
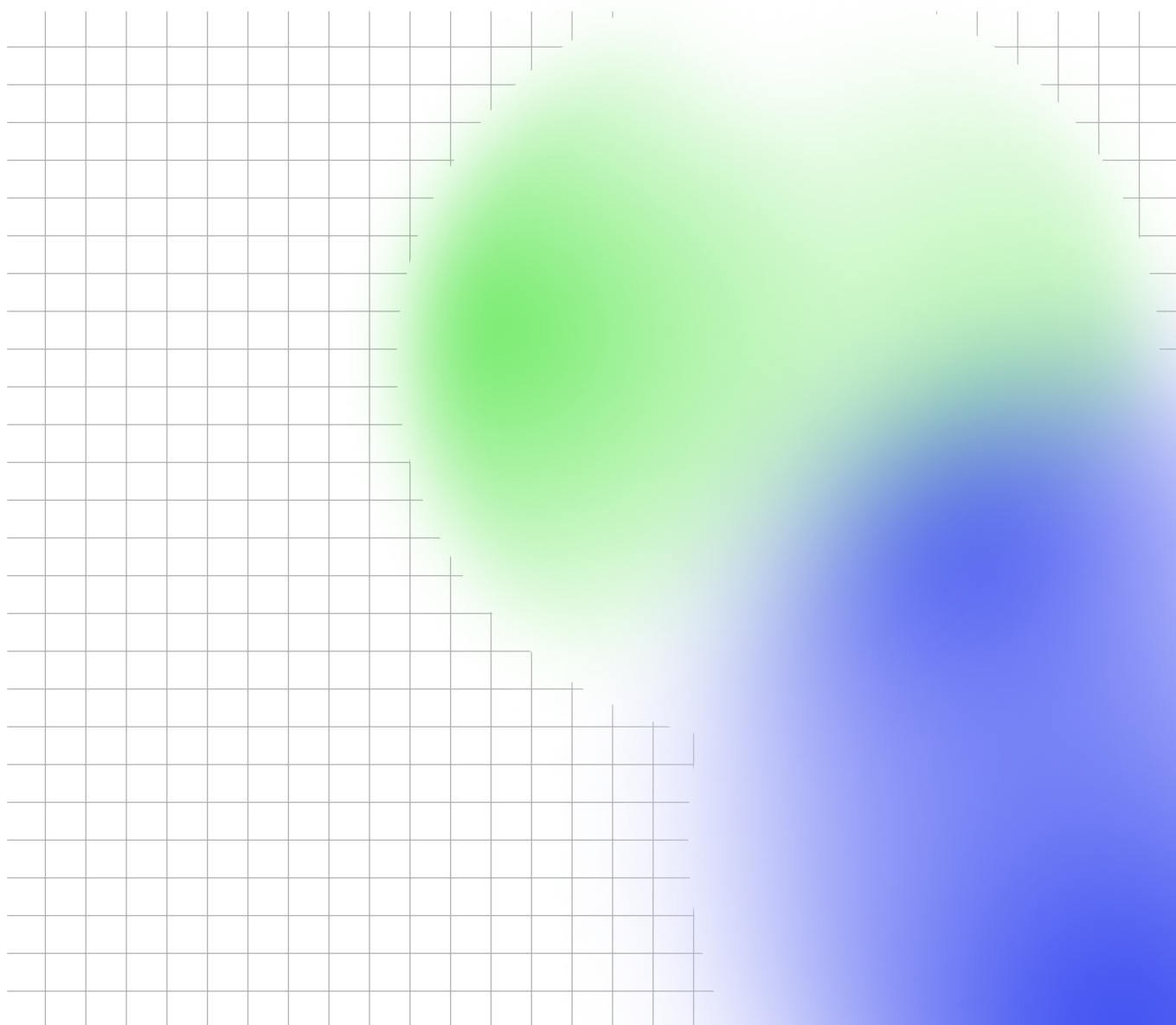


DESIGN FOR



INFORMATION FLOW BETWEEN RESEARCHERS & DATA SCIENTISTS IN FORD

Sep 2021



INFORMATION FLOW BETWEEN RESEARCHERS & DATA SCIENTISTS IN FORD

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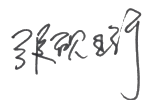
Preface

This thesis project is the first time I conduct a user research project for months by myself. It is a big challenge for me to figure out how to intervene academic theory into the design process, however, I think I had a good try. And I believe it is an interesting process and validated what I've learned from my Master Design for Interaction at TU Delft.

During the five months of writing and conducting the thesis, I not only need to deal with the questions from the research but also my mindset. It is hard to keep feeling passionate about the same topic for that long. Therefore, I appreciate all the people that help me during this journey. External input helps me refresh my thoughts and keeps me from being stuck in a bottleneck for too long.

First of all, I would like to thank the Ford student community, Nicole and Milene create a community that enables the students to learn from each other and easier to reach out to Ford employees. Second of all, I would like to thanks my friends, Lee, Chia-yu, and Siqi. They are always willing to help me revising my project and giving me advice. Lastly, I want to thanks my supervisors, Jacky, Nazli, and Dwi. Jacky and Nazli always give me very constructive feedback. Even though the advice sometimes makes me feel lost at the beginning, and I have to put lots of effort to reconstruct the project, but I see the change is good for the thesis in the end. And I want to thanks Dwi for always give me confidence by giving me positive feedback and useful advice that I can adapt to the project.

Thanks to my family that always gives me endless support and visited me during the period I was writing the thesis. I could not have done without their support.

Sep 2021 

Executive Summary

As more and more data has been generated in the automotive industry in recent years, demand for data analyzing tasks increases among the research and development teams. It thus becomes an inevitable phenomenon that information and knowledge exchange between data scientists and domain experts becomes more frequent. The information flow influences the performance of the team and the outcome of the operation, many companies thus try to implement knowledge management to avoid fiction caused by knowledge gaps and intransparent information among different teams. This thesis will take the collaboration between R&A (domain experts) and GDI&A (data scientist) from Ford RIC as a case to analyze their information flow.

To understand what are the factors that influence the development of a structure to manage the information flow, I look into the literature on knowledge management implementation, and the studies about the characteristics of mediums and tools that influence how information flows between employees. The insights from the literature provide different aspects to inspect information flow in the organization, and become the foundation for designing workshops to research on the current situation between R&A and GDI&A in Ford.

An iterative design approach was used to analyze the user and context deeper and more holistic in this thesis. The research started from analyzed the teams from their current situation and culture. And found some information is missing between R&A and GDI&A. They are:

1. The context behind the request is not shared, which makes GDI&A could not give more accurate support and feel less engaged.
2. There is not a repository that documents previous cases and their requests. Therefore, GDI&A needed to cope with repetitive requests, and R&A could not find references for inspiration.

To fulfill both of the requirements, the first priority is to build up better principles of addressing requests in each collaboration project first. Once the workflow of each project and its request is standardized and documented, cases and requests can be viewed by different teams in the organization.

Considering the information (request and its context) that has its complexity and the working habit from R&A and GDI&A, the result of the research suggest that:

1. use asynchronous communication to start the request
2. a classification of the request types is needed, it helps R&A formulate their request and GDI&A evaluate the situation to adopt suitable strategies
3. synchronous discussion (meeting) is needed to confirm the direction and more detailed information
4. an open environment that stored the cases and requests enable the data scientist to reduce their work and domain experts search for inspiration

To make the cases and its request access to those who are not in the team, only high-level information should be in the open environment, external links can be provided for more detailed information.

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01 Introduction

- 1.1 Background introduction
- 1.2 Project context
- 1.3 Project focus
- 1.4 Stakeholders

1.1 Background Introduction

With the fast-growing development of science and technology, vast quantities of data have been generated. It gives opportunities for companies to validate their products and operations more objectively. Therefore, Data Science and Analytics (DSA) are becoming essential business knowledge in the industries nowadays, including the automotive industry. With DSA, the automotive industry is able to view itself in various aspects including customer behavior, market mix, supply chain, and predictive quality (M. Woodward, et al., 2015). A 2020 report by ReportLinker indicates that the big data market in the automotive industry is predicted to have a notable increase of 130% from 2019 to 2025, which will reach 7,8 billion USD (ReportLinker, 2020). Researchers from MIT also pointed out that leading companies who implement data-driven design to support decision-making were more productive by 5% and made 6% more profit than other competitors in the same industries (McAfee, et al., 2012).

It is clear how powerful data is and the benefit it can bring to the industry, however, not all domain experts know how to use the data. If a team decides to introduce data in their research process or business direction, it is inevitable for them to collaborate with data scientists and analytics professionals. It becomes important to look into knowledge management in multi-disciplinary collaboration, since communication strategies and how knowledge is shared influences the satisfaction and performance of the employees (Mohr & Nevin, 1990). Normally, neither party, data scientist and domain experts have the ability to solve the problem all by themselves, which means they must depend on others' expertise (Muller et al., 2019).

However, when it comes to knowledge management and information flow in the collaboration among the organization, it is never simple. First, suitable strategies of knowledge management and communication for each organization are different (Mohr & Nevin, 1990), besides, it is a challenge for companies to implement due to lack of guidance and decent implementation framework (Storey & Barnett, 2000). Even though suitable strategies, guidelines, and frameworks for the organization are found, the question remains whether proper mediums and tools can handle the information flow. With more and more communication mediums/tools in the market, organizations need to look into their own needs and find suitable mediums that can fulfill them.

