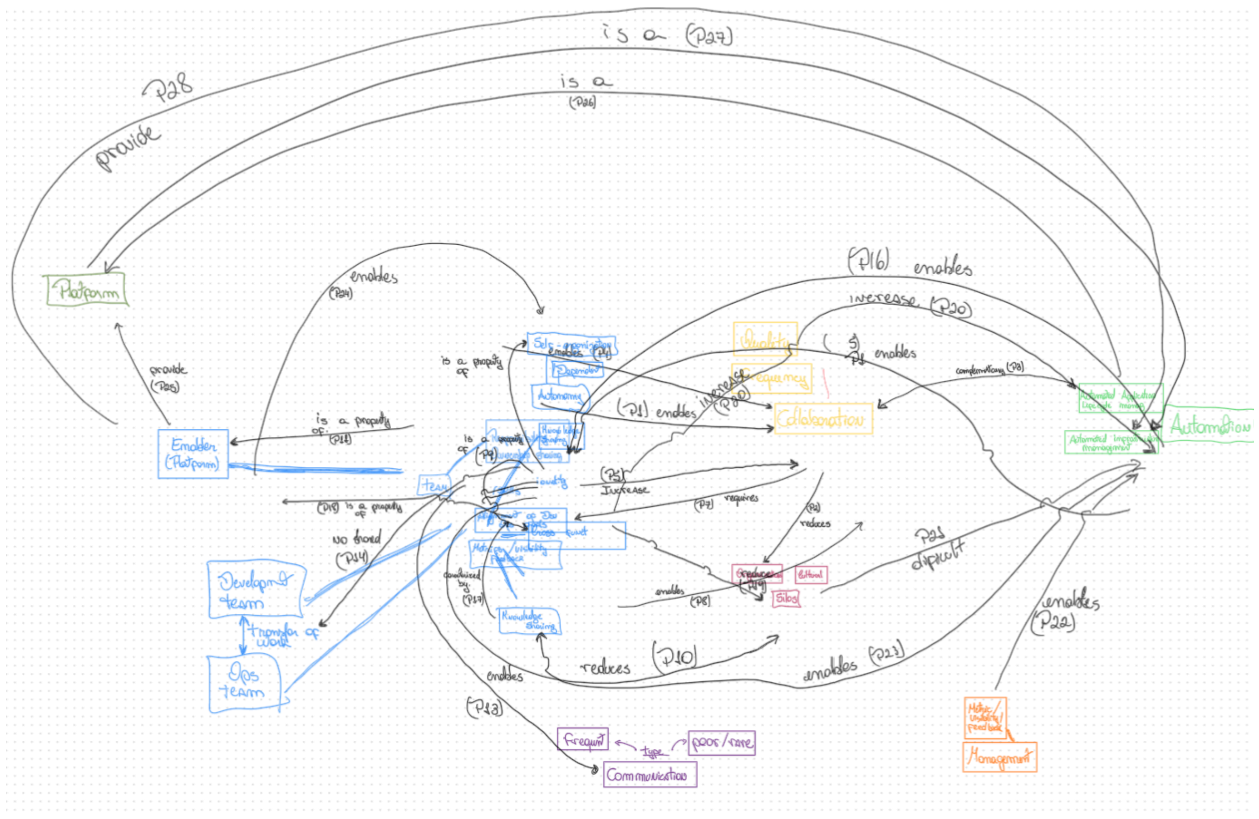
Testing results

Objective, description and contextualization.

O objetivo do teste foi verificar através de análises de entrevistas realizadas. O objetivo foi coletar informações que corroboram com as proposições e hypothesis geradas.



The purpose of the test was to verify the propositions and hypotheses generated through interview analysis. The goal was to collect information that corroborates the propositions and hypotheses.

To ensure accurate identification and refinement based on the information shared, the first phase of testing focused on validating the propositions. In parallel, we also identified potential improvements. This process led to the emergence of new variables, indicators, and propositions. Validating and testing the propositions before moving to the hypotheses ensures that the hypotheses are already refined when tested. As the hypotheses are more related to the different combinations of variables and indicators, it is better to have them thoroughly refined for this phase. The indicators for the variables were defined by the researchers and can be adjusted as needed before proceeding.

For this testing and analysis phase, we first invited Paes, given his broad vision and expertise in the field. He has authored a book and provides consultancy on team topology and taxonomy.

In the interview with Paes, we identified X indications of potential improvements and validated Y propositions. The objectives of this interview were: to validate the interview model, test the theory with someone who has deep knowledge of the research context, and confirm the results we had identified.

We conducted "test rounds" with Paes to validate the theory, the questions, and the research we intended to pursue. This also involved testing the semi-structured interview approach, with the questions derived from the propositions.

After selecting Paes for the first interview, the second round involved two participants. These interviewees were technical leaders with a solid understanding of team structures and the ability to discuss how this impacts team taxonomy, beyond just their technical perspective.

Like the first interview, we observed several refinements, and together with Paes' insights, these contributed to the evolution and inclusion of new attributes and propositions in the resulting theory.

Propositions and Hypothesis testing

[VALIDATE P1] - A **TEAM** CULTURE BASED ON **RESPONSIBILITY/OWNERSHIP SHARING** ENABLES **COLLABORATION**

Paes interview: "Pero eso también luego tiene que ver con cambios de responsabilidades ya que, en las empresas, sobre todo en las que son muy grandes y también en las gubernamentales, suele haber mucha separación de responsabilidades y un perfil solo puede hacer un tipo de cosas. Pero eso es lo que tienes que cambiar también."

[VALIDATE P2] - PROMOTING COLLABORATION REDUCES ORGANIZATIONAL SILOS/CONFLICTS

Paes interview: "¿En qué medida la colaboración puede contribuir a reducir los silos entre desarrollo y operaciones? Dicho de otra forma, ¿con qué frecuencia crees que tienen que colaborar para reducir los silos?

