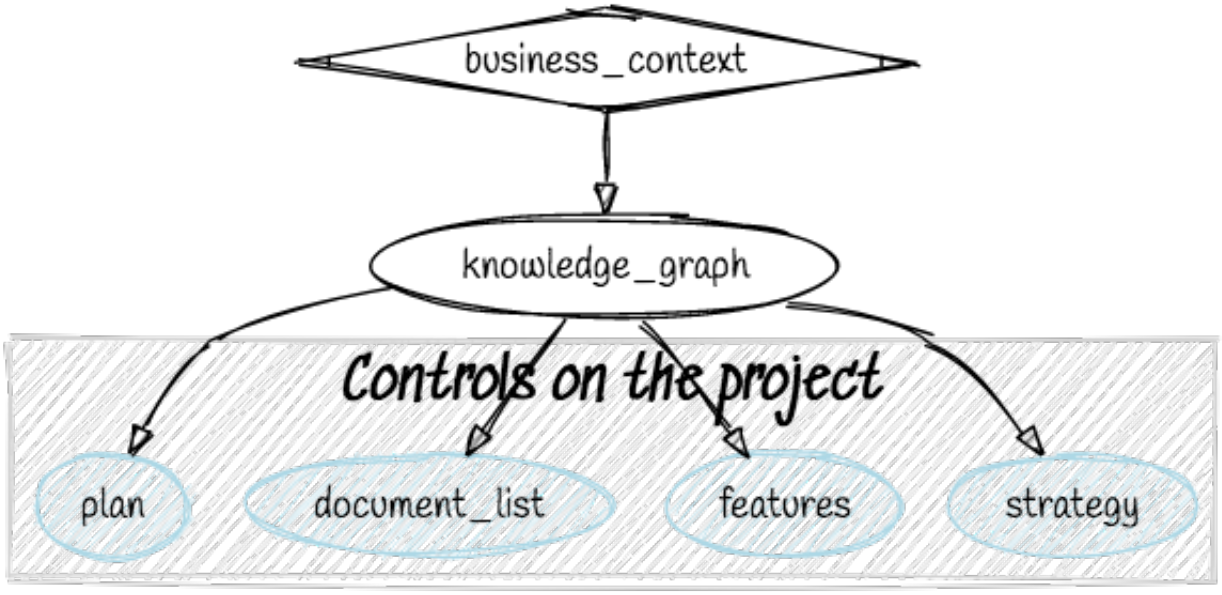
Setting-up projects with known success-factors

Key points

1. Projects can be characterised to reflect their specific business domain.
2. This is reflected in project plans, documentation, features and strategy.
3. These artefacts are generated from a success-factors paper & business library.
4. This is generated by a knowledge graph that uses keyword & topic models.
5. Software is free and method is recorded, so it can be applied by project teams.

Visual abstract



Outputs

1. Project plan
2. Project documentation list
3. Feature list for project work-packages
4. Table of Contents for the Project Strategy

Abstract

Projects are often controlled with plans, documentation lists, feature lists and strategies. We demonstrate how to create these artefacts from document libraries and a list of project success-characteristics. These sources are specific to the sector and organisation in question. In this way, we generate slim project-management artefacts that are both consistent and applicable to the project context. This is done by using natural language processing to generate a knowledge graph which generates the four artefacts. This worked-example looks at the project characteristics for a UK nuclear decommissioning project.

Methods

1. Automated Keyword extraction
2. Automated Topic Modelling
3. Knowledge graph creation.

Inputs

1. A paper identifying success factors for this type of project
2. A library of relevant guidance / regulations

Keywords

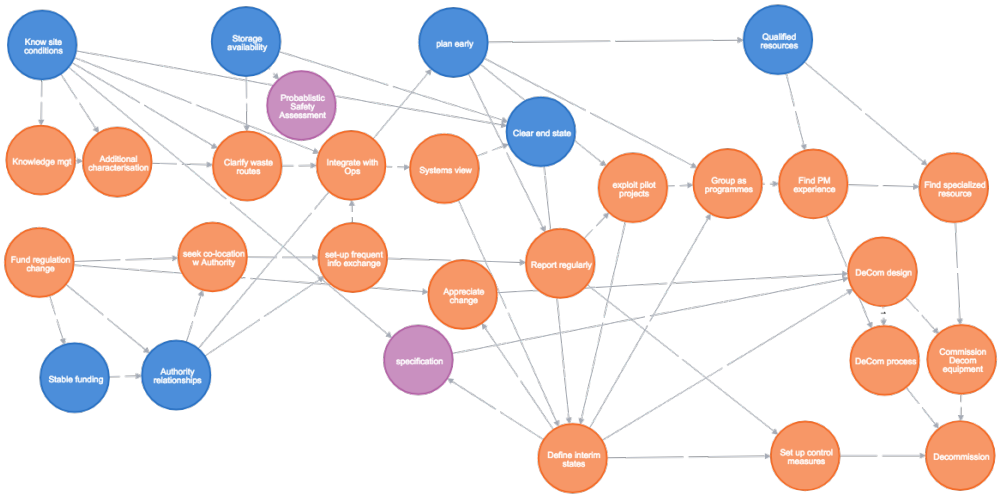
project management, project controls, project set-up, project strategy, project innovation, project characterisation, project data models, machine learning, topic models, natural language processing, graph database, design thinking, knowledge graphs.