It is obvious how complex it is if the organization wants to optimize its information flow under the context of collaboration between domain experts and data scientists. There is not a formula that suits all of the cases, each case is unique based on their situation.

1.2 Project Context

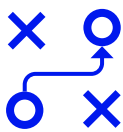
Ford Motor Company is a multinational automobile manufacturer headquartered in Michigan, United States. In Ford, facilities that mainly focus on technology research are the Research & Innovation Centers (RIC), which are located across the world including Dearborn, Michigan; Palo Alto, California; Aachen, Germany; and Nanjing, China.

In recent years, Ford transformed from a technical product development innovation perspective to a more human-centered service design perspective (Ford Media, 2020), and used customer experience and big data to foster innovation in smart mobility (Ford Media, 2015). As Ford adopts a more service-oriented business model, lots of data is created and being used in user research. In order to create value from this data, Research and Advanced Engineering (R&A) teams in Aachen are now adapting Data-enabled design approaches in their projects and being open minded to cooperate with academic institutes. For example, they cooperate with RWTH Aachen University and launch the Personal Mobility Experience Innovation project (Ford Media, 2015), and collaborate with TU Delft with several University Research Projects (URP) to develop data-enabled design in their research process.

Project scope

This University Research Project (URP) is a collaboration between the Research and Advanced Engineering (R&A) team from Ford Aachen and TU Delft faculty of Industrial Design Engineering (IDE) that started in 2016. According to the R&A team, the URP is an opportunity for them to integrate into their further research while utilizing data in the service design process.

Ford R&A team formulated the main goal of the URP is to (1) use data in the early stage of design thinking to understand their user better and (2) use data as an inspiration for generating new ideas/service opportunities in the creative process. To achieve these goals, they formulated the collaboration into three graduation projects, which are:



Data strategy

Which data helps better understand the user and its context in order to create new insights?

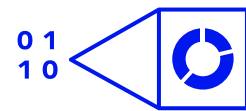
How are different sources of data relevant for designers?



Data as creative material

How can data be collected and used during the development process to create new and improved products and services?

How does data as design material influence creativity?



Data Visualisation

How can data visualization increase engagement and facilitate communication when generating user insights, and when proposing new smart commercial vehicle concepts?

Project focus

There are already many IDE students dedicated to these three directions, for example, Jansen (2021) purpose an implementation strategy to understand user behavior in the R&A team's design process; Hao (2021) design a tool kit for the R&A team which help them using "data as a creative material" by different role-playing. Most of the projects focus on the design and strategy itself, while I see **an opportunity** that has not been drawn yet, which is the **information flow between different stakeholders**. Especially since the R&A team **needs to collaborate with external data experts frequently while conducting data-enabled approach**, information flow becomes an essential and crucial aspect of this data-enabled design project.

Stakeholders

This thesis will take a deeper look into the information flow between the stakeholders in the context of collaboration between data scientist and researchers.

In RIC Aachen, most of the development teams in RIC Aachen still need support from data specialists outside their team since not all of them have the knowledge and experience to utilize data to support their research. Connected Data Forum (CDF) and Global Data Insight and Analytics (GDI&A) thus play a role to help the development teams using the data to analyze their research as another source of user input.

The collaboration between the Craftsman team from the R&A department and GDIA is chosen to be studied in this thesis, since it fits the project focus. The Craftsman team is using data in their research on light commercial vehicles for the craftsmen community, and is constantly supported by GDI&A who process and transfer data for them (Figure 1.1).

Research & Innovation Center (RIC) Aachen

Ford established the Research & Innovation Center to accelerate its development of technologies and experiments in connectivity, mobility, autonomous vehicles, customer experience, and big data. RIC Aachen is one of the research centers around the world which work for Ford Europe.

Research and Advanced Engineering (R&A) department

The Research and Advanced Engineering (R&A) department in RIC Aachen mainly develops new smart mobility concepts for medium and long term implementation. It consists of multiple tracks that focus on different projects and target groups.

The Craftsman Track (C.T.) is one of the R&A teams in RIC Aachen. They aim to offer a better experience for the craftsmen community by designing light commercial vehicles (LCVs) and services around LCVs.

Global Data Insight and Analytics (GDI&A) department

The Global Data Insight and Analytics (GDI&A) department in RIC Aachen acts as a data scientist/analyst that offers timely, actionable, and forward-looking insights to the problem owners. They analyze and provide business insights/strategies that are related to consumer, mobility, and data tools. They have representatives in Connected Data Forum (CDF), together they help other teams in Ford to enrich their research by utilizing the data. In the context of this project, GDI&A cooperates with the Craftsman Track team and helps them with data collecting and analysis.

Connected Data Forum (CDF)

It is a forum formed with representatives from different departments who are experts in the data analysis field in RIC Aachen. They describe themselves as data coaches who support development teams by giving the collected data/advice and demonstration about data analysis. Requests from the development teams will be evaluated based on business priority and feasibility study, and decide suitable representatives and collaboration ways to help them. The forum is a newly launched association, therefore, the workflow is still on its way to becoming more complete and standardized.

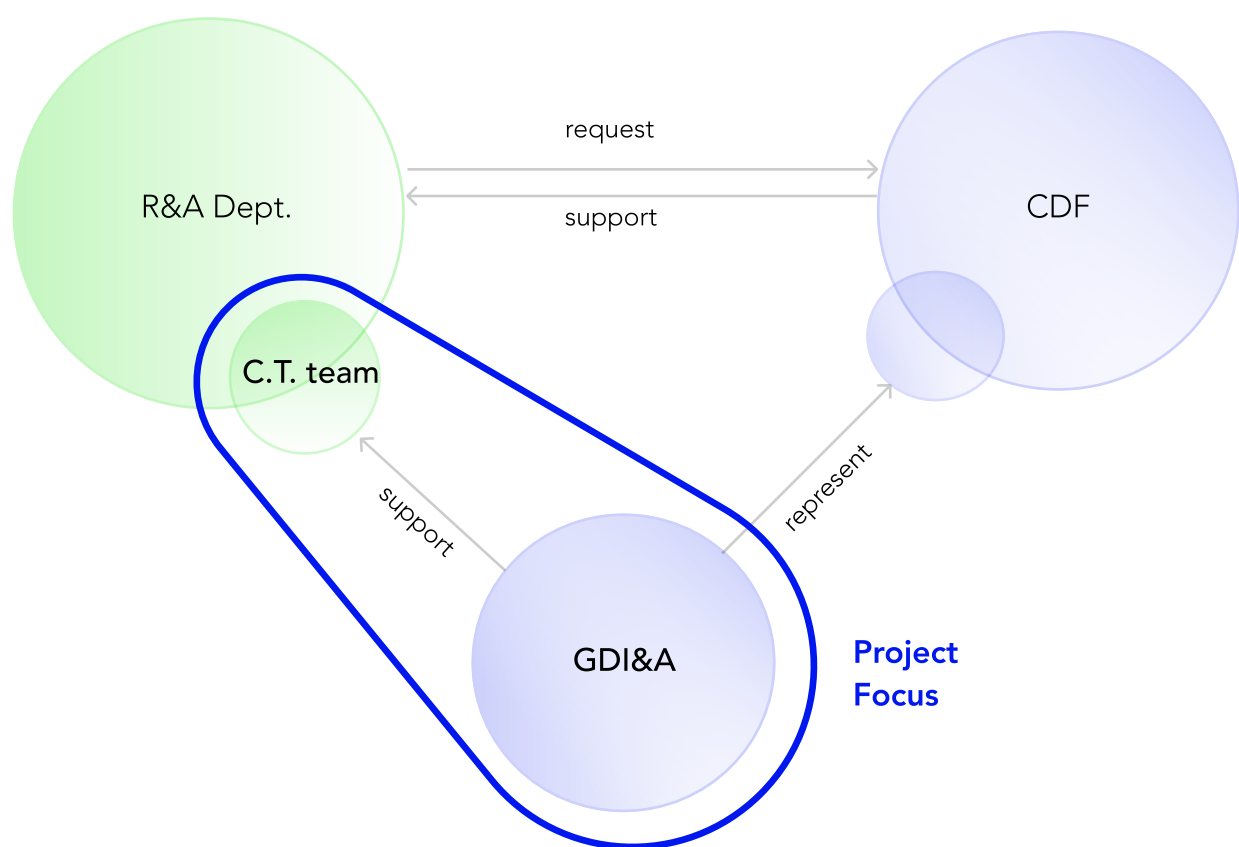
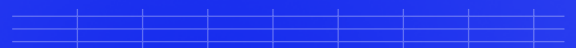


Figure 1.1: Stakeholders of this project, and the focus group.



02

Project objective & Approach



2.1 Research Question

“

How to optimize the information flow between data scientists & researchers in Ford ?

Many researchers point out the importance of knowledge management and communication strategies, since it influences team performance and outcome directly. However, there isn't a project (in this URP) focusing on the information flow and communication between the multi-discipline (data scientists and domain experts) collaboration in Ford.