Respuesta (Manuel):

Tendrían que colaborar muy frecuentemente, porque esto significa que el equipo de desarrollo no sabe o nunca visto cómo se crea un servidor o un servicio en *cloud* (porque hasta ahora eso está dentro de un equipo de operaciones) y no tiene conocimiento de cómo hacer un *deployment* o cómo saber si un *deployment* tiene éxito o no y no sabe qué se está monitorizando. Todo esto está ocultado al equipo de desarrollo y no es visible para ellos. Entonces, sí, en este punto se necesita mucha colaboración."

[VALIDATE P4] - A TEAM CULTURE BASED ON KNOWLEDGE SHARING ENABLES COLLABORATION

Paes interview: "Tenemos que crear una infraestructura, una base de datos, por ejemplo, y para ello el equipo de desarrollo crea un ticket. El equipo de operaciones entonces va con ellos y lo hacen juntos. Este es un tipo de colaboración/facilitación, está entre medias. Cuando hacemos esto no es solo para crear la base de datos, sino para que el equipo de desarrollo entienda cómo funciona el proceso, qué tipo de herramientas se usan, etc."

[VALIDATE P8] - A TEAM CULTURE BASED ON METRICS/VISIBILITY/FEEDBACK ENABLES COLLABORATION

Specialist 1: "So I think that's the first thing. There must be this recurrence of, as if it were a retrospective, a recurrence of this autonomy of the two teams. If the operations team is spending a lot of time on the operation of this project here, which it shouldn't; on the contrary, it's also the opposite"

Specialist 2: "We have metrics for throughput, response latency, among others, that we not only monitor but are our goals, and our customers know they can count on them. These metrics are monitored automatically so we can react when something deviates from the expected."

[VALIDATE P9] - RESPONSIBILITY/OWNERSHIP SHARING IS A PROPERTY OF CROSS-FUNCTIONALITY/SKILLS TEAMS

Manoel interview: "...tenemos equipos más **autónomos**, con más **responsabilidad compartida** (end-to-end) y en los que esperamos ver menos colaboración con otros equipos (**menos dependencias**). Porque lo que estamos intentando hacer es un equipo más capaz de hacer todo el ciclo de vida completo. "

"equipos de producto (que nosotros los llamamos stream-aligned Team) que tienen ownership end-to-end, y pueden hacer todo por ellos mismos y que tienen una misión clara"

"Podemos intentar tener equipos de productos que sean end-to-end y tengan responsabilidad compartida" - Dani coment: Valida, parcialmente, ya que une estos términos dando por hecho que tienen relación

"¿tú crees que para que un equipo sea stream-aligned (o equipo de producto) y sea end-to-end debe tener responsabilidad compartida obligatoriamente? ¿Tu dirías que es una condición imprescindible?

Specialist 2: "from the moment you have shared objectives and each one has to do their part, you have a real team and you can have a greater impact, achieve bigger goals"

Respuesta (Manuel):
A ver, yo creo que es lo ideal."

" **en estos equipos cross-funcionales es inherente la responsabilidad compartida**, pero hay que reducir la carga cognitiva.

Respuesta (Manuel):
Si"

[VALIDA P10] - RESPONSIBILITY/OWNERSHIP SHARING REDUCES ORGANIZATIONAL SILOS/CONFLICTS

To reduce silos, it is essential to collaborate frequently in the early stages to ensure information sharing.

Paes interview: "el equipo de desarrollo no sabe o nunca visto cómo se crea un servidor o un servicio en *cloud* (porque hasta ahora eso está dentro de un equipo de operaciones) y no tiene conocimiento de cómo hacer un *deployment* o cómo saber si un *deployment* tiene éxito o no y no sabe qué se está monitorizando. Todo esto está ocultado al equipo de desarrollo y no es visible para ellos. Entonces, sí, en este punto se necesita mucha colaboración."

Specialist 2: "If they're closer in time zone, you can even do something a little better"

If there is no shared responsibility, conflicts arise.
"If I had Silos between functions, then it's just going to be fights, and then you're going to do what's going to end up scaling, and then you're going to have a VP of product fighting with a VP of engineering with another of operations; like, no, if it got up there, we're already lost"

[VALIDA P11] - RESPONSIBILITY/OWNERSHIP SHARING IS A PROPERTY OF ORGANIZATIONAL STRUCTURES THAT RELY ON AN ENABLER (PLATFORM) TEAM. THE EXISTENCE OF PLATFORM TEAMS DOES NOT LEAD TO A SEPARATION OF RESPONSIBILITIES BUT RATHER THEY BECOME FACILITATORS AND MAKE OWNERSHIP SHARING POSSIBLE, UNLIKE DEV OPS (BRIDGE) TEAMS THAT BECOME NEW SILOS WITH THEIR OWN RESPONSIBILITIES (E.G., DEPLOYMENT, MONITORING, ETC.)

When a platform team arrives, they take on part of the responsibility and reduce the cognitive load.

Paes interview: "En teoría, estos equipos pueden hacer todo por sí mismos, pero esto no es factible desde el punto de vista de carga cognitiva, de tamaño de equipos, etc. Además, muchos equipos no tienen el conocimiento necesario. Entonces, por esto viene Team Topologies y plantea la necesidad de equipos de *enabling* y un servicio de plataforma que tiene que ser construidos de manera que realmente reduzca, y no incremente, la carga cognitiva".

"...un equipo stream aligned por sí mismo no pueden sobrevivir, en el sentido que la carga cognitiva es muy alta y por esto necesitan que los equipos de plataforma y *enabling* les ayuden a reducir la carga cognitiva, para que puedan abstraerse de hacer ciertas cosas."

[VALIDATE P12] - RESPONSIBILITY/OWNERSHIP SHARING IS A PROPERTY OF TEAM SELF-ORGANIZATION AUTONOMY

Manoel interview: "Un equipo autónomo tiene que compartir más responsabilidad dentro del equipo, incluso la definición de producto y la definición de valor al cliente."

