark Boyd, 2016b) and versioning is part of the API design life cycle.
Architecture	Architecture refers to the fundamental concepts or properties of a system in its environment, embodied in its elements and relationships, and in the principles of its design and evolution (ISO et al., 2011).
Authentication	Authentication is the ability to prove that a user or application is genuinely who that person or what that application claims to be (IBM, 2014a; ENISA, 2019; NIST, 2019).
Authorisation	Authorisation protects critical resources in a system by limiting access to only authorised users and their applications (IBM, 2014b).

Collaboration (on public services)	Collaboration on public services indicates that a government is pursuing collaboration with third parties to deliver added value in public service design and/or public service delivery. Collaboration involves using shared resources, taps into the power of mass collaboration on societal issues and can lead to the development of innovative, distributed and collective intelligent solutions. Collaboration is also related to the concept of service-oriented principles of reuse, composition and the modularity of a service. With the addition of new services, new (public) value is proposed to users. This value relates only to creating private value for new businesses, but also to creating public value (i.e. added value for society) (European Commission, 2019q).
Container	An alternative to using a platform as a service (PaaS) on top of a virtual machine is to use containers (e.g. the popular hub Docker). Containers provide a way of more clearly separating an application's system requirements from the nitty gritty of the operating system itself (Chaplin and Roberts, 2017).
Digital government	Digital government refers to the use of digital technologies, as an integrated part of governments' modernisation strategies, to create public value. It relies on a digital government ecosystem, comprising government actors, non-governmental organisations, businesses, citizens' associations and individuals, which supports the production of and access to data, services and content through interactions with government (OECD, 2014).
Digital platform	Although the definition of a digital platform would require an analysis of its characteristics from different points of view (Van Gansen et al., 2018), in the context of this study, a 'digital platform' is a digital 'product that serves or enables other products or services' (Gartner, 2020b). It provides reusable, common business services to accelerate the development of the next generation of government services that are simple and intuitive and make it easy for people and businesses to deal with government (Australian Government, 2019b).
Digital technologies	Digital technologies or ICT include the internet, mobile technologies and devices, as well as data analytics, used to improve the generation, collection, exchange, aggregation, combination, analysis, access, searchability and presentation of digital content, including for the development of services and apps (OECD, 2014).
Documentation/definition (in API)	Documentation (or a definition) is a technical content deliverable, containing instructions about how to effectively use and integrate with an API (Swagger.io, 2019b).
E-government	This refers to the use by governments of ICT, particularly the internet, as a tool to achieve better government (OECD, 2014).
External API	An external API is designed to be accessible outside agency boundaries, ranging from government inter-agency interactions to the wider population of web and mobile developers. This means it may be used both by developers inside the organisation and by any developers outside that organisation who wish to use it for other purposes (definition based on Williams (2018)).
Information technology (IT)	IT refers to the use of technology for the storage, communication or processing of information. This technology typically includes computers and telecommunications, applications and other software. The information may include business data, voice recordings, images and video. IT is often used to support business processes through IT services (Axelos, 2011).
Infrastructure	Infrastructure refers to the framework or features of a system or organisation (Wordreference.com, 2020).
Internal API	This type of API is generally used to facilitate the sharing of data and services between systems within an agency, avoiding the need for complex point-to-point integration. They are not visible to any system outside the agency that created the API and are generally in the domain of the agency's IT department (definition based on Williams (2018)).
Interoperability	This refers to the capability to communicate, execute programs or transfer data among various functional units in a manner that requires the user to have little or no knowledge of the unique characteristics of those units (IEEE, 1991).