I will take the collaboration between R&A and GDI&A as the case to study, investigate their information flow. What are the flaws and fiction when information is delivered and received? What is the reason that causes the problem? And how can they improve it?

2.2 Approach

To figure out the solution to improve the information flow, I need to look into various factors that will influence the collaboration and communication between two teams. Therefore, in this project, I will review the literature first, which provides knowledge and frameworks to analyze information flow in different aspects for further research. After the literature review, I will design and conduct three iterations by activities or prototypes. Through three different evaluations, I am able to inspect the situation in a more holistic way by digging deeper into the interaction between information/data and the users, the interaction between users and users (Figure 2.1).

I will adopt a user-centered design approach throughout the whole project. Qualitative design methods include observation, interviews will be used in each iteration. In each iteration, users' data will be collected from the evaluations, and I will reflect on the result and synthesize the data into high-level insights. The result from each evaluation will become an input for the next iteration, new research questions will be formulated and new prototypes will be conceptualized based on previous phases and the theories from the literature review.

In the end, a solution for optimizing the information flow between R&A and GDI&A will be generated based on the insights from each iteration.

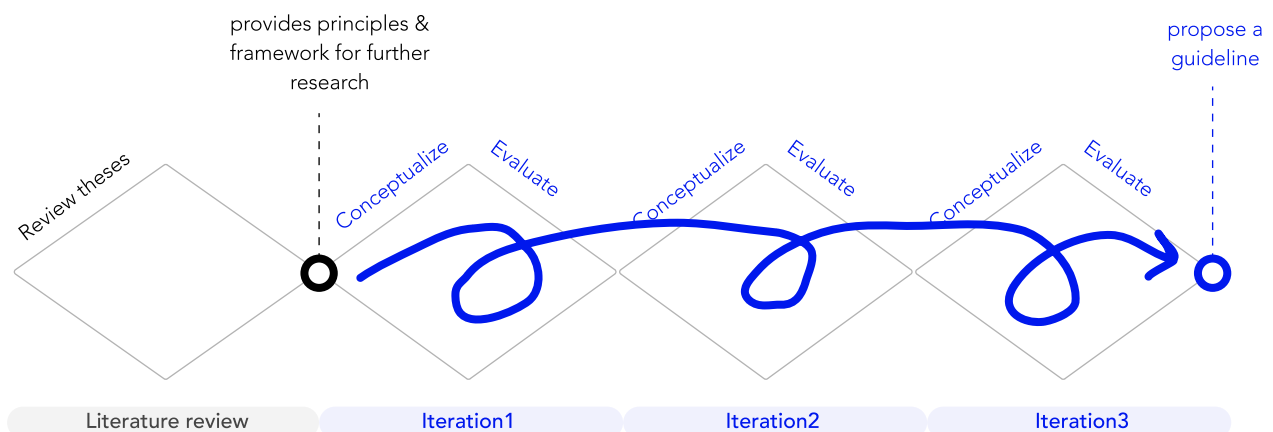


Figure 2.1: Approach in this thesis.

03 Literature Review

Information flow is influenced by many factors, including the relationship between the collaboration teams, the communication between the teams, and the mediums that carry the information. From the literature review, I will extract theories into elements that can be reflected or validated in the context of the collaboration between R&A and GDI&A.

- 3.1 Implement knowledge management in an organization
- 3.2 Communication strategy and the culture between the teams
- 3.3 Communication mediums and their capability
- 3.4 Conclusion

3.1 Implement knowledge management in an organization

Even though knowledge management is widely regarded as important, researchers found it difficult for organizations to implement it successfully (Drucker, 1993; Storey and Barnett, 2000). Since implementing knowledge management is a complex issue that involves support from a technological infrastructure, changing the culture in the organization, and managing different types of knowledge, organizations may encounter difficulty without having any guideline and structure plan. Besides, many organizations do not know how to start managing knowledge and information. Therefore, researchers **suggest developing a guideline for knowledge management framework** is the first thing that needs to be done (Wong & Aspinwall, 2004).

The fact that a framework is so essential and being the first step for implementing knowledge management, organizations should not simply follow one from the literature. Without figuring out suitable strategies, organizations could fail to implement knowledge management (Wong & Aspinwall, 2004), they may put too much attention on the usage of information technology instead of proposing a correspondence change from a human and cultural aspect (Arora, 2002). Based on different constituents and elements the researchers and organizations want to emphasize, research about implementing knowledge management frameworks varies. Wong and Aspinwall (2004) converged and synthesized multiple studies and identified most primary and frequently appeared factors into four main elements which allow others to inspect and reflect on when developing their own framework. They are:

1. the structure of knowledge management;
2. identifying the types of knowledge;
3. knowledge management processes or activities;
4. knowledge management influences or factors.

For the first element, the structure offers a direction that guides the members to conduct knowledge management. Once the structure is proposed, organizations can follow the strategy which guides them on how to execute the activities to achieve effective communication and information exchange.

Secondly, identifying different types influence the strategy and how the organization tackles them appropriately. For example, one of the most common ways to differentiate the types of knowledge is to define it as tacit or explicit. Tacit knowledge stands for knowledge that an individual may not be consciously aware of, it is embedded from one's experience and harder to describe; on the other hand, explicit knowledge is easier to communicate, articulated, expressed, and documented. Another way to categorize the knowledge that is commonly used in the business is high or low level, high level describes the knowledge/information that is more abstract and general, it can also act as the context for more detailed information (IIBA, 2005); for lower-level (detailed) information represent those which is more specific and individual knowledge about how they operate and deeper conversation about each project between subject matter experts.

The third element, knowledge management processes or activities is an essential function that shows how an organization manipulates knowledge/information (Holsapple and Joshi, 2002). After identifying the types of knowledge, the process and activities enable the organization to manage them in different ways.

The fourth element, an organization's culture, and its structure are the factors that influence knowledge management (Jarrar, 2002). It affects how the knowledge is created, shared, and distributed, therefore, without taking those factors into consideration could lead to a failure to initiate knowledge management in an organization.

Takeaway

1. Developing a structure that can guide the organization to implement knowledge management is important.
2. The structure of knowledge management is deeply influenced by the culture in the organization.
3. The structure involves processes and activities that manage different types of knowledge/information for different purposes.

From the literature about implementing knowledge management, I see the importance of formulating a structure for an organization. It influences how the knowledge and information flow between stakeholders. One thing that needs to be noticed is that the structure design needs to consider the culture of the organization (Figure 3.1).

Therefore, in the next paragraph, I will look into how different cultures and environments shape the knowledge/information flows in the collaboration.

KM structure

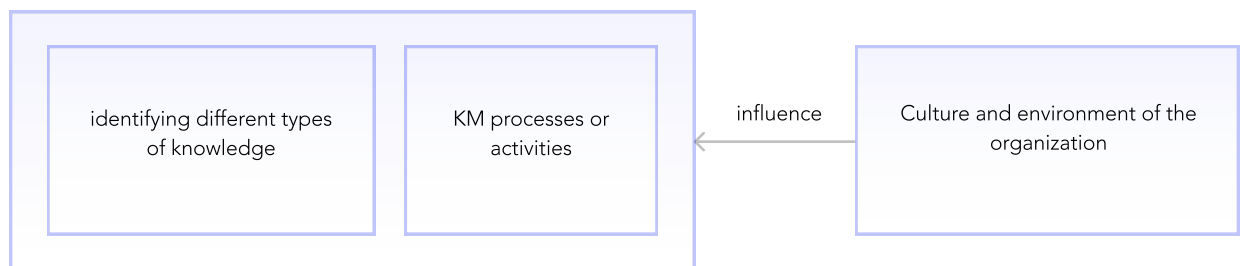


Figure 3.1: Elements in knowledge management implementation.

3.2 Communication strategy & the condition between the teams

Mohr and Nevin (1990) introduced a framework that explains how the condition between the teams influences communication. Only suitable communication strategies enhance the satisfaction, commitment, and performance of the employees. It is a model applied in many communication research broadly, including broader scope like interfirm relationships (Mohr et al., 1996) and a more specific focus like intra-organizational cross-functional teams (Peter & Fletcher, 2010).

Mohr and Nevin classify the factors that influence the effectiveness of collaboration caused by communication into two dimensions, which are channel conditions (culture, environment) and communication facets. They suggest each communication condition has its suitable strategies. When conditions match the right strategies, the teams can enhance their satisfaction and performance in their work.

Communication strategies are distinguished in four aspects: frequency, direction, formality, and content (Table 3.1). Frequency refers to the frequency and duration between channel members. Direction refers to the movement of communication, it can be unidirectional or bidirectional (one-way or two-way); vertical or horizontal. Formality refers to the contacts that are well structured and routinized, informal communication means it is more personalized and spontaneous. Contents are distinguished to direct and indirect, direct content aims to change others behavior by requesting them to take specific actions (lower level information), on the other hand, indirect content tries to provide other beliefs or visions through discussion on general business topics and operating procedures (higher-level information), in this way, one's behavior will change indirectly since their attitude is changed.