"...tenemos equipos más **autónomos**, con más **responsabilidad compartida** (end-to-end) y en los que esperamos ver menos colaboración con otros equipos (**menos dependencias**). Porque lo que estamos intentando hacer es un equipo más capaz de hacer todo el ciclo de vida completo. "

"equipos de producto (que nosotros los llamamos stream-aligned Team) que tienen ownership end-to-end, y pueden hacer todo por ellos mismos y que tienen una misión clara"

"Podemos intentar tener equipos de productos que sean end-to-end y tengan responsabilidad compartida" - Dani coment: Valida, parcialmente, ya que une estos términos dando por hecho que tienen relación

"¿tú crees que para que un equipo sea stream-aligned (o equipo de producto) y sea end-to-end debe tener responsabilidad compartida obligatoriamente? ¿Tu dirías que es una condición imprescindible?

Respuesta (Manuel):

A ver, yo creo que es lo ideal."

Manoel agrees but also points out that there are other aspects to consider. Silos can actually be a good thing. A silo means that the team is well-defined and focused on solving its own tasks without needing to coordinate or adjust with other teams at that moment.

Manoel interview: "Hay gente que dice que esto al final es un silo (que es lo que al principio decíamos que era un problema cuando empezamos con DevOps). Yo digo que sí es un silo, pero es un silo distinto que tiene valor. Con este tipo de silo a nivel de producto estamos diciendo que este equipo tiene un enfoque muy claro en un producto o en una parte de un producto."

[VALIDATE P13] - A TEAM CULTURE BASED ON RESPONSIBILITY/OWNERSHIP SHARING ENABLES COMMUNICATION

Valida P13 (responsabilidad compartida > mayor comunicación), aunque en sentido inverso

Specialist 2: "from the moment you value collaboration a lot, you will make the teams talk to their neighbors and want to share responsibility for something bigger."

[VALIDATE P14] - RESPONSIBILITY/OWNERSHIP SHARING IS ASSOCIATED WITH THE TRANSFER OF WORK BETWEEN TEAMS. IF THERE IS NO SHARED RESPONSIBILITY, THERE IS NECESSARILY A TRANSFER OF WORK BETWEEN DEVELOPMENT TO PRODUCTION AND OPERATION TEAMS (AND VICE VERSA)

Paes interview: "Tenemos que crear una infraestructura, una base de datos, por ejemplo, y para ello el equipo de desarrollo crea un ticket. El equipo de operaciones entonces va con ellos y lo hacen juntos. Este es un tipo de colaboración/facilitación, está entre medias. Cuando hacemos esto no es solo para crear la base de datos, sino para que el equipo de desarrollo entienda cómo funciona el proceso, qué tipo de herramientas se usan, etc."

Specialist 1: "question: So, would you say that when there isn't this sharing of responsibility, there's this transfer of tasks between teams?

Interviewee: Yes, undoubtedly. We talk about responsibility, but it's work, it's the work of keeping it running. It might be well done, never have a problem, but you're attentive, monitoring, you're responsible for it. And, of course, depending on how well it's done, the responsibility can be lighter or heavier."

[VALIDATE P21] - ORGANIZATIONAL SILOS/CONFLICTS MAKE THE ADOPTION OF AN AUTOMATED APPLICATION LIFE-CYCLE MANAGEMENT DIFFICULT

Silos hinder automation, though it's important to note that silos can also be useful in certain cases.

Paes interview: "Question: ¿En qué medida crees que la existencia de los silos dificulta la automatización?

Answer: dificulta mucho porque en vez de automatizarlo cada silo lo intenta hacer dentro de su silo y esto les toman mucho tiempo o esfuerzo o intentan usar servicios o incluso *shadow projects* que no son oficiales y no son transparentes, lo cual es un problema de cultura ya que no pueden hablar abiertamente sus problemas."

On the other hand, silos are important when a team needs to automate something that will improve their workflow and is tied to their cognitive capacity. In this case, ensuring the team's autonomy allows them to develop their own automations.

"En general los silos dificultan. Ósea, no es 100% malo, porque hay casos que quieres automatizar de una manera concreta lo que necesita este equipo o este grupo de equipos porque es lo que ayuda, pero hay otros casos donde queremos compartir algunos flujos de automatización, datos y no tenemos las conversaciones para definir qué problemas son los específicos son para un equipo y qué problemas son comunes y deberíamos buscar una solución común. "

[VALIDATE P22] - METRICS, VISIBILITY & FEEDBACK ENABLES AUTOMATED APPLICATION LIFE-CYCLE MANAGEMENT

Specialist 2: "I believe you can't simply blindly trust automation, and metrics are like the pulse that determines if things are working or not. We have feedback from this process, and human supervision is important."

"So, metrics are essential for us to know if things are working as expected, and we have alerts to notify us when something isn't going well."

"As we're a platform team, some metrics are very important to us, as we sign contracts with our customers, such as Service Level Objectives (SLO)"

Specialist 1: "question: So in your opinion, metrics and having this visualization of this information ends up helping.

Interviewee: yes

Isaque Alves: Maintaining this automation

Interviewee: Perfect, exactly. The more indicators of quality, agility, and fluidity of all these processes"

[VALIDATION P23] - AUTOMATED APPLICATION LIFE-CYCLE MANAGEMENT ENABLES SKILLS/KNOWLEDGE SHARING

Specialist 1: "Do you think that by automating and focusing efforts on this, it will help me share knowledge between these two teams?