IT infrastructure	IT infrastructure refers to all of the hardware, software, networks, facilities, etc., that are required to develop, test, deliver, monitor, control and support IT services. The term IT infrastructure includes all of the IT elements, but not the associated people, processes and documentation (Axelos, 2011).
IT service	An IT service is a service provided to one or more customers by an IT service provider. An IT service uses IT and supports the customer's business processes. An IT service combines people, processes and technology and should be defined in an SLA (Axelos, 2011).
Legal interoperability	Each public administration contributing to the provision of a European public service works within its own national legal framework. Legal interoperability is about ensuring that organisations operating under different legal frameworks, policies and strategies are able to work together (European Commission, 2017a).
Microservice	A microservice is a basic element that results from the architectural decomposition of an application's components into loosely coupled patterns consisting of self-contained services that communicate with each other using a standard communications protocol and a set of well-defined APIs, independent of any vendor, product or technology (Karmel et al., 2016).
Northbound interface	A northbound interface of a component is an interface that allows the component to communicate with a higher level component, using the latter component's southbound interface. The northbound interface conceptualises the lower level details (e.g. data or functions) used by, or in, the component, allowing the component to interface with higher level layers. When used in a software-defined networking (SDN) community, for example, this involves APIs referring to programmatic interfaces that live on the northern side of the controller interface and not the south-side protocol driver interfaces (Open Networking Foundation, 2013; Metzler, 2015).
Open asset	This refers to government data, software, specifications and frameworks that are open, so that anyone can freely access, use, modify and redistribute their content with no or limited restrictions such as commercial use or financial charges (definition proposed by this study).
Open government	Open government can be defined as the opening up of government processes, proceedings, documents and data for public scrutiny and involvement, and is now considered a fundamental element of a democratic society (OECD, 2017). The open government initiative was started in 2009 by Barak Obama (The White House, 2009); after that, numerous governments adopted open data initiatives. It is founded on the belief that greater transparency and public participation can not only lead to better policies and services, but also promote public-sector integrity, which is essential for regaining the trust of citizens in the neutrality and reliability of public administrations.
Open services	These are digital public services that can be reused by other public administrations or eventually by third parties to provide value added services via a mechanism of service composition. Open services necessitate proper design of digital public services. The design principles of service-oriented architecture can prove useful: modular, decomposed services; interoperability through an API; and loose coupling (European Commission, 2016c).
Organisation	In general, here, the term 'organisation' refers to a public administration unit or any entity acting on its behalf, or to an EU institution or body (European Commission, 2016c).
Organisational interoperability	This refers to the way in which public administrations align their business processes, responsibilities and expectations to achieve commonly agreed and mutually beneficial goals. In practice, organisational interoperability means documenting and integrating or aligning business processes and the relevant information exchanged. Organisational interoperability also aims to meet the requirements of the user community by making services available, easily identifiable, accessible and user focused (European Commission, 2017a).
Participation (in policymaking)	Participation in policymaking happens when governments open up governmental decision-making to citizens, businesses and public administrations to ensure an open process for participation with the aim of enhancing public value (European Commission, 2019q).
Platform	See 'Digital platform'.
Private API	See 'Internal API'.