Channel condition is categorized into three aspects: structure, climate, and power (Table 3.2). The structure is identified by the nature of the exchange relationship between two teams. If they join to plan for a long-term and interdependent collaboration, it is called a relational structure; in contrast, shorter with lower linkage collaboration is called a market structure. The second aspect is the climate, it refers to the level of trust and supportiveness in the environment during the collaboration. The last aspect is power, which refers to whether the relationship between two teams is symmetric or asymmetric.

| Communication | |
|---------------|---------------------------------|
| Frequency | High vs Low |
| Direction | Bidirectional vs Unidirectional |
| Content | Indirect vs Direct |
| Modality | Informal vs Formal |

Table 3.1: Aspects of communication facet.

| Condition | |
|-----------|-----------------------------|
| Structure | Relational vs Market |
| Climate | Supportive vs Unsupportive |
| Power | Symmetrical vs Asymmetrical |

Table 3.2: Aspects of condition facet.

Based on their research, Mohr and Nevin suggest that if the condition is relational structure, supportive climates, symmetrical power, it is better to have a more collaborative communication strategy (Figure 3.2). It means the two teams need to have higher frequency, more bidirectional, more indirect content, more informal communication. In these conditions, members need to share necessary and expected information from others, it is crucial to make sure all of the members stand in the same position and reduce nonsense or overlapping works, and reduce the fiction in sequences of tasks between teams (Pikkarainen et al., 2008).

On the other hand, if the condition is market structures, unsupportive climates, or asymmetrical, more autonomous communication strategies fit in the teams. In these cases, the negative outcome comes from communication overload and higher expectations from members. The unnecessary cost of time and effort makes the members feel dissatisfied. This includes attending a long meeting that is not so relevant to them. For example, an article from Harvard business review pointed out that many organizations criticize that meeting too frequently diminishes productivity, collaboration, and well-being for both groups and individuals (Perlow & Hadley, 2017).

| Condition | Communication | |
|---|---|--|
| | Collaborative high, bidirectional , indirect , informal | Autonomous low, unidirectional, direct, formal |
| Relational structure Supportive climate Symmetrical power | Enhance the performance | |
| Market structure Unsupportive climate Asymmetrical power | | Enhance the performance |

Figure 3.2: Relationships between communication strategies and conditions

Takeaway

- 1. Collaboration that is long term, being open/supportive, and symmetrical suits more collaborative communication strategies, which means the information flow between the teams is more frequent, bidirectional, and higher level information needs to be shared, vice versa.

From the literature about communication strategies, it shows that teams with different cultures and environments have their own suitable way to transfer knowledge/information.

In the following paragraph, I will look into which tools and mediums can match the strategies and are able to carry the information that needs to be transferred.

3.3 Communication mediums & their capability

Media richness theory (MRT) is a framework introduced by Daft and Lengel (1983). It is frequently used and adapted when it comes to the communication medium's capability to reproduce and transfer information. The richness of the mediums is defined by four factors, which are:

1. Multiple information cues—offers various information channels for communication (eg. words, verbal, touch, sight)
2. Immediacy of feedback—the ability to have rapid and bidirectional communication
3. Personal focus—enables users to express their feelings and highlight their needs or situations for the information receivers.
4. Language variety—enables users to convey a wider range of meanings with greater variety of words, signs and symbols in a language.

Most of the research indicates that face-to-face meetings (including video meetings) attain the highest richness among all the channels, followed by audio communication (telephone) and writing messages (e-mail, instant messages) in the last place. Moreover, the support of tools also enhances the medium's richness (Cockburn 2000), such as whiteboards, cards, papers. Daft & Lengel (1983) pointed out task performance improves when "complexity of information that needs to be transferred" matches "the medium's richness" (Figure 3.3). Some ineffective examples are:

1. Written media like memos and reports is hard to deal with the equivocal situation (negotiation, discussion) since it may oversimplify the information.
2. Rich mediums like face-to-face meetings deliver various information, which may cause noise, distraction, and ambiguity to the information receivers if the task is relatively simple.

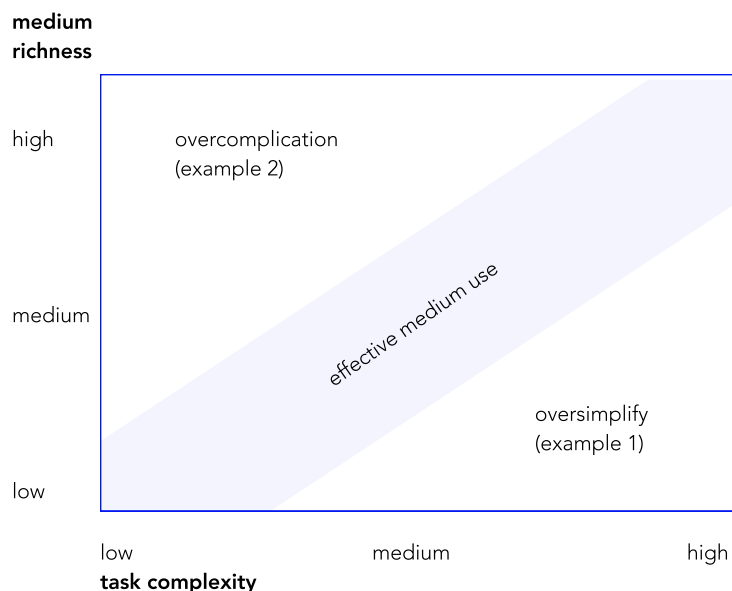


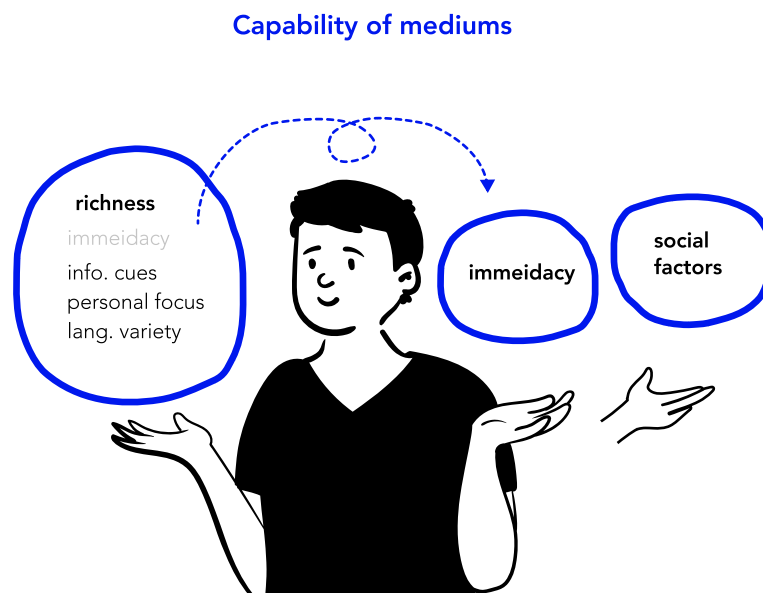
Figure 3.3: Media richness model

Even though MRT is a commonly used theory, some researchers indicated it is outdated, since the theory was developed before modern communication tools were created (Buriticá & Wilde, 2020). Research (Carlson & George, 2004) also pointed out that **synchronicity (immediacy) is a factor that is more limited when it comes to richness, it shows more impact while combining with other constructs**. They suggest viewing synchronicity as a media capacity that needs independence from richness. Besides, companies and employees nowadays (Harley & Moran, 2019) also found both synchronous and asynchronous has its own benefits, for example, asynchronous communication enables users to contribute when convenient and provides time for ideas to incubate.

Besides richness and synchronicity, how people choose mediums is also influenced by other social factors. A study (Hollingshead et al., 1993) indicates that compared to communication mediums, task performance is more related to familiarity of using those mediums. Other studies point out that the social environment and the characteristics of the mediums influence the medium selection. Rice and Shook (1990) stated that the usage of medium is highly connected with organizational hierarchy. For example, even though some decisions are easy to make, it is still impossible to make some major business decisions without face-to-face conferences with crucial stakeholders.

Takeaway

The capability of mediums can be influenced by its richness, synchronicity (immediacy), and other social factors.



The key takeaways from the literature review are:

Implementation of Knowledge management

1. Developing a structure that can guide the organization to implement knowledge management is important.
2. The structure of knowledge management is deeply influenced by the culture/environment in the organization.
3. The structure involves processes and activities that manage different types of knowledge/information for different purposes.

Communication strategies & the condition between the teams

1. Collaboration that is long term, being open/supportive, and symmetrical suits more collaborative communication strategies, which means the information flow between the teams is more frequent, bidirectional, and higher level information needs to be shared, vice versa.

Communication mediums

1. The capability of mediums can be influenced by its richness, synchronicity (immediacy), and other social factors.

From the literature, we see how complex and customized it is to improve the information flow in an organization (Figure 3.4). A holistic view of the ideal collaboration between the teams can be depicted only when we understand the collaboration and users in different layers. Therefore, I will validate and reflect the elements that are synthesized from the literature review through the iterations.