Interviewee: Yes, definitely. I would say that, as I gave my example, the limitation of the way I asked for permission to do it and even then it was, let's say, a half-baked transfer of knowledge. Because no one stopped to show me, I had to go and do some research and so on. And then thinking about the knowledge needed for all this to work and who holds it and what is the flow of knowledge that needs to exist, I understand that there is knowledge that is exclusive to development. Which is Dev, there is this knowledge of operations that belongs to the practitioner who is exclusively operations and exclusively DevOps. It even involves the DevOps part because he is studying, just like the development team, the issues of developing the Framework and scalability in that sense. Between the application; on the other hand, the devops specialist is the one who can innovate, right, in this area of infrastructure. He is the one who is concerned with trends, he is the one who is studying new infrastructure tools, in short, organization and automation, and I think that DevOps is a meeting. "

[VALIDATION P28] - ENABLER (PLATFORM) TEAMS PROVIDE AUTOMATED APPLICATION LIFE-CYCLE MANAGEMENT

Specialist 1: "Airflow, I see a lot of this team, the Central team that maintains Airflow for the data science teams in corporations. So this team is responsible for maintaining the Airflow infrastructure and the various Airflow instances running, but the teams that only use it don't need to worry. For them, it's peace of mind. Platform as a service and there's the Central team that does this."

Refinement suggestions/changes

3 attributes added.
4 new propositions.

1 - [ATTRIBUTE] Insert an attribute related to the team's cognitive load.

Cognitive load is a subjective attribute. Since we haven't consolidated it, we define it as high and low, for future refinement.

CHANGE:
Change the enumeration **Quality degree -> Subjective Degree**. Change to accomplish with the new attribute added in the team.
Add cognitive load attribute to team.

2 - [PROPOSITION P29] Platform Servicing reduce product team cognitive load

COMMENT: The proposition P11, P29 talks about the platform, but just about the platform service provided by horizontals (Enabler and Bridge). Now we can represent the other side. The relations between platform servicing and team.

CHANGE: [NEW PROPOSITION]
P29 - Platform Servicing reduces team cognitive load.

References:

Paes: "La plataforma tiene que reducir la **carga cognitiva** de los equipos de producto que consumen la plataforma."

"...en teoría **los servicios de plataforma reducen la carga cognitiva** si están bien hechos, si están ayudando los equipos de producto."

"Como definición, un equipo de **plataforma** es un equipo que tiene un objetivo primordial reducir la carga cognitiva de otros equipos y ayudarles a ser más autónomos, acelerando así su entrega de valor."

Paes interview: "...falta pensar en qué automatizaciones necesitamos para reducir la carga cognitiva de los equipos. Y también, se necesita automatizar a nivel de gobernanza y de temas como seguridad, privacidad, regulaciones. Todo esto tiene mucho sentido automatizarlo en algún tipo de servicios de plataforma, pero falta mucho para esto porque es mucho más difícil que comprar una herramienta. Este es tu negocio interno, y tú tienes que tener tus expertos que colaboran con plataforma para automatizar, no todo, hay cosas que no se puede automatizar, pero hay mucha cosa que puede automatizar (controles financieros, controles de privacidad, etc.) porque esto es otro tipo de dependencia que suele haber. Los expertos en seguridad, *compliance*, legal, esto es también un cuello de botella. Entonces es importante promover la automatización y aumentar así el flujo del valor y no tener todas estas dependencias."

Paes interview: "Es curioso porque empezaron a hacer que cada equipo tenga end-to-end ownership y lo único que tenían que hacer de forma standard era usar los servicios cloud del amazon, nada más, no tenían plataforma ni nada. Entonces, ahí los equipos eran stream aligned ideal en el sentido de no depender de ningún otro equipo, pero sin embargo llegaron a una carga cognitiva muy alta. Entonces tenían que preocuparse con tanta cosa, que ya ni siquiera tenían tiempo para analizar las necesidades de los clientes del servicio. Simplemente estaban ocupados con la parte técnica. Por esto, un equipo stream aligned por sí mismo no pueden sobrevivir, en el sentido que la carga cognitiva es muy alta y por esto necesitan que los equipos de plataforma y *enabling* les ayuden a reducir la carga cognitiva, para que puedan abstraerse de hacer ciertas cosas."

Specialist 2: "So, you create a layer of abstraction. I'm not sure if this is a silo in the sense that there's not even access, you have to understand a bit of a level below. So, when I'm setting up my service here, I say I need so many instances, what's the type of database, what's my data retention plan, data replication, how much redundancy do I need. I have to have a minimum understanding of what this means in how the infrastructure will actually be provisioned, but I don't need to understand cloud configuration, virtual machine, network, data allocation, and none of that."

COMMENT:

Therefore, *Bridge_Team* supports and helps development and operation teams, mainly by deploying and hosting applications in the platforms they build **(platform builders)**, monitoring, and providing support. But not provide consulting and evangelization of the DevOps practices. That creates a dependence. According to practitioner 1, when establishing a platform, “You're missing out on an opportunity to deliver more value”.

References:

Specialist 2: "You're missing out on an opportunity to deliver more value, so I think that in essence this collaboration is what allows us to have economies of scale by deliberately creating these silos. When we create these platform teams, we're creating a dependency."

3 - [ATTRIBUTE] Insert the attributes motivation, duration, and Definition of Done to Collaboration.

CHANGE:
Add attributes to collaboration.
Adjust explanation (E6 - Collaboration)

Motivation: The reason or purpose for the collaboration ("why we are doing this"). This explains the objective behind the interaction between teams.
Duration: The estimated or expected length of the collaboration. This sets an anticipated timeframe for the collaborative effort.
Definition of Done: The agreed-upon endpoint or success criteria for the collaboration. It serves as a marker to indicate that the collaboration is complete and can be measured, for example, with a boolean value (true/false) when the goal is achieved. Examples include having an API defined or a test automated.

COMMENT:
We adjust the validation to Definition of Done to align with the current terminology.