Public API	See 'External API'.
Public value	Public value refers to various benefits for society, which may vary according to the perspective or the actors, including the following benefits: (i) goods or services that satisfy the needs and expectations of citizens and clients; (ii) production choices that meet citizens' expectations of justice, fairness, efficiency and effectiveness; (iii) properly ordered and productive public institutions that reflect citizens' desires and preferences; (iv) fairness and efficiency of distribution; (v) legitimate use of resources to accomplish public purposes; and (vi) innovation and adaptability to changing preferences and demands (OECD, 2014).
Remote procedure call (RPC) API	An RPC API is a set of procedures (methods) that the client application can invoke and is executed by the server to fulfil a task. RPC APIs stem from the replacement of in-memory object messaging with cross-network object messaging in object-oriented applications (Feng et al., 2009).
Representational state transfer (REST)	REST is a software architectural style that defines a set of constraints that restrict the roles/features of architectural elements and the relationships allowed among those elements within any architecture that conforms to REST (Fielding, 2000).
Resource (in the REST architectural style)	In the REST architectural style, resource representation is central. Any information that can be named can be a resource: a document or image, a temporal service (e.g. 'today's weather in Los Angeles'), a collection of other resources, etc. (Fielding, 2000). A resource involves conceptual mapping to a set of entities, rather than referring to the entity that corresponds to the mapping at any particular point in time (Fielding, 2000).
RESTful API	RESTful APIs are based on the REST architectural style (Fielding, 2000).
Semantic interoperability	<p>Semantic interoperability ensures that the precise format and meaning of the data and information exchanged are preserved and understood throughout exchanges between parties, in other words it ensures that 'what is sent is what is understood'. In the EIF, semantic interoperability covers both semantic and syntactic aspects (European Commission, 2017a).</p> <ul style="list-style-type: none"> — The semantic aspect refers to the meaning of data elements and the relationship between them. It includes developing vocabularies and schemata to describe data exchanges, and ensures that data elements are understood in the same way by all communicating parties. — The syntactic aspect refers to describing the exact format of the information to be exchanged in terms of grammar and format.
Service-oriented architecture	Service-oriented architecture refers to an application pattern in which applications offer services to other applications by means of interfaces (European Commission, 2019q).
Smart city	<p>There is no definitive definition of a smart city because of the breadth of technologies that can be incorporated into a city for it to be considered a smart city. From the definition given by Mark Deakin and Husam Al Waer in their research publication (Deakin and Waer, 2011), the factors that contribute to a city being classified as smart are:</p> <ul style="list-style-type: none"> — the application of a wide variety of digital and electronic technologies in the city and its communities; — the application of ICT to enhance life and working environments in the region; — the embedding of such ICT within government systems; — the territorialisation of practices that bring people and ICT together to foster innovation and enhance the knowledge that they offer. <p>For a more formal definition of the term, see also Ramaprasad et al. (2017).</p>
Social value	This report uses the OECD definition of 'public value' as that for 'social value': 'Public value refers to various benefits for society that may vary according to the perspective or the actors, including the following: 1) goods or services that satisfy the desires of citizens and clients; 2) production choices that meet citizen expectations of justice, fairness, efficiency and effectiveness; 3) properly ordered and productive public institutions that reflect citizens' desires and preferences; 4) fairness and efficiency of distribution; 5) legitimate use of resource to accomplish public purposes; and 6) innovation and adaptability to changing preferences and demands.' (OECD, 2014).