Output 1: Project plan

Project plan

Project Activity	Successor Project-Activities
“Know site conditions”	[“Integrate with Ops”, “Additional characterisation”, “specification”, “Clarify waste routes”, “Clear end state”, “Knowledge mgt”]
“Report regularly”	[“exploit pilot projects”, “Set up control measures”]
“plan early”	[“exploit pilot projects”, “Report regularly”, “Group as programmes”, “Qualified resources”]
“exploit pilot projects”	[“Define interim states”, “Group as programmes”]
….	… *full list in appendix*

Visual plan



Blue(Success factors), Orange(Project services), Purple (Requirement-related)

Work break-down

Here the project-tasks have been grouped by success-factor.

Success Factor	Project Services supporting that Success Factor
“Know site conditions”	[“specification”, “Integrate with Ops”, “Clarify waste routes”, “Additional characterisation”, “Knowledge mgt”, “Clear end state”]
“Authority relationships”	[“plan early”, “set-up frequent info exchange”, “seek co-location w Authority”, “Stable funding”, “Fund regulation change”]
…	…*full list in appendix*

Output 2: Project Documents

Document List and document relationships

The diagram shows dependencies between documents.

	m.document
1	Site conditions list
2	Interim state definitions
3	Waste itemisation database
4	Master report
5	Specific project characteristics
6	regulation
7	List of Dutyholders
8	Probablistic Safety Assessment
9	Radioactivity log
10	Facilities description document
11	DeCom process document
12	Control measures dashboard
13	System Description
14	specification
15	Waste route diagrams
16	Authority Stakeholder Database
17	Storage availability database
18	End state definition
19	Confirmed Funding profile
20	Knowledge repository
21	Master plan
22	Qualified resource list
23	DeCom design

Green (Site and stakeholder related)

More central documents have more connections to other documents.
e.g. Waste itemisation database, Facilities Description and regulation.

Output 3: Feature list for project work-packages

These are the domain-specific features that should be tracked across the project. i.e. they are the attributes or properties captured for each work-package or sub-project. In this case, many of the features relate to requirements and site/stakeholder aspects that relate to project tasks.