Paes interview:

"Pregunta (Dani):

¿Qué más parámetros crees que se pueden modelar sobre la

colaboración? Respuesta (Manuel):

Pues **duración**, **motivo** y una **validación** que cuando termina la colaboración y cuanto más específico mejor (si puede ser un booleano mejor). Por ejemplo, vamos a colaborar para definir esta API, pues el punto de llegada es tenemos la API definida y los dos equipos están de acuerdo en que ese es el punto de llegada. Otro ejemplo, necesitamos automatizar algún test, entonces el punto de llegada es tener un test automatizado en el pipeline. Entonces, para la colaboración son estos puntos: la duración estimada o esperada (que luego se puede cambiar) y el punto de validación que indica que se terminó la colaboración. Bueno, y también en algún momento puede pasar que la colaboración no esté funcionando porque uno de los equipos o no tiene tiempo o conocimiento para colaborar en esta área. Y luego la **facilitación** también debería tener un motivo, ósea porque estamos haciendo esto, e igual que antes saber cuándo se habrá terminado porque también hay un riesgo en la facilitación (para los *enablers teams* en particular, pero también puede darse facilitación entre equipos, por ejemplo, un equipo de producto senior que está ayudando un equipo más junior haciendo una migración de microservicios). Entonces, el tipo de interacciones puede estar más definido y de manera más específica y permitir que cualquier tipo de equipo interactúe con otro."

4 - [PROPOSITION P30] - A high quality collaboration reduces dependency, increasing team autonomy.

COMMENT:

Collaboration is crucial, but it can be costly and should only be used where it clearly adds value. Avoid using it for routine tasks or to address unnecessary dependencies that could be resolved by improving existing structures or processes. A collaboration-based culture focuses on solving problems in the most effective way possible. Therefore, at the start of any collaborative effort, you must clearly define its motivation, expected duration, and a clear definition of "done." These variables will determine the ideal **collaboration frequency** and **collaboration quality**.

Collaborations are meant to solve specific problems and should not be used for everyday tasks. For example, teams collaborate to automate a process or resolve an issue. Once autonomy is gained, they can return to focusing on their tasks and improving their area of expertise.

CHANGE:
P30. A high quality collaboration reduces dependency, increasing team autonomy.

Paes interview:

"Sí, un contrato temporal digamos. La colaboración es importante, pero también tiene un coste alto, entonces vamos a usar la colaboración donde realmente tiene valor. No para un trabajo digamos más común en el que estamos colaborando porque hay una dependencia que no debería haber, una dependencia que deberíamos solucionar."

Paes interview:

"En el caso de UX, si hay un equipo centralizado de UX y muchos equipos dependen de este equipo centralizada, y esto es un problema (puede no serlo, pero normalmente lo es) porque dificulta el flujo de valor al cliente. Justo hace poco hable con una empresa que tienen ahí un problema porque hay un proceso que indica que el equipo de UX tiene que aprobar todo y eso les toma dos semanas y media para un cambio que ellos pueden hacer en dos días. Por eso **las interacciones sirven para reducir dependencias**, no para mantener interacciones con una determinada frecuencia (porque esto significa que tenemos una dependencia que a lo mejor no es útil a nivel de flujo), sino que muchas veces queremos colaborar para hacer una facilitación durante un tiempo y enseñar a un equipo, por ejemplo, a cómo hacer un buen diseño o cuales son las guías de diseño de la empresa, de forma que ese equipo pueda hacer, no el 100%, pero sí el 80% de las cosas de UX."

5 - [METHOD] - Insert customer focus on Horizontal Team

COMMENTS:
Since we have to add customer_focus() to horizontal teams, we can adjust the Product Team setting external as the focus.

CHANGE:
Add method + customer_focus(internal) to Horizontal Team
Set as external to the Product team customer focus.

REFERENCE:

Paes interview: "...en el modelo solo ponéis "*customer focus*" en los equipos de producto, pero **los de plataforma y enabling también tienen que tener *customer focus***, la única diferencia es que el customer es interno y no externo. Os digo esto porque tiene que ver con la pregunta."

Specialist 2 shows how they works as a enabler(platform) team leader: "My primary objective is to increase the number of products and customers on our platform. Often, teams choose not to create this dependency and prefer to do everything internally to gain speed. The platform will always provide an overview of various customers and products, but it doesn't cover all use cases. Ultimately, I believe it's beneficial for the business to invest in this type of team; however, it's an exciting challenge to effectively sell the advantages of this platform and deliver value to customers."

6 - [CONNECTION] - Product management in enabler (platform) team

COMMENT:
So far, we only have enough information to add the connection. We'll take a question to the next test round to better establish a proposition and hypothesis that helps describe and validate.

CHANGE:
Add the connection (+ manage) from Product Management to the horizontal team.
Add to the explanation: Product management activities enable a horizontal team to create a valuable product (services and platform).

REFERENCE:

Paes interview: "hace falta tener más ***product management* dentro de la plataforma** y es lo que a muchas empresas les falta. Los equipos de producto también muchas veces son equipos de desarrollo, aunque hacen más cosas y son *build-and-run teams*, muchas veces no tienen ownership de la parte de negocio y producto. Tienen un *backlog* que alguien define o su *product manager* define y el equipo ejecuta. Y aún falta ahí. Pero, el tema de cross-functional está bastante extendido entre los equipos de producto general y en plataforma no tanto."

7 - [EXPLANATION] - Adjust explanation (E3 - Automation)

COMMENT:

Automation **also reduzir a carga cognitiva** das equipes. Logo, além da automação de tarefas técnicas, é fundamental automatizar áreas mais complexas como **governança, segurança, privacidade e regulamentações**. A principal ideia é que esses processos, tradicionalmente manuais e gerenciados por especialistas (como equipes de segurança ou compliance), criam **dependências e gargalos** que desaceleram o trabalho das equipes. Ao transformar essas atividades em **serviços de plataforma automatizados**, as equipes podem se concentrar em seu trabalho principal, como a entrega de valor aos clientes.

CHANGE:

Paes interview: "...falta pensar en qué automatizaciones necesitamos para reducir la carga cognitiva de los equipos. Y también, se necesita automatizar a nivel de gobernanza y de temas como seguridad, privacidad, regulaciones. Todo esto tiene mucho sentido automatizarlo en algún tipo de servicios de plataforma, pero falta mucho para esto porque es mucho más difícil que comprar una herramienta. Este es tu negocio interno, y tú tienes que tener tus expertos que colaboran con plataforma para automatizar, no todo, hay cosas que no se puede automatizar, pero hay mucha cosa que puede automatizar (controles financieros, controles de privacidad, etc.) porque esto es otro tipo de dependencia que suele haber. Los expertos en seguridad, *compliance*, legal, esto es también un cuello de botella. Entonces es importante promover la automatización y aumentar así el flujo del valor y no tener todas estas dependencias."