Software-defined networking (SDN)	SDN is a paradigm whereby a central software program, called a controller, dictates the overall network behaviour (Kim and Feamster, 2013).
Software development kit	Typically, this is a set of software development tools that allows the creation of applications for a certain software package, software framework, hardware platform or computer system (Shamsee et al., 2015).
Software ecosystem	A software ecosystem is a set of businesses functioning as a unit and interacting with a shared market for software and services, together with the relationships among them. These relationships are frequently underpinned by a common technological platform and operate through the exchange of information, resources and artefacts (Messerschmitt and Szyperski, 2003).
Southbound interface	In SDN, the southbound interface refers to the interface and protocol between programmable switches (SDN-capable switches) and the software controller (Kim and Feamster, 2013).
Spatial object	A spatial object is a geographical feature, namely an abstract representation of a real-world phenomenon related to a specific location or geographical area (European Commission, 2019r).
Standard	A standard is a document that specifies a technological area with a well-defined scope, usually by a formal standardisation body and process (OGC, 2019b).
Technical specification	A technical specification is a document written by a consortium, vendor or user that specifies a technological area with a well-defined scope, primarily for use by developers as a guide to implementation. A specification is not necessarily a formal standard (OGC, 2019b).
Three-tier architecture	A three-tier architecture is a client–server architecture in which the functional process logic, data access, computer data storage and user interface are developed and maintained as independent modules on separate platforms. Three-tier architecture is a software design pattern and a well-established software architecture (Techopedia, 2018).
Time to first hello world	This is a metric that measures how successful documentation and API design is at enabling consumers to test a new integration with the API (Wiegers, 2018).
Transparency	Transparency refers to disclosing relevant documents and other information on government decision-making and government activity to the general public in a way that is relevant, accessible, timely and accurate (European Commission, 2019q).
Value chain	The value chain itself describes the full range of activities that are required to bring a product or service from conception, through the different phases of production (involving a combination of physical transformation and the input of various producer services), to delivery to final consumers and final disposal after use (definition proposed by this study).
Web API	Web APIs are APIs that are offered and consumed through the web. They deliver requests to the service provider and then deliver the response back to the requestor (i.e. they are an interface for web applications or applications that need to connect to each other via the internet to communicate) (Definition.net, 2019).
Web application	The term ‘web application’ refers to a web page or collection of web pages delivered over HTTP that use server-side or client-side processing (e.g. JavaScript) to provide an ‘application-like’ experience within a web browser. Web applications are distinct from simple web content in that they include locally executable elements of interactivity and persistent state (W3C, 2010).
Web service	Different definitions of web services exist. The W3C defines a web service as ‘a software system designed to support interoperable machine-to-machine interaction over a network. It has an interface described in a machine-processable format (specifically WSDL [Web Service Description Language]). Other systems interact with the Web service in a manner prescribed by its description using SOAP messages, typically conveyed using HTTP with an XML serialisation in conjunction with other Web-related standards’ (W3C, 2004). This definition links the concept of a web service to a set of specific technologies (SOAP and Web Service Description Language). Others provide more generic definitions. For example, in IBM (2014b), the authors state that a ‘Web Service is a generic term for an interoperable machine-to-machine software function that is hosted at a network addressable location’ and Papazoglou and Georgakopoulos (2003) define a web service as ‘a specific kind of service that is identified by a URI [uniform resource identifier], whose service description and transport utilise open internet standards’. These definitions extend the W3C definition by essentially defining a

	web service as a service that is offered over the web. The Advancing Open Standards for the Information Society (OASIS) reference model for service-oriented architecture defines a service as ‘a mechanism to enable access to one or more capabilities, where the access is provided using a prescribed interface and is exercised consistent with constraints and policies as specified by the service description’ (OASIS, 2006).
Web service interface (provided by a web service)	Web service interfaces are designed to offer access to high-level functionalities for end users (either humans or machines) (definition proposed by this study).
Whole-of-government approach	This refers to the joint activities performed by diverse ministries, public administrations and public agencies to provide a common solution to particular problems or issues. The approach and content of these initiatives can be formal or informal and the areas covered can be related to policy development, public project management or public services (Australian Government, 2004).

Annex 2 | Applied methodology

We have based our research on the recommendations of the *ICT Impact Assessment Guidelines*, developed within the ISA² programme (European Commission, 2017f), and have extended these recommendations through the analysis of additional data sources. Figure 28 summarises the combination of a number of research methods that have been used to investigate the different aspects of the study. This approach was found to be fundamental to meeting the objectives of the study and to analysing new possibilities offered by APIs from different disciplinary perspectives and stakeholders' views. It was found that the use of this approach facilitates the cross-fertilisation, complementarity and validation of the results from different methods and allows for corroboration between quantitative and qualitative data.

We have based our analysis on different activities targeted at the following European government stakeholders:

- the e-government action plan steering board, which is composed of Member States' representatives who are responsible for their national e-government strategies (European Commission, 2016m);
- the chief information officer network, namely a network of DG DIGIT peers in the EU Member States' public administrations;

- the Digital Champions of the European Union, namely ambassadors for the DSM, appointed by their Member States to help every European become digital (European Commission, 2014c);
- the OASC network (OASC, 2019).

The activities include:

- a quantitative data analysis based on data collected from different resources, including the documents in the JoinUp platform (European Commission, 2019s), a set of APIs from data catalogues and API registries (including the ProgrammableWeb directory of APIs) and a set of API cases collected from previous studies on e-government and digital government at the EU level;
- a survey specifically focused on public-sector API strategies, based on a semi-structured questionnaire – the survey has run from September 2018 to the end of the study (European Commission, 2018k);
- a survey assessing the validation of the API framework and the recommendations we propose in this study (European Commission, 2019t) – the survey has run from September 2019 to the end of the study;



FIGURE 28: Applied methodology.