Implementation of Knowledge management

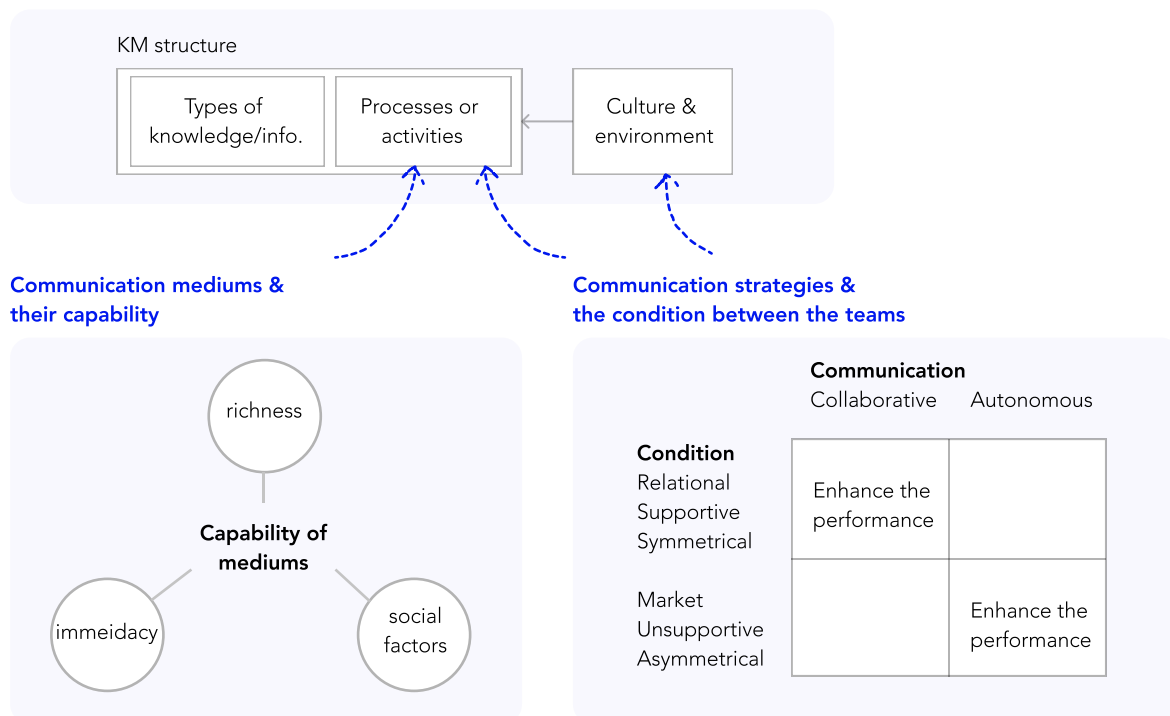


Figure 3.4: The scope of literature review and the correlation between each topic.

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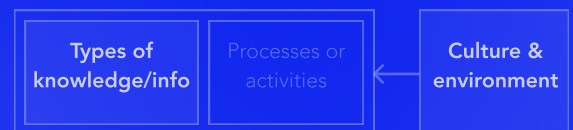
Iteration1

Knowledge and information management needs to consider carefully the culture, environment in the collaboration, information flow, and communication strategies needed to fit the relationship between the teams. Therefore, in this chapter, I aim to map out the current situation including the culture between R&A and GDI&A and the information that is needed but missing.

Research objective

1. What is the relationship between R&A and GDI&A?
2. What kind of information is needed from R&A and GDI&A but missing?

KM structure



4.1 Conceptualization of the design activity

Method

The problem in this project contains much knowledge in stakeholders' own specialization. I thus will adopt an approach that allows participants to share their thoughts which connect to their own experience and expertise better.

Contextmapping with generative tools will be used in this phase. This research method regards users as the experts of their own experiences (Sleeswijk Visser et al, 2005; Sanders & Stappers, 2012). It is a user-centered approach that lets the participants lead the research direction. It takes the participant to recall previous experiences which help them to reflect on and find underlying values. The process stimulates them to envision their desirable vision (dream) by creating with the generative tool (Figure 4.1).

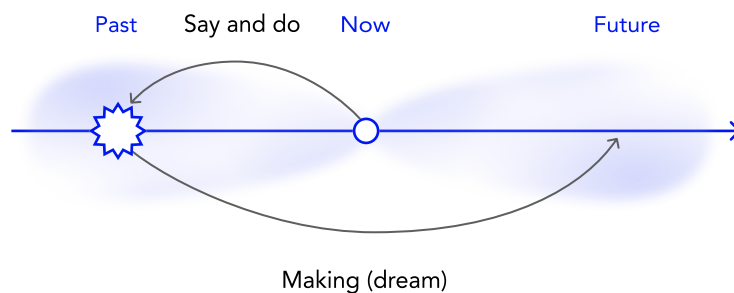


Figure 4.1: The path of expression of the process of contextmapping

Conceptualization

Firstly, to inspect the process of the collaboration between R&A and GDI&A, I mainly focus on the period when R&A is conducting research that needs data.

Secondly, to find out what is specific information or interaction is missing in the collaboration, I will analyze the collaboration in different steps (eg. data collecting, data analyzing).

4.1 Conceptualization of the Design activity > Conceptualization

The generative tools consist of two canvases. The first canvas aims to make participants recall their previous experience and project their ideal interaction in the future (Figure 4.2). It enables the participants to rate each step. The first question to them is "to what degree do you think the strength of collaboration is in each step" the second is "to what degree you think the ideal strength of collaboration should be in each step." The second canvas uses tools (includes letters in a bottle, telephone, telescope) as metaphors, and lets participants create their desirable communication by combining the tools together (Figure 4.3).

| collect | observe | hypothesis / idea | analyze (code) | result (visualize) |
|---------|---------|-------------------|----------------|--------------------|
| | | | | |
| | | | | |
| | | | | |
| | | | | |

| collect | observe | hypothesis / idea | analyze (code) | result (visualize) |
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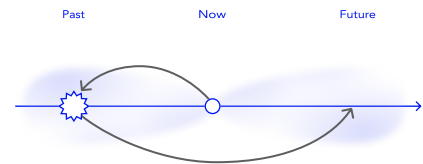


Figure 4.2: Canvas 1 asks the participants to rate the strength of collaboration in each step. The left one stands for the current situation (now & past), the right one stands for ideal strength in the future.

| collect | observe | hypothesis / idea | analyze (code) | result (visualize) |
|---------|---------|-------------------|----------------|--------------------|
| | | | | |
| | | | | |
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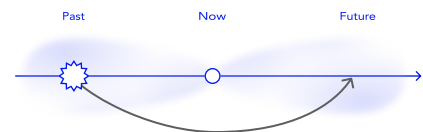


Figure 4.3: Canvas 2 asks the participants to create their ideal communication way by combining the tools together.

Execution

Participants

Two participants were recruited in this workshop. They are the main contact persons from R&A and GDIA in the collaboration.

P1: employee from R&A

P2: employee from GDIA

Setup

The Test is conducted remotely in the online meeting environment while using online collaboration boards. Online collaboration boards are created and sent separately, which means each participant will work on an individual board.

Execution

The participants will go through two activities, each activity involves them creating their answer (scale bar, and communication tool) on the canvas, and having an interview after each task. After the participants finish their interpretation and answer, they are invited to have a discussion. In this way, each stakeholder is able to express their own thoughts without distraction, and understand the others' positions before the discussion.

4.2 Result

Culture/Relationship between R&A and GDI&A

GDI&A and R&A are two symmetric teams and they are very willing to give support to others. Also, the collaboration is a long-term plan since some specific data can only be collected by GDI&A, GDI&A will keep helping R&A access the data and giving advice based on their knowledge as they can.

P2

"We are two symmetric teams, there isn't hierarchy between us, and we are very willing to support others"

P2

"I like the discussion that can understand their situation better, but we don't usually have the opportunity"

Based on the theory from Mohr and Nevin(1990), it can be expected that collaborative communication strategies are needed from the teams. That is to say, **a more frequent and deeper discussion that helps team members feel more engaged and believe in the same direction is needed.**

Information environment in R&A and GDI&A

For qualitative data, observation and interviews are used to understand the craftsmen community. Then, workshops are held to help the R&A team to synthesize the insights from the qualitative data. The insights help to make decisions in the development and **influence how to collect the data in the future.**

On the other hand, quantitative data collection is where R&A needs GDI&A to help constantly. Since

1. only GDI&A has the technique and knowledge to access and process PID data
2. and the language to collect and process the data is different between two teams, *(GDI&A mainly works in Jupyter notebook that is empowered by Pyspark to analyze with a large scale of data; on the other hand, engineers in the R&A team are using Matlab as the main software to analyze.)*

when data is needed from R&A, GDI&A will access the raw data, process it, and lastly transfer it to the file that R&A can use and deliver it to R&A. After receiving the data, R&A mainly analyze and visualize the data in Matlab and Excel (there are some employees start to use Alteryx and Qlikview, which are the tools also used in GDI&A) (Figure 4.4).