8 - [HYPOTHESIS] Adjust the P2 hypothesis.

COMMENT: The hypotheses H2.2 Teams with eventual collaboration are associated with fewer organizational silos and H2.4 Teams with low-quality collaboration are associated with fewer organizational silos were refuted. However, they were refuted with the argument that the need for frequent collaboration to break the silo. This weakens the validity of the hypothesis in the context described, but this hypothesis can describe a team with low-quality collaboration associated with organizational silos.

CHANGE: change the propositions:

H2.2 Teams with eventual collaboration are associated with **fewer** organizational silos

-> H2.2 Teams with **eventual collaboration** are associated with **organizational silos**

H2.4 Teams with low-quality collaboration are associated with **fewer** organizational silos
-> H2.4 Teams with **low-quality collaboration** are associated with **organizational silos**

EXPLANATIONS ADJUSTS

\subsubsection*{Providing Explanations to justify the Theory}
An explanation is a relationship among constructs and other categories that are not central enough to become constructs. An explanation answers a question of why categories and classes are related, and this helps explain how DevOps team structures differentiate in the theory context, including notions of causality and asymmetry~\cite{sjoberg:2008}. To that end, the following explanations are based on the constructs and propositions shown in Appendix~\ref{app:constructs_propositions}.

E1 - Team and specializations

We identified four-team specializations: Product_Team, Development_Team, Operation_Team, and Horizontal_Team. Each of these specializations has characteristics that justify its existence, whether in the attributions of variables they inherit from the Team or in actions they perform.

A Product_Team is completely responsible for a product/service (from scoping out the functionality, to architecting, building, and operating it). Thus, it is common to have responsibility/ownership_sharing = medium_sharing or full_sharing, i.e., shared responsibility of products and tasks (e.g., NFR shared responsibility, infrastructure management shared responsibility, monitoring shared responsibility, and incident handling shared responsibility) and autonomy = self_organization, i.e., access to all necessary information to develop, deploy, and operate the product (see Proposition P12). When provided by a Platform Servicing, the product team can set a cognitive_load = median/normal. In this way, product teams can innovate quickly with a strong customer focus as there is alignment with business goals (alignment_of_dev&ops_goals = product_thinking), which is a requirement of a collaboration-based culture (see Proposition P7). Collaboration and responsibility sharing are properties of cross-functional teams (see Propositions P5 and P9, respectively), thus, product teams require having cross-functionality/skills = True, and this reduces silos (see Propositions P2, P10, and P19). Collaboration is crucial, but it can be costly and must be used when it clearly adds value. Product teams can establish a clear motivation, duration, and definition of done for a collaboration. Resulting in a Collaboration.frequency = daily and Collaboration.quality = median or high. All these properties imply that product teams are self-sufficient and capable of promoting innovation with product thinking. The following excerpt supports this explanation [1:11] \textit{``Consolidated product teams, which have dealt with both organizational and cultural silos by aligning dev \& ops goals with business goals and show cross-functional teams with shared product ownership, end-to-end product vision and high-levels of self-organization and autonomy''}.

The relationship between Development_Team, which focuses on feature development, and Operation_Team, which focuses on creating and maintaining the project's infrastructure, establishes structures and taxonomies already known and cited by the authors in previous works that depend on the values of some attributes we identified in Construct C3. These attributes are as follows. Well-defined and differentiated roles, i.e., role_definition/attributions = True , usually show poor collaboration (Collaboration.frequency = eventual) and communication (Communication.type = poor/rare), promoting a transfer of responsibilities. Hence, roles with clear and non-shared responsibilities (responsibility/ownership_sharing = minimal or null_sharing), build a scenario where the collaboration is not fostered or promoted (see Proposition 6). It generates a transfer of responsibility between the teams (see Proposition 14) instead of sharing common responsibilities. However, as collaboration and shared responsibility increase, silos, and conflicts are reduced or eliminated. The following excerpts support this explanation [2:11] \textit{The classical DevOps structure focuses on collaboration among developers and the infrastructure team. It does not eliminate all conflicts but promotes a better environment to deal with them} [1:9] \textit{``resulting from the creation of teams in which developers and operators daily collaborate, but there exists still a transfer of work between them, showing some cultural barriers''}.

Finally, Horizontal Teams are a specific structure that helps and supports the needs of multiple development or product teams within an IT department. With a customer_focus(internal) and Product_Management activities, they ensure that core operations are handled efficiently, delivering value and reducing the dev/product teams cognitive_load (see Proposition 29). Sometimes it is not necessary to create new structures because the operation team/department takes over these needs and assists dev/product teams. These needs can be platform servicing and tools for automated application life-cycle management (see Proposition 26) and automated infrastructure management (see Proposition 27), and also consulting, training, evangelization, mentoring, human resources, etc. Horizontal_Team is an abstract class as it will only serve as a model for the Enabler_Team and Bridge_Team, which inherit the attribute cross-functionality/skills: boolean, thus, they could be cross-functional or not; usually, an Enabler_Team or a Bridge_Team has multiple skills, but it is not mandatory (see Proposition P18).

Enabler_Team --- named in different ways, e.g., DevOps Centers of Excellence, chapters, guilds, platform/SRE teams --- provides platform servicing and tools (see Interface Platform_Servicing and Proposition P25), consulting, training, evangelization, and mentoring. This enables product teams with automated application life-cycle management (see Proposition 28) and self-organization \& autonomy (see Proposition 24), driving the DevOps culture, values, and practices.