Source: Customised from ICT Impact Assessment Guidelines, ISA² Programme (European Commission, 2017f).

- a workshop, organised at the JRC premises in October 2018, the goal of which was to understand the main aspects of the public-sector API strategies in the EU – the outputs of the workshops (i.e. presentations and talks) are available at European Commission (2018a);
- three workshops, which were organised during 2019 in collaboration with the APIdays series of conferences, namely in Helsinki, Barcelona and Paris (APIdays global, 2019);
- a hackathon, organised as part of the INSPIRE 2018 conference, from which we extracted useful insights, especially regarding API trends in the geospatial domain (European Commission, 2018l);
- a number of stakeholders' cross-fertilisation meetings, with colleagues from DG DIGIT and DG CNECT.

A number of resources from the web have been taken into consideration to retrieve information on government APIs. The following are just some of these, and these specific references could be used in the future to search for and update specific information about APIs:

- the JoinUp platform, a collaborative platform created by the European Commission to help e-government professionals share their experience with each other (European Commission, 2019s);
- the EDP (European Commission, 2019f), a unique source of government open data that harvests the metadata of public-sector information available on public data portals across European countries – the EDP publishes these data in a single catalogue, together with information regarding the provision of data and the benefits of reusing them;
- the EU ODP, which provides access to an expanding range of data from the EU institutions and other EU bodies (European Commission, 2020f);
- the ProgrammableWeb directory, the world-leading source of news and information about APIs (ProgrammableWeb.com, 2019c);
- the final report of the study *Towards faster implementation and uptake of open government*, which aimed to provide input to the European Commission

to support the new dynamically evolving e-government action plan 2016–2020 (European Commission, 2016g).

In the next sections, we present the activities related to our multiple-case study analysis, the survey and the workshop on API strategies.

Multiple-case study

From the API cases identified in the study, we selected seven diverse cases on the use of APIs in the EU public sector (Williams, 2018) to cover a variety of different circumstances and dimensions, with the purpose of deriving insight from a broad base of the API community. The selection was based on meeting the following set of criteria:

- different levels of API strategy adoption (operational or strategic),
- different sizes of public organisations (local, national and supranational),
- a coverage of Member States in the north and south of the EU,
- a range of sectors and public services (transportation, utilities, smart-city-related public services, gazetteers, permits and more).

The cases selected, illustrated in Figure 29, were as follows: (i) an interview with parties focused on the high-level vision or strategy behind API use (the Italian Digital Transformation Team), (ii) interviews with parties focused on using APIs as components of wider architectural platforms/ecosystems (Estonia's X-Road and FIWARE) and (iii) interviews with people involved in specific API implementation (Madrid Mobility Labs, the Amsterdam city data API, DAWA and the Flanders KLIP web API).

A brief description of the cases⁽²⁵⁾ follows.

- **X-Road** is an API-driven data exchange ecosystem platform that was initially developed between 1998 and 2001. It represents a government API framework developed by the Estonian government and licensed under the MIT licence. It is also used as a backbone