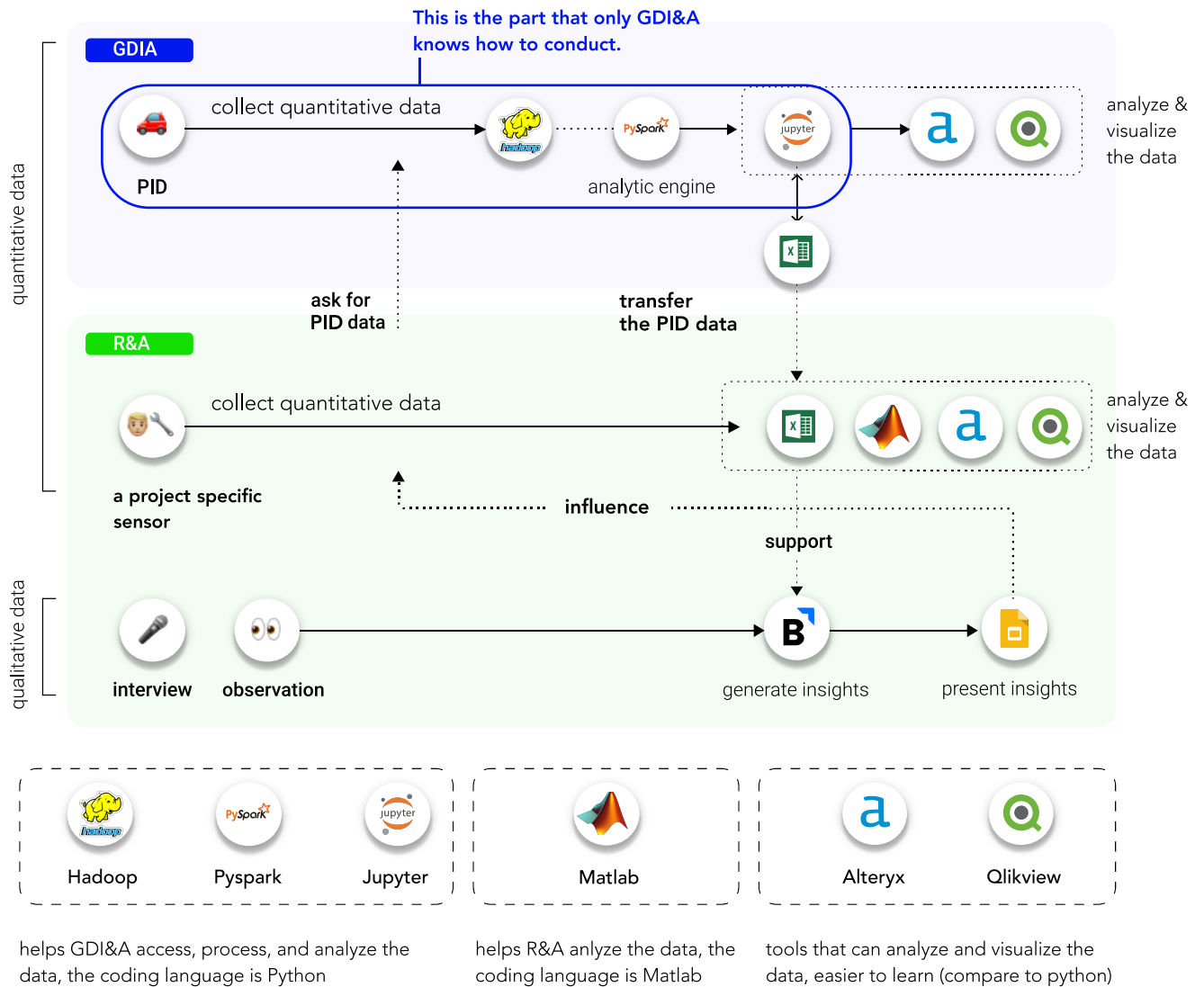


Figure 4.4: Stakeholders of this project, and the focus group.

Current information flow between R&A and GDI&A

1. Data Collection

For qualitative data, observation and interviews are used to understand the craftsmen community in R&A. Workshops are held to help the R&A team to synthesize the insights from the qualitative data. And the insights help to make decisions in the development and influence how to collect the data in the future. The information (insights that influence data collection) is not shared with GDI&A.

For quantitative data, the observed LVCs are equipped with two kinds of sensors to collect quantitative data. Currently, a project-specific sensor' data is collected by R&A directly, however, PID data is stored in Hadoop and only the GDI&A team has the license to access it. Therefore, R&A needs to write an email requesting PID data. GDI&A then will access the raw data from Hadoop, process them and transfer them to the file that R&A can open. The main problems here are (1) some requests are repetitive, (2) and the purpose of the data usage is ambiguous.



Requests are repetitive

GDI&A desires a more automatic solution while the request is similar and repetitive, and gives them some context when they access the data. Therefore, they write a script for R&A which enables them to access certain data more autonomously. The ultimate vision of GDI&A is to build up a platform or a repository, so every permitted user can get the resource without asking them. Besides, R&A ask their questions mostly through E-mail and informal conversation in the office, it is difficult to share with others or to be tracked by team members without being documented in an open environment.

P2

"Sometimes the requests are the same, so we have to do repetitive work."



Purpose of the data usage is ambiguous

GDI&A shows high interest in the background information behind the request and the further usage of the data they help R&A collect, they believe it is a clue that enables them to give more accurate opinions or data sets for R&A. However, the information about R&A's research hasn't been shared with GDI&A most of the time, deeper discussion does not happen, GDI&A barely knows how the project is conducted. Besides, due to the time and capacity, it is not an ideal solution to include GDI&A in their research process.

P2

"It's important to also understand why you want this data? ... Maybe that data is better to understand this, or to support these ideas."

2. Data Analysis

After receiving the processed data offer from GDI&A, R&A will use it as materials to support their own research. R&A uses data as a creative material to improve the development. Therefore, it is important for them to develop their skill in data analysis and data visualization.



R&A wants to learn knowledge about data analysis from GDI&A

Researchers from R&A believe that GDI&A has knowledge and skills they can learn from. They show great interest in previous cases from GDI&A. R&A believes that those cases can help them gain inspiration or pick up useful knowledge from GDI&A and adapt it in their project. On the other hand, GDI&A believes that every case has its path to analyze, therefore, the value of browsing their previous work randomly could be limited.

P1

"I want to translate the ideas from their cases to our use case , therefore, it will be very nice if we are able to view their previous cases."

3. Communication way

Most of the time, both of the employees want to receive the information from others in a more autonomous and asynchronous way **first**. For example, GDI&A want to take a look at the project result from R&A by document instead of joining their meeting; R&A want to see GDI&A's previous work themselves.

Once they find they need more help or explanation, they still want to talk to others face to face.

The parts they want to enhance the communication are different. GDI&A wants to see more and have a conversation about the development of the project, while R&A wants to discuss more about how to analyze and visualize.

P1

"I want to translate the ideas from their cases to our use case , therefore, it will be very nice if we are able to view their previous cases."

P2

"We do not have to have meetings all the time or to understand this, but it can just like, taking a look and understand (the project's result and further development) will be good enough."

4.3 Reflection

How the result responds to the research objective:

1. What is the relationship between R&A and GDI&A?

The relationship between R&A and GDI&A is supportive, symmetric, and long term. Therefore, deeper discussion that exchanges high level information is needed more frequently.

2. What kind of information is needed from R&A and GDI&A but missing?

The goal, purpose and the context behind the request is not shared from R&A to GDI&A. Implicit knowledge from GDI&A is eager from R&A, they want to learn from GDI&A experience.

The evaluation shows that the parts GDI&A and R&A want to enhance are different. GDI&A is asking for a more contextualized content while R&A is keen to gain the support of technical aspects. To find a direction for the research to go on, I synthesize these findings into two main requirements, which are :

Clear question with context behind it is required

The situation of information exchange now is more like answering the request on a surface level without a deeper understanding of the process and the vision behind R&A's request. Without a clear question with context behind, GDI&A feels difficult to give reference and advice to R&A, besides, GDI&A could not see the value and impact of their contribution.

Accessibility to previous cases and requests

Due to the fact that there is not a place to share previous cases and check the requests that have been asked in the organization, R&A can not view relevant cases for inspiration, GDI&A has to cope with repetitive requests.

Requirement one focuses on the information flow between R&A and GDI&A. While requirement two has the potential to involve more teams from the organization. To fulfill requirement two, development teams in the organization need to agree on making the information available to be viewed by others.



Requirement

Clear request with context behind it

(more collaborative communication)

Accessibility to previous cases and requests

Impact

Feel more engaged

Give R&A more precise support

Reduce repetitive works

learn data analysis knowledge



GDI&A



R&A



I need this !

I am curious about this !



"The context behind the request" and "the information about other cases" are missing in the information flow between R&A and GDI&A, I am going to find suitable communication mediums that can carry the information in this chapter.

Even though R&A and GDI&A explain a little bit about how they want to communicate from the last iteration, it is hard to imagine which kind of medium fits both of the stakeholders. In this chapter, I conducted an evaluation to validate it.

Besides, since it is important to identify the types of knowledge/information in knowledge management, how we classify the information from the request and cases becomes another question that needs to be figured out.

Research objective

1. What are the suitable mediums to carry the information?
2. How can the information be identified?

KM structure



5.1 Conceptualization of the design activity

Conceptualization

From the result from the last iteration, I see that the first requirement (request with context behind it) has a higher priority to cope with. Once the principle of addressing the request is standardized, it can become a format that more projects can use. With more projects and their requests are documented, they can be uploaded to an open repository which enables different teams to view them (requirement two). It is to say, once the content and communication way is built up and documented in each case, it can become a foundation to share and link different cases and requests in an open environment.