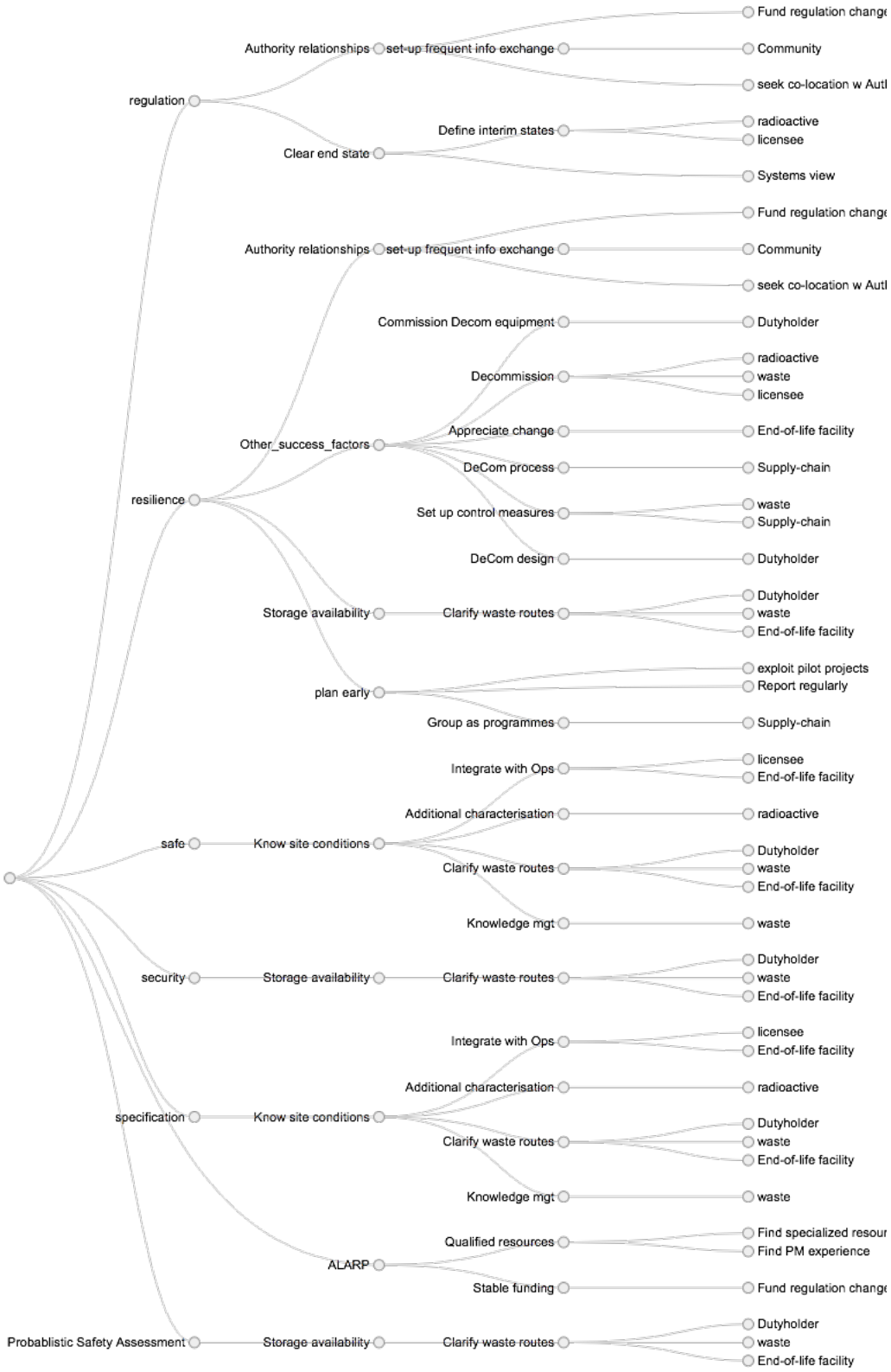
Work-package feature	Work-package 1	Work-package 2
Facilities affected		
Waste type, mass, and location		
Radioactivity		
Relevant regulations		
Related specification		
Licensee		
Related Dutyholders		
Supply chain list to date		
Local Community Groups		
Agreed ALARP level		
Safety performance		
Resilience score		
Security performance		

These features should be considered for inclusion in any lists and reports per Work-package. This work-package list may be an Excel sheet, or in Power BI or in an EPM system, or SQL database.These features are a key element of the project data-model.

Output 4: Project Strategy

The project strategy assists:
- stakeholder groups to understand the business justification
- the team to understand the method of execution.

The output is a Table of Contents for the strategy.



The structure should reflect the characteristics of project success in the business domain as well as the language and interests of the strategy consumers.

Table of Contents as file

Level 1 REQUIREMENT	**Level 2 SUCCESS FACTOR**	**Level 3 PROJECT SERVICE**	**Level 4 SITE FEATURE**
regulation	Authority relationships	Fund regulation change	null
regulation	Authority relationships	set-up frequent info exchange	Community
regulation	Authority relationships	seek co-location w Authority	null
..	***remainder in Appendix***	…	…

This worked-example settled on one of several possible structures, allowing Requirements the highest level in the hierarchy. Two merits of the approach:
- selection of a particular structure is explicit
- stakeholders can be involved in selection.

Inputs

1. A paper identifying success factors for this type of project
2. A library of relevant guidance / regulations

Input 1: Paper

Invernizzi, Locatelli, Brookes (2020) [1] propose the following factors in successful nuclear decommissioning projects:

Success factor	Description
“Know site conditions”	“detailed knowledge of the site conditions”
“Authority relationships”	“good relationship with the regulatory authorities”
“Storage availability”	“the availability of storage facilities”
“Clear end state”	“Clear site end state permits scope definition”
“Stable funding”	“Stable funding”
“plan early”	“It’s a plan that goes from cradle to grave!”
“Qualified resources”	“The availability of suitably qualified resources”

The paper also proposes project tasks to support these factors:

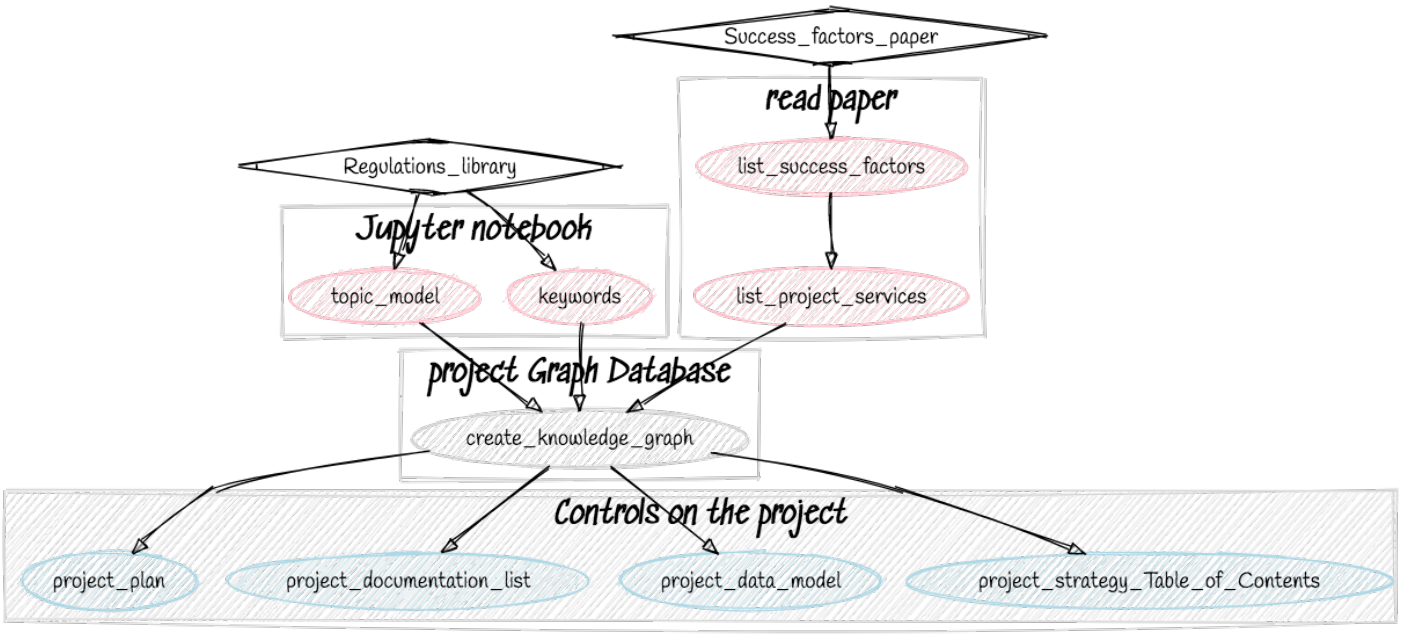
Project_Service	Description
“Additional characterisation”	“Characterise NDPs”
“Fund regulation change”	“If additional fund- ing to deal with these changes is not readily available, the overall NDP performance might be affected”
…	***full list in appendix***

Input 2: Library of guidance

The UK Office of Nuclear Regulation publishes a set of technical guidance This is a set of pdf documents. This is one element of the regulatory context for nuclear decommissioning projects. A subset of 17 documents were selected for their relevance to project and technical management.

Document
Commissioning-of-security-systems-and-infrastructure-cns-tast-gd–4.4.pdf.txt
Construction Assurance ns-tast-gd–076.pdf.txt
Decommissioning ns-tast-gd–026.pdf.txt
full list in appendix

Infographic



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The feature list to be tracked per work-package.

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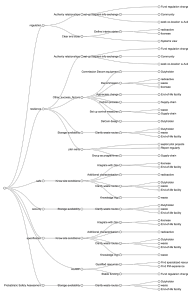

Business challenge

- Project structure is sometimes copied from project to project
  - sometimes structure does not adequately define or control the project
  - sometimes there is too much structure, which is expensive
- Project plans, strategies and controls are sometimes created separately
  - project controls can be opaque and inconsistent with each other

Business motivation

- ensure project characteristics make their way into project controls
- track only the project features that are important
- standardise early consultation across multiple stakeholders and standards
- consistently apply research-findings to improve project performance

Use cases

1. Set-up project in new business area
2. Set-up project where there are diverse stakeholders and business languages
3. Refresh organisation's project-model if track-record is poor
4. up-skill project teams in flexible data-models and machine-learning.

Technology applied

All technology is free to use, without subscription. The code is written up in Jupyter notebooks, which allows guidance to sit alongside the code, so limited coding experience is needed.
1. Gensim is OpenSource
2. NetworkX is OpenSource
3. Neo4j Desktop is free.
4. Jupyter Notebooks and Python are OpenSource.