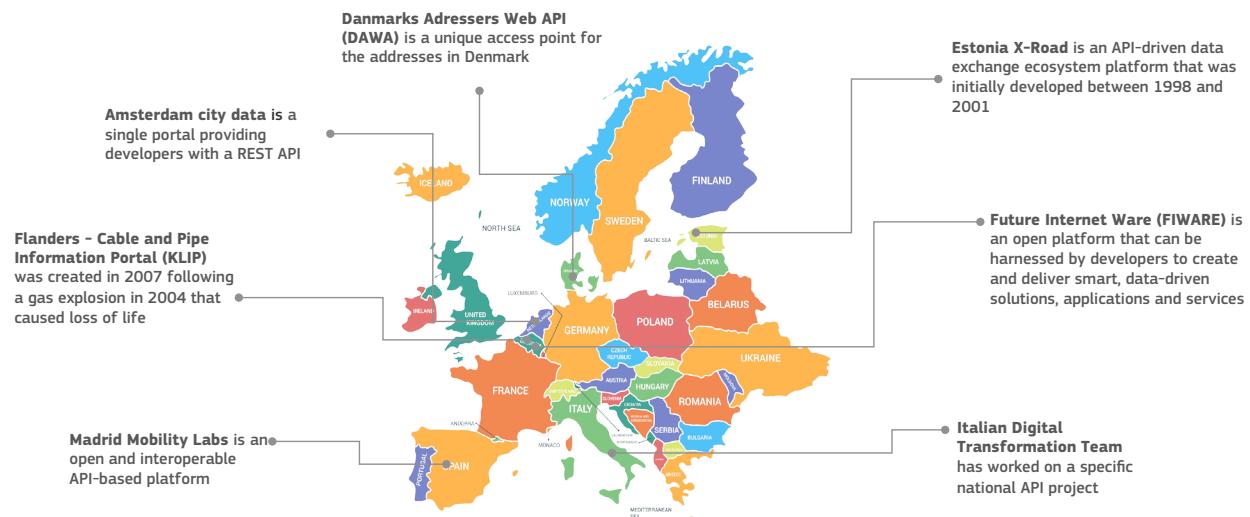


FIGURE 29: Case studies.

Source: JRC, own elaboration.

of the Finnish national data exchange layer. Originally built for SOAP/XML web services, it now extends to REST APIs (e-Estonia, 2019).

- **FIWARE NGSI v2** is an open platform that can be harnessed by developers to create and deliver smart, data-driven solutions, applications and services. It is a public–private partnership funded by the EU, corporate members and venture capitalists to develop the following: (i) a scalable open-source platform to access and manage heterogeneous related data through standardised unrestricted APIs, (ii) a standard for exchanging context information, namely the FIWARE NGSI (ETSI, 2019; FIWARE Foundation, 2014) and (iii) generic enablers and solutions to provide smart services with the FIWARE context broker as the main component (FIWARE Foundation, 2017).
- **Italian Digital Transformation Team (API strategy)**. The Digital Transformation Team, which was created to build the ‘operating system’ of the country, has developed a specific API strategy. The strategy’s goal is to create a series of fundamental components on top of which simpler and more efficient services could be built for citizens, government and businesses (Team Digitale, 2019).
- **Amsterdam city data**. A single portal has been developed to provide developers with access to Amsterdam’s open data and some non-public classified data with controlled access for city employees. These city data went live in 2016 for civil servants and in mid-2017 for developers. The architecture is loosely coupled, using APIs to deliver data to the frontend portal (Soetendal, 2019).
- **DAWA** displays data and functionality regarding Denmark’s addresses, access addresses, road names and zip codes. DAWA is used to establish address functionality in IT systems. The target audience for this site is developers who want to integrate address functionality into their IT systems. DAWA is part of the Amazon Web Services suite (Danish Agency for Data Supply and Efficiency, 2019).
- **KLIP** was developed by the government of Flanders in 2007 following a gas explosion in 2004 that caused loss of life. It is an API-driven platform in which all public and private utilities must share and request detailed digital maps showing the location of underground cables and pipes prior to carrying out engineering works (Informatie Vlaanderen, 2019).
- **Madrid Mobility Labs** is an ecosystem of APIs and a portal that brings information to citizens through multiple channels and applications for transportation-related APIs, such as on buses, parking, public bicycles, traffic, city hall sensors, third-party sensors and data (EMT-Madrid, 2019).

The structured interview for each case was designed to gather information about the following aspects (European Commission, 2019u):

- general information on the case study;
- non-technical aspects such as the strategy and vision of the implementing organisation and the purpose, usage, enablers, cost and benefits of the API;
- technical aspects such as the API specification or standard, authentication and authorisation, management and support;
- the need of the European Commission to provide/advocate regulations, guidelines or standards to enhance interoperability.