In contrast, Bridge_Team supports and helps development and operation teams, mainly by deploying and hosting applications in the platforms they build (platform builders), monitoring, and providing support. The engineers of these bridge teams are DevOps practices facilitators; hence, they usually create, deploy, and manage both the infrastructure (environments) and deployment (CI/CD) pipelines, although they may be also involved in other tasks, such as requirements (user stories) analysis and coding. They are usually the bridge interface between developers and IT operations to drive the DevOps culture, values, and practices.

E2 - Management

Management is an important activity that assists in developing a software system or provide a servicing. It is responsible for generating metrics and indicators and monitoring risks. There are two management specializations. Product_Management is responsible for managing the product end-to-end (both development and operation) whereas Project_Management is responsible for managing a temporary endeavor of that product lifecycle (e.g., development). This specialization also enables a Horizontal_Team to create a valuable product, which includes services and platforms. In our theory, note that Management has the attribute change_type, which represents the frequency of changes. The following excerpts support this explanation [9:15] \textit{``change is necessary in order to improve. Without that, there is not much room for maneuvering''}. [9:17] \textit{``Change management is best pursued as small, continuous actions, the majority of which are ideally both automatically tested and applied''}.

E3 - Automation

Automation is an essential DevOps activity. Beyond its role in streamlining technical tasks, automation is instrumental in reducing the cognitive load on teams. This principle enables extending automation to complex domains such as governance, security, privacy, and regulatory compliance. These processes, traditionally manual and reliant on a specialized team, often introduce significant dependencies and bottlenecks. By transforming these activities into automated platform services, teams can redirect their focus toward their core objective: the delivery of customer value.
It is then presented in the diagram in several ways. On the one hand, Automated_Application_Life_Cycle_Management, for example, refers to the automation of some of the application life cycle processes (from development and deployment pipelines to monitoring tasks) and the adoption or providing tools for supporting these processes. For example: build automation (continuous integration, CI); testing automation (continuous testing or quality assurance automation); delivery automation (continuous delivery, CD); deployment automation (continuous deployment, CD); operational tasks automation (continuous measurement/feedback/monitoring from operations to development); and recovery automation. On the other hand, Automated_Infrastructure_Management refers to the automation of infrastructure management and configuration management tools.

E4 - Platform Servicing

Platform provides automated CI/CD pipelines and managing infrastructure (physical and/or virtual environments, containerization, Infrastructure as Code (IaC), pipeline automation (CI/CD and release tools), and IT operation.

This platform can be provided as a service (see Platform_Servicing in Appendix~\ref{app:constructs_propositions}), which represents a service automation that implements DevOps best practices. The specializations of this interface are ALM_Interface (Automation Life Cycle Management) and IaC_Interface (Infrastructure as a Code). The first one (see Proposition 26) implements continuous integration, continuous testing, continuous delivery and deployment, recovery automation, and continuous monitoring. The second one (Proposition 27) implements the managing and provisioning of infrastructure through code instead of through manual processes, this means, configuration files containing infrastructure specifications are created, making it easier to edit, distribute, and update configurations. Ultimately, this platform servicing reduces the cognitive load on teams (see Proposition 29). A platform's primary purpose is to reduce the cognitive_load, automating governance, security, and compliance, which are typically bottlenecks. By automating these processes, a platform reduces dependencies and increases the flow of value.

E5 - Communication

Communication in Figure~\ref{fig:team1} is directly related to the Team class. The objective is to inform that the team has relationships with another team. It has the attribute type , ranging from poor/rare to frequent. An example of frequent communication is [2:13] \textit{``Development and infrastructure teams participate in the same chat; it even looks like everyone is part of the same team''}. Some initiatives aim to achieve a greater frequency of communication: [5:10] \textit{``training for Devs and Ops on the responsibilities of other departments can be very beneficial for communication''} (see Proposition 13). However, we also identified that [2:6] \textit{``Limited DevOps initiatives, centered on adopting tools, do not improve communication''}, this occurs mainly in cases where companies focus on the short-term benefits of DevOps with automation and tool adoption, but not giving the same value to cultural values.

E6 - Collaboration

Collaboration in Figure~\ref{fig:team1} is directly related to the Team class. Collaboration is crucial, but it can be costly and should only be used where it clearly adds value. Avoid using it for routine tasks or to address unnecessary dependencies that could be resolved by improving existing structures or processes. A collaboration-based culture focuses on solving problems in the most effective way possible. Therefore, at the start of any collaborative effort, you must clearly define its motivation, expected duration, and a clear definition of "done." These variables will determine the collaboration frequency that goes from eventual to daily, and collaboration quality that goes from low to high. Collaboration is considered an essential aspect of specifying the structure of teams as shown in [1:28] \textit{``collaboration frequency is highly related to the team structures and is a critical variable for DevOps adoption. Indeed, Collaboration is one of the key values of DevOps culture''}.
In some cases, members work together daily. This implies frequent collaboration between team members and usually a daily meeting in addition to other less frequent meetings with related teams. Promoting Collaboration reduces organizational silos/conflicts (see Proposition 2) as

shown in [7:1] \textit{“A collaborative culture essentially aims to remove the silos between development and operations teams and activities”}. However, members of product teams in other organizations have more differentiated roles (Dev versus Ops) so they work together but on different tasks. This means there is not a real collaboration but a transfer of responsibilities as shown in [4:10] \textit{“Here, developers are not responsible for application deployment and management. Completed applications or features are handed over to the DevOps teams for deployment and management [...] ''}.

E7 - Culture

For DevOps, establishing a culture is as crucial as defining automation tools and practices. Communication, collaboration, transparency, and blame represent team cultural values. Some teams benefit more from these factors, which is why they appear in Appendix~\ref{app:constructs_propositions} at times as attributes and at other times as classes. Customer-centric action, end-to-end responsibility, and automate everything represent DevOps principles. Reaching cultural maturity is built slowly together with the team. [12:1] \textit{``Trust, the cultural core of DevOps and microservices, needs to be cultivated across software teams.''}

Refinement questions

Voltar no primeiro artigo e depois eu volto aqui nesse refinement questions. Preciso ver se preciso colocar algo a mais.