Methods

Automated Keyword extraction

Keywords are taken from the guidance-library by scoring each word by how linked that word is to other well-linked words. This provides not just a list of keywords, but also the strength of relationships between keywords. This is done with the TextRank algorithm, which is like Larry Page's PageRank algorithm for web-pages.

Automated Topic Modelling

The strongest topics across the regulation library are identified by a topic model method called Latent Direchlet Allocation, or LDA. Murdock (2019)[2] says that

> *'LDA is a generative model that represents each document as a bag of words generated by a mixture of topics.'*
>
> *'It posits that each document has a distribution of contexts, or topics, that it is composed of.'*

Knowledge graph creation

The above methods generate lists of key concepts from the regulation library, as well as lists of relationships between concepts. The concepts become 'nodes' of a knowledge graph, and the relationships become 'edges' between these nodes.
e.g. 'radioactivity' is related to 'waste'. This is an edge connecting 2 nodes.

The success-factors paper contributes a number of success factors, as well as a number of recommended project services to be carried out by the project management team. These are added as nodes. Edges are added where there are:
- relationships between success factors
- between project services
- between a success factor and a project task.

Groups of similar nodes can take the same 'labels' .e.g.'success factor'.

This combined graph is one interpretation of project success in Decommissioning.Next, the project team:
1. views the graph for useful patterns
2. reinforces patterns by changing nodes and edges and labels.

Outputs are generated by querying the graph for specific labels.e.g. the Strategy TOC relates to a query which asks for nodes with labels in this order:

> *(requirements)–>(success_factor)–>(project_service)–>(site or stakeholder)*

Our contribution

context >> patterns >> form

We apply business *context* to a project. This provides an agreed *form* or structure. We do this by seeking *patterns* and reinforcing those which stakeholders recognise.

Another way of saying the same thing:

bundle >> unbundle >> deploy

1. *bundle up* the entire business context of the project
2. *unbundle* just enough to structure the project
3. *deploy* the project against this project structure.

Application to a project

1. clone repository. Apply Jupyter notebooks to your documents
2. use ‘human-in-the-loop’ filtering of keywords and topics
3. work with project experts during the knowledge-graph stage.

optional

1. use many more documents and keywords where required
2. add stakeholder criteria just as the success paper was added
3. add the team’s preferred project framework in the same way.

Limitations

This has been a simple working-example.The results should not be used without scrutiny and amendment by nuclear project managers.
- I have limited experience of the nuclear sector
- a limited number of keywords were used
- a limited number of documents were used
- I did not review the regulations.
- there are other regulations which apply.

Appendices

Full inputs and outputs are here

Intermediate results and knowledge graphs are here

Code to build Knowledge graph in Neo4j here

Repository with method and guidance. This should be sufficient for applying this to other projects and sectors. here *July 2020 note: still tidying up the notebooks in the folder Jupyter_notebooks, but its all there*

Acknowledgements

Diletta Colette Invernizzi, Giorgio Locatelli & Naomi J. Brookes (2020): Characterising nuclear decommissioning projects: an investigation of the project characteristics that affect the project performance, Construction Management and Economics, DOI: 10.1080/01446193.2020.1775859 here

The UK Office of Nuclear Regulation technical guidance

This project relies extensively on the Gensim[3] library, and the examples provided by its creator Radim Hurek. I have done nothing more than apply a little of this to Portfolio management. The examples cited above would be the best way to get a full introduction to the capabilities of Gensim.

NetworkX used to create knowledge graph from keywords

Neo4j Desktop is a graph database used here to create the knowledge graph.

Jupyter Notebooks is an accessible way to provide both guidance and images alongside code in a notebook format.

Python, Pandas, NumPy Matplotlib, PdfTextMiner6

TOC graphic with Raw Graphs, Infographic with SketchViz

Footnotes

1. Diletta Colette Invernizzi, Giorgio Locatelli & Naomi J. Brookes (2020): Characterising nuclear decommissioning projects: an investigation of the project characteristics that affect the project performance, Construction Management and Economics, DOI: 10.1080/01446193.2020.1775859 here ↩
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   title={Topic Modeling the Reading and Writing Behavior of Information Foragers},
   author={Jaimie Murdock},
   year={2019},
   eprint={1907.00488},
   archivePrefix={arXiv},
   link here ↩
3. @inproceedings{rehurek_lrec,
   title = {{Software Framework for Topic Modelling with Large Corpora}},
   author = {Radim {\v R}eh{\r u}{\v r}ek and Petr Sojka},
   booktitle = {{Proceedings of the LREC 2010 Workshop on New
   Challenges for NLP Frameworks}},
   pages = {45–50},
   year = 2010,
   month = May
   } ↩