Therefore, in this iteration, I will look into how to transfer the "request with its context" first. (1) Find out what is the suitable medium to communicate, and (2) how the information can be classified.

Researchers state that mediums' capability is influenced by their richness, synchronicity, and other social factors (Daft & Lengel, 1983; Carlson & George, 2004; Hollingshead et al., 1993). To focus on the nature of the medium itself and not to make the research too complicated, I decided to analyze the mediums by their richness and synchronicity. To validate the characteristics more thoroughly, the mediums that are tested in this evaluation will cover from low to high levels of richness and immediacy (Figure 5.1).

Current ways to communicate between two teams are by email and informal conversation in the office. Since deliver the "request with its context" is more complex than R&A address their request before, I add some rules to enrich the information, which are:

1. Give a brief that explains the context and purpose behind the requests
2. Add the tags of which data is collected in this case
3. Send it with images (increase the information cues)

Besides, I add a topic tag to help them identify the main objective of the request. (vehicles or drivers). It may not be the best classification, therefore, the interview will be conducted and figure out what are better classification that can add to the requests.

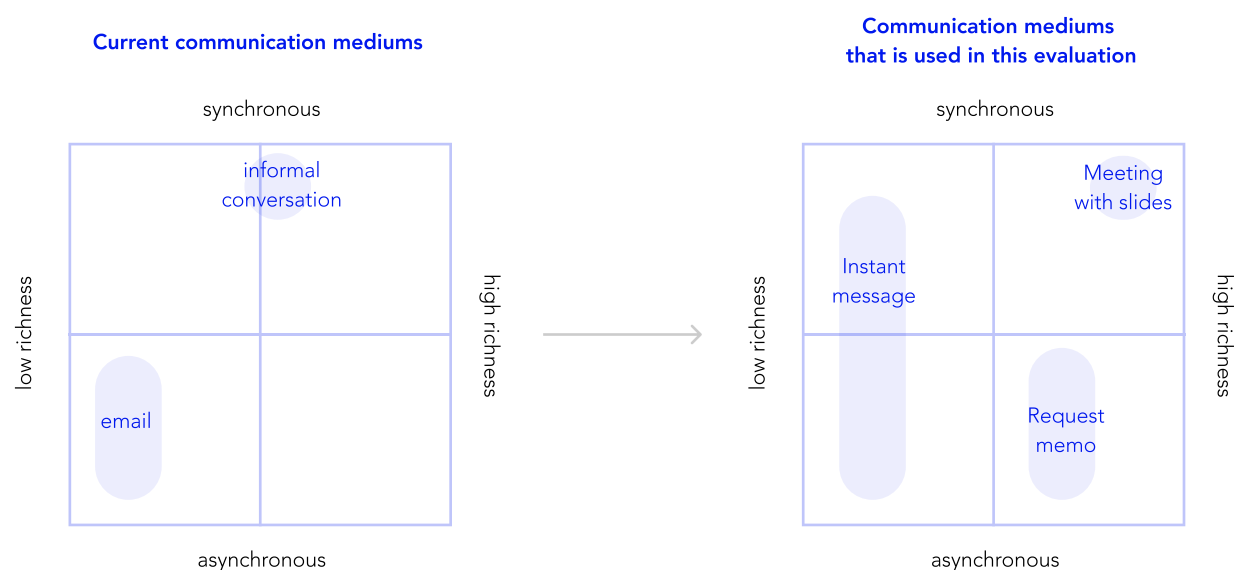


Figure 5.1: The deviation of the mediums on the "medium capability map" in the current situation and this evaluation

5.1 Conceptualization of the Design activity > Conceptualization

Meeting with slides

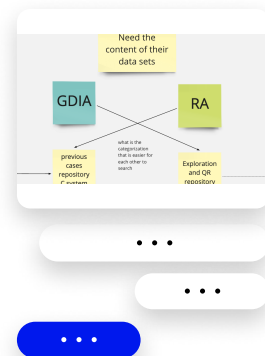
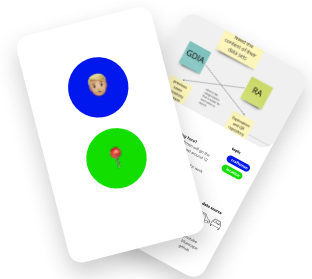
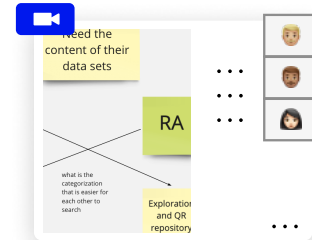
A presentation and slides needed to be prepared, the presenters have to introduce the background behind the requests, the purpose behind the requests. The slides need to contain visuals including diagrams from analysis, or images/photos that can explain the context.

Request memo

The memo contains visuals (diagrams, photos), short descriptions that illustrate (1) the background (what), (2) purpose (why), and (3) requests (how), tags including keywords, and data source. Since it is a document that doesn't allow synchronous communication, these elements are here to help the request receivers understand the content faster. The short description of What, Why, and How aims to state the context in shorts and structures the request with a clearer view.

Instant message (IM)

Visuals and messages can be delivered in the instant message environment, the content needs to contain the context and the request.



Execution

By conducting an evaluation of 3 different types of communication mediums with the employees, I can explore how the information flows with different mediums, and how the participants feel about each medium.

Participants

The participants that were recruited are the employees who are involved in this collaboration project. There are two roles in this evaluation, which are data coach and requester. Data coaches are employees from GDI&A, requesters are employees from R&A. In this evaluation, data coaches are the one receiving the information, requesters are the one giving the information.

P1, P2: employees from GDIA (data coach)

P3, P4: employees from R&A (requester)

Setup

First of all, the requesters need to prepare a 3-5 minutes presentation with slides before this evaluation. The content needs to include visuals, context, and lastly, the questions they want to ask the information receivers. Secondly, the requesters need to extract the content from the presentation and put them on the request memo cards.

For data coaches, an interaction web page is prepared for them, it aims to simulate the situation that they are doing their own task from their main team. The interaction web page consists of a timer and a calculating test (Figure 5.2).

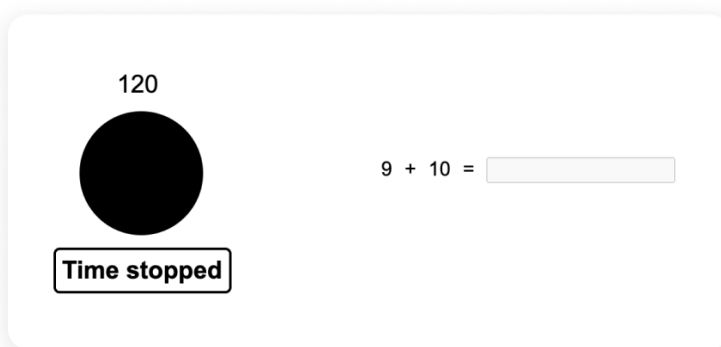


Figure 5.2: The working simulation has a timer and a working space (answer box). The timer will count down from 2 minutes, when the participants leave the working space, it will stop counting down.

5.1 Conceptualization of the Design activity > Execution

Execution

The evaluation is conducted in three parts, instant message comes first, followed by request memo+instant message and meeting with slides, each part contains a data coach and a requester. In order not to expose the information while using less rich mediums, data coaches and the requesters will switch their communication partner when the part 2 occurs. In part 3, they will listen to a presentation from the requester together (Figure 5.3).

During part 1 and part 2, data coaches need to calculate for 2 minutes in a 5 minutes communication (simulating they are doing their task). If data coaches communicate with requesters and stop calculating, the timer will stop, once they come back to calculate, the timer will resume counting down.

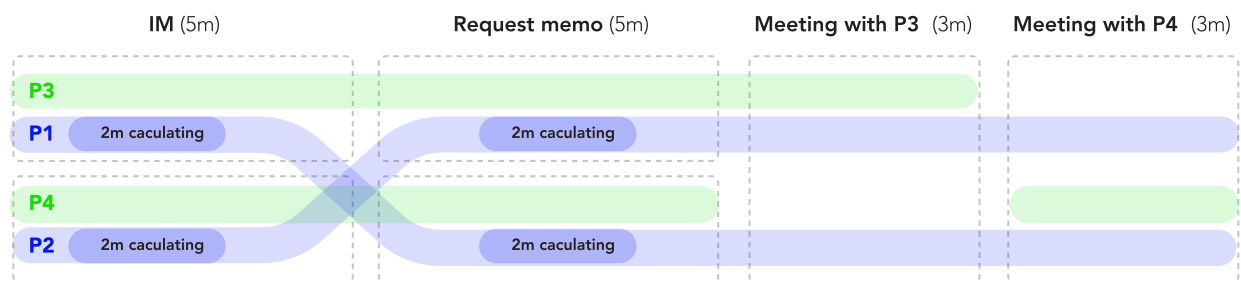


Figure 5.3: The deviation of the mediums on the

5.2 Result

Meeting with slides

Meeting with slides is concerned as the richest communication medium from both data coaches and requesters. Participants mentioned that most of the time, a meeting needs a lot of effort to understand it without any background knowledge. But at the same time, it is very engaging to have deeper communication, especially if the meeting is on a smaller scale. Downside of the meeting is also obvious, all participants need to be present and spare the time for it.