Survey

Our survey is aimed at gathering information about the state-of-the-play of government API strategies across Europe and abroad. The survey had three axes: the first explored information about API strategies at different levels of governments (international, national, regional and local), the second explored present API implementation projects and the third explored the demand for European actions regarding APIs.

The survey contained 130 questions related to the three axes' topics. Specifically, the first axis – API strategies – focused on gathering information about the goals, drivers, enablers, barriers and risks of current API strategic

thinking. It also enquired about budgetary aspects and business models being adopted. It also explored the impacts of API adoption from four perspectives, namely economic, social, organisational and technical. The second axis – API implementation projects – focused on gathering information about API implementation projects, about the availability of guidelines and best-practise documentation, about the sectors in which API solutions are being adopted, about access policies and methods that are being utilised and about the monitoring methods and metrics used. The third axis – API European vision – focused on understanding strategic gaps that may be addressed through actions at the European level.

Thirty-five representatives from the European government stakeholders targeted submitted their responses. Different government levels were represented; specifically, 22 responses stemmed from national institutions, eight were from local institutions and five were from an international institution. The sample size, although limited, facilitated the identification of certain patterns, to focus the work on the different phases of the project.

Figure 30 depicts the maturity-level spectra of the samples. From the responses obtained, it can be seen that 12 organisations already have an enacted API strategy and three have even already made amendments to it. Sixteen organisations have ongoing API strategy design processes and five organisations do not have an API strategy or plan to have a specific API strategy in the near future.

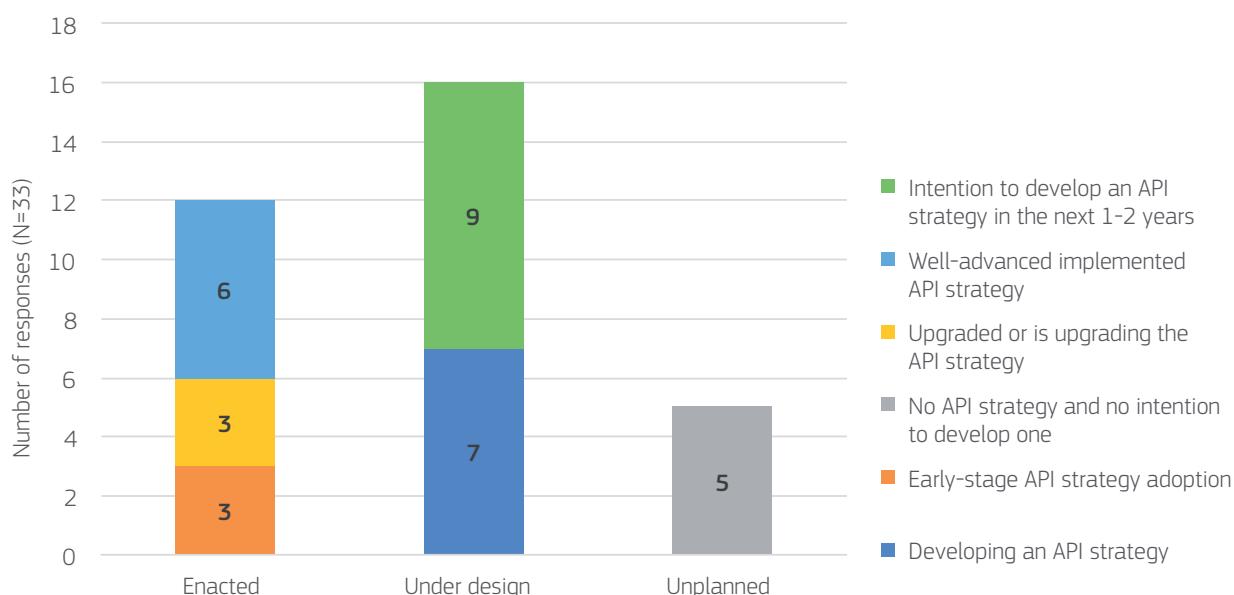


FIGURE 30: API strategies maturity level (survey).