DevOps (bridge) team

CREATE PROPOSITIONS FOR THIS CONTEXT:

DevOps teams in these organisations understand the codes of developers and help out where necessary. Developers are also made aware of how the automated infrastructure works, though not directly involved in its creation or maintenance. According to some practitioners, a level of confidence brought about by the basic understanding of other aspects of the process and familiarity with the other actors. Intra-team collaboration is reported as brainstorming and coding together when issues are encountered. Collaboration in FinCo2 involves the DevOps team creating users’ stories from requirements, breaking them into manageable tasks and delegating these tasks to developers through Azure DevOps.
Some of the interviewees had the job title of ‘DevOps Engineer’ and worked in distinct DevOps teams or departments. “We don’t actually have developers in our team. So, in our case. . . it’s just DevOps” [Finco1 DOps1]. They further described their team as “platform builders” for developers, “who support them and host their applications on our platform.” Here, we see DevOps being presented as a job description, with DevOps Engineers responsible for carrying out “DevOps functions”,

Fig. 2c depicts the Developers-DevOps mode where DevOps teams creates, deploys, and manages both the cloud infrastructure and deployment pipelines. Developers applications are also deployed and maintained by the DevOps team.

Here, developers are not responsible for application deployment and management. Completed applications or features are handed over to the DevOps teams for deployment and management, who are the DevOps practices facilitators.

DevOps bridge team mode was the mode widely used in our study. This mode (shown in Fig. 2d) was found in hybrid environment of cloud and onpremises deployment. Here, DevOps teams interface with both developers and IT Ops to drive the practices of DevOps like conffguration management, continuous integration and continuous delivery, automated testing, deployment, monitoring, and metrics collection.

Developers provide business solution, leaving the creation, deployment, and management of both the cloud infrastructure, virtual systems, and deployment pipelines to the DevOps teams. These teams are provided services of on-premises infrastructure by the Ops team. Essentially, the DevOps teams are customers to the Ops team, and service providers to developers. It is important to note that in this approach to DevOps, everyone is responsible for their actions.

Using automation tools, DevOps engineers create pipelines to enable continuous practices such as continuous integration/continuous deployment, continuous testing etc.

The DevOps teams under study are tasked with migration from existing platforms to either cloud based or an automated on�premises environment, and its subsequent maintenance. Generally, they act as intermediary between IT Ops and developers, providing the means to an end in software development (SD) by creating automated pipelines on both physical and virtualized servers to enable continuous integration and continuous delivery.

our ffndings show DevOps being described by practitioners in the study as not just a culture and speciffc job description, but also distinct teams separate from both developers and IT Ops teams. Although members of these teams have backgrounds in either software development or IT Ops, the nomenclature "DevOps" now separates them from their original silos and classiffes them as a unique team of "platform builders"

Bridge team: create a separate DevOps team that functions as a bridge between Devs and Ops

FROM THE DOCUMENT: sorting.docx

No documento do sorting, não tem nada que fala sobre o DevOps (bridge) team.

AUTOMATION brings from experience

Automation emerges from the capacity to identify and act on repetitive processes, a sensitivity cultivated through direct, hands-on experience. Experience from diverse backgrounds introduces novel solutions that enhance efficiency and preemptively address potential problems, thereby improving overall system quality and streamlining workflows.

Specialist 1: "Because automation comes from experience, right? People do it, there are many people who do something repeatedly without realizing that it is repeated. So the opportunity for automation comes from experience, right? I saw something like this somewhere else, I can do it here, I've already done something similar and in another scenario, I'll do it here. Or even the sensitivity of realizing that this is being very manual because it's taking a lot of time. And I realize that I'm repeating the code, I'm repeating commands, how can I automate? I think all of this is experience. Both life experience and diversity, right? Even if we're talking about people who automate things. And another person who automates in the backend, for example, in this team I'm on, there was a foreign collaborator, he was Hungarian, he created a hook in Git that for each commit, before finishing the commit he runs a Bash script, in Git you can do this. There's a page there about hooks where you can configure the hooks, what did he do? Did he create the hook to run lint before committing? So it's a file there that runs lint on the frontend and runs lint on the backend if it passes, if it doesn't pass, it prints the error there and then the developer has to go there, only commit if it passes lint, right, man, I think that's phenomenal. I didn't know, I didn't even know about this Git thing and I hadn't even had this idea of, Oh, you can put these lints inside, that is, automation in the local environment, that opened up a whole other bunch of things for me. Damn, I can use the local developer computer, because we have the local environment, there's a test environment. The repository and there's production, anyway, there are several moments that we can automate at various moments as soon as possible and that reminds me, right? Other theories. Other principles. That the sooner you identify the problem. That is, the faster the cycle, right, of making a change, identifying a problem and correcting it, the better, then damn. I thought, the best scenario is that everything that is local is faster. Everything I can do to avoid the person's location because if they only commit to lint in the repository, it's better to receive the email later. They're focused on something else, they've already missed the boat. Just giving the example of multidisciplinarity, how much his experience alone has already contributed to teaching me a lot of other things, and I think that's all I need to do."

Team cognitive load limits cross-functionality.

Due to the team's cognitive load, it's not advisable to have a fully cross-functional and 100% independent team. In such a setup, each member will end up focusing on their own area because they will be overloaded with tasks and improvements to make. This ultimately hinders the proper evolution of both the project and the team.

Paes interview: "Ellos dicen ok, para ser cross-functional tenemos en el equipo un diseñador, un frontend, un backend, un tester, PO, etc. y al final necesitas un equipo de 15 personas y no tienen responsabilidad compartida porque cada uno está en su silo dentro de equipo. Esa idea de cross functional puede llevar a este entendimiento que es un poco *naive*. Es mejor mantener un equipo pequeño e ir a buscar cross-funcionalidad con más responsabilidad compartida que es típicamente el modelo T shape (cada persona tiene una especialidad, pero pueden hacer varias cosas distintas)."