Source: JRC, own elaboration.

Workshop

The project held a stakeholder workshop (17–18 October 2018 in Ispra, Italy) (European Commission, 2018f) to share the initial findings and gather more input related to government strategies for APIs across Europe and beyond. The workshop included keynote speeches from world-renowned experts from industry and academia, as well as contributions from API practitioners and representatives from different government levels (local, national and international) across Europe. The workshop's highlights are summarised below. Alongside introductions from the JRC and DG CNECT about the scope and purpose of the study and this workshop, four keynote speakers outlined some main considerations for workshop participants.

- **David Berlind** (Chief Editor of Programmable Web) set the scene with a keynote speech defining API concepts. He reflected on how inherent features of API solutions, such as reusability and substitution, potentially endow organisations with internal efficiency gains. He also highlighted the flexibility and ease of scalability that APIs offer for externalising resources for inter-organisational solutions. During a second intervention, he explained how the whole API classification exercise of setting up a ProgrammableWeb API catalogue has helped to understand key aspects of APIs.
- **Kin Lane**, the ‘API evangelist’, provided an in-depth look into the critical aspects that one should keep in mind when establishing sustainable organisational API

systems. He also presented the lessons learnt from the implementation of an API strategy in the United States under Barack Obama’s administration, for which he was a Presidential Innovation Fellow.

- **Medhi Medjaoui**, lead API economist at the API Academy and co-founder of the APIdays series of conferences, focused on APIs in the economic arena. He presented an analysis of the transition from the current API economy to a programmable economy, including both macro- and microeconomic perspectives. He stated that holistic API strategies in organisations should cover private, partner and public realms, given the main forms of interaction that APIs can support.
- **Mark Boyd**, writer and analyst of the API sector, opened the session related to APIs in the city realm. He presented relevant aspects of current city API deployments across the EU, specific API application cases and foresights about the key enablers for the sustainable growth of API city-based ecosystems.

As well as these keynote speeches, specific sessions were dedicated to representatives from governments across Europe. They presented their API strategies and experiences, providing valuable information about organisational arrangements, technical infrastructure approaches, the barriers and risks faced (and mitigation measures), community-building initiatives and the links between APIs and government platforms.

Annex 3 | Quick references to the study outputs

This document is the final report and main deliverable of the APIs4DGov study. It is complemented by a series of outputs of the study which could support the next actions in adopting APIs in governments. Some of these outputs are openly published as JRC technical reports and focus on specific topics of the study that could be relevant for readers. As highlighted by the study, governments should adopt APIs in a coordinated way. This report gives some ideas on a possible framework but, to give governments a more concrete tool, a further more detailed technical report has been published within the study (Mark Boyd et al., 2020a).

The specific government API case studies analysed in this work are also documented in detail in a separate report (Williams, 2018). These case studies present some of the ways that governments have implemented APIs in various areas and at different government levels. These case studies have also been used to support the ISA² ELISE action (European Commission, 2016j).

A webinar, developed within the study, could also be beneficial for those readers who would like to know more about governance models, ecosystems and benefits of APIs for public-sector organisations. The webinar, performed within the ISA² ELISE action, has also been published (European Commission, 2019v).

To establish a common level of technical background knowledge and an even landscape on web APIs, a document on web API general-purpose standards, terms and European Commission initiatives has been published as a technical report (Santoro et al., 2019).

For those readers who would like to know more about the background material of this study, a complete record of the workshop on EU API strategies has been published (European Commission, 2018f). In addition, all of the datasets that support the study have been published as part of the JRC data catalogue (European Commission, 2020h). These datasets could be used to support similar studies or to further adopt APIs in government.

The survey on government API strategies, which was used to develop our analysis on many aspects of the study, including costs and benefits and key enablers, drivers, barriers and risks, is also publicly accessible (European Commission, 2018k).

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Tools

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