P1

"I feel the meeting is engaging, but we don't meet that often"

P4

"Live interaction to discuss the request enables us to understand from both sides what the possibilities are."

Pros and cons

1. enable both data coaches and requesters to have more detailed discussion(+)
2. better to some background knowledge before meeting(-)
3. needs to arrange(-)

Request memo

Request memo is able to carry the information that includes the requests and its background information, data coaches can get the information in a short time and are able to give feedback. Data coaches feel more inspiring and more willing to start a conversation while receiving the request memo compared to only receiving instant messages, it is regarded as a suitable material to start further discussion. Request memo not only is seen as a structured way to formulate information from both data coaches and requesters, but remains flexible on time to receive and reply. It is worth noting that, requesters believe that even though a request memo seems like an effective tool, a direct contact is still needed.

P2

"The questions on the memo are already very clear, I believe I am able to answer them."

P4

"Good way to structure a request and think of the initial inputs... It allows feedback on the form, to initiate discussion"

Pros and cons

1. enable data coaches to capture basic knowledge and the purpose of the request(+)
2. enable requester to structure their request (+)
3. data coaches can receive the information in a more flexible time(+)
4. discussion not possible(-)

Instant message

Data coaches think less information is received while using instant messages. It takes more time for receivers to get the whole idea in the instant message session, even though the response is fast. The delay caused by typing and reading becomes friction for both of the stakeholders. It could lead to mismatching responses. Instant message is an oversimplified medium when information givers want to share ideas or request help when information receivers do not have any background knowledge. Fractal information and less efficient communication while using instant messages make receivers feel more insecure and discouraged. Moreover, the messages that come from the chat constantly make data coaches distracted from their task. Participants still remain positive toward its convenience of quick reply, however, it is clear that synchronous communication does not fit here to start a conversation from zero.

Classification of knowledge/information types

The topic tag helps data coaches get the main topic of the request. However, requesters pointed out defining the request type in the form in the request memo may also help further communication faster. For example, type the output they need (raw data, data dashboard, live data), duration of data collection, and the filter of criteria (whether the data is off the shelf or not).

P1

"While I am typing my answer, a new question is following the previous answer. I have to admit, sometimes I missed the question. "

P4

"Quick way to ask a question. But it is not ideal to initiate contact."

Pros and cons

1. enable data coaches and requester to have quick reaction without being present(+)
2. not able to carry multiple requests with background knowledge(-)

How the result responds to the research objective:

1. What are the suitable mediums to carry the information? (processes and activities)
 - (1) "Request memo" and "Meeting with slides" have the capability to carry requests with background information.
 - (2) "Request memo" is preferred to start further collaboration, because it is able to convey a clear message (high richness), people prefer to receive it more flexibly (asynchronous).
 - (3) "Meeting with slides" is the richest medium, people find it necessary to have deeper conversations to avoid putting effort in the wrong places.
2. How can the information be identified?

Compared to the topic's classification, defining the outcome of the request could be more relevant and useful for understanding the request .

Concluding from users' feedback, I see that Request memo has the potential to become the starting point for the information flow in each case and request. It could be the foundation for further discussion and meeting, since users believe the meeting is easier to catch up when background knowledge is given. Another benefit of Request memo is its documentation, it can be viewed if the information is shared with others.

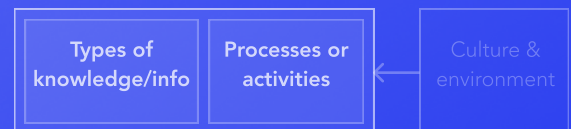
As for the classification of requests, the topic's tag is useful for data coaches to understand the topic faster. On the other hand, requesters suggest defining the request based on different outcomes that are asked from the request. It can become a useful clue that helps both stakeholders to reach consensus about the need from the requester.

After two iterations, I synthesized the insights and designed a digital platform that embedded the elements which fit the needs from R&A and GDI&A. However, the process of the knowledge/information transfer is not structured yet. An evaluation will be conducted in this iteration to see how R&A and GDI&A use the medium and the elements in reality.

Research objective

1. What are the suitable procedures for R&A and GDI&A using the mediums and the elements? (processes or activities)
2. To what degree does the information need to be shared with different people in the organization? (Types of knowledge/info)

KM structure



6.1 Conceptualization of the design activity

Conceptualization

A digital platform prototype is designed that embeds the elements (images, request types) that are synthesized from previous research. It aims to let the participant simulate how they will use the prototype through the whole journey of information exchanging. Besides, the classification of request types (see 2-1 in this chapter) is designed based on different outcomes that is required from R&A.

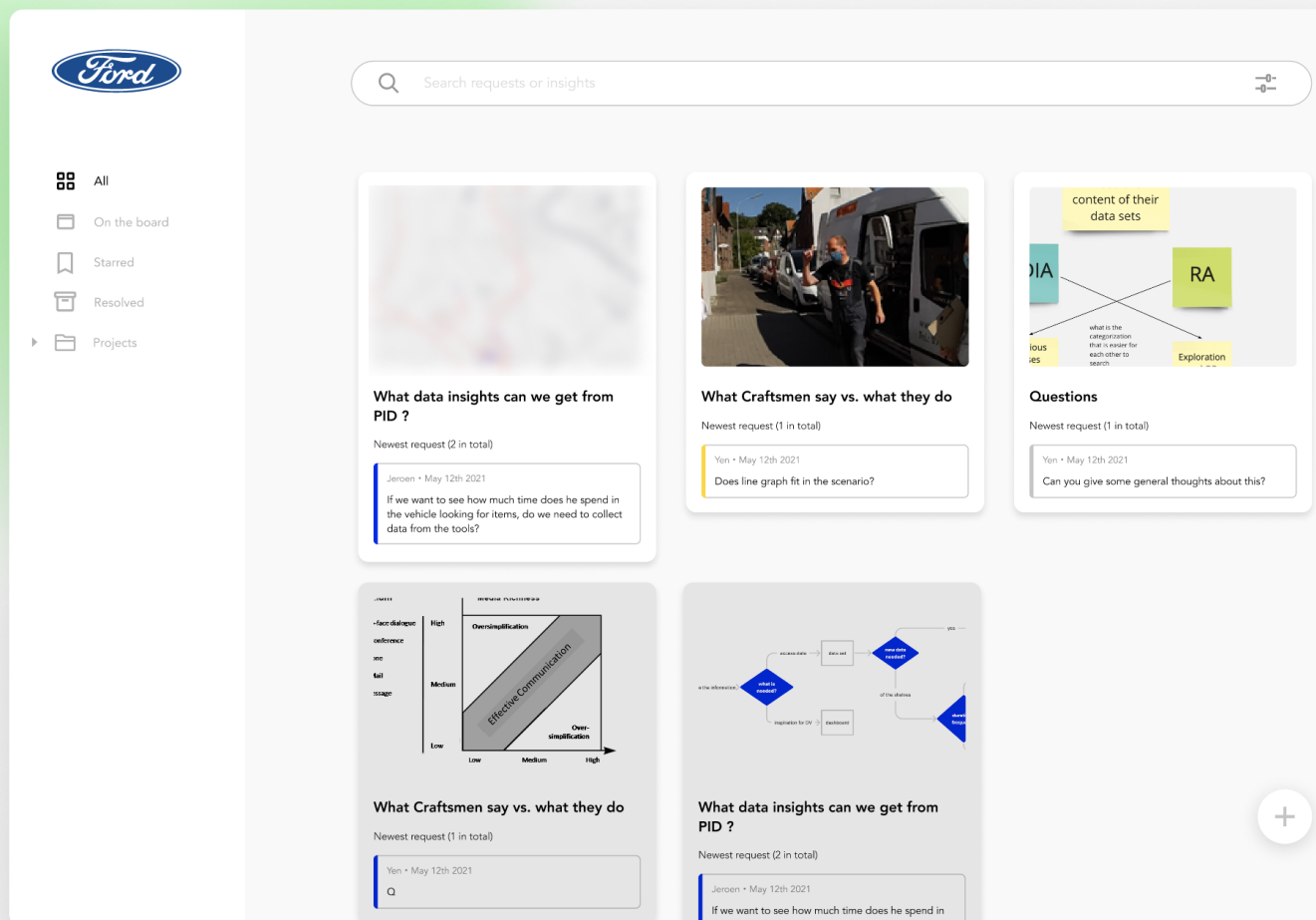
1. Asynchronous open environment

Previous iterations show that an open environment can be the best solution for starting the information flows between two teams in Ford, besides, since the process is documented, so it is able to share, track, and reach (it is hard to achieve if the communication is informal face to face conversation or through personal email).

The result from iteration 2 tells that request with context can be carried by Request memo and Meeting. More specifically, asynchrony of memos makes it stand out from meetings, since it is more flexible. It does not mean memo can replace meeting, but it is able to provide a foundation for the meeting.

As for “reaching other cases and its requests”, iteration 1 shows that informal conversation and email is hard to share with and viewed by people outside the team. Therefore, to make these processes documented in an open environment helps the knowledge shared among the team members. Based on the findings that are summed up above, I purpose a digital platform that consists of following main elements (Figure 6.1).

Figure 6.1: The digital platform prototype



6.1 Conceptualization of the Design activity

1-1 The request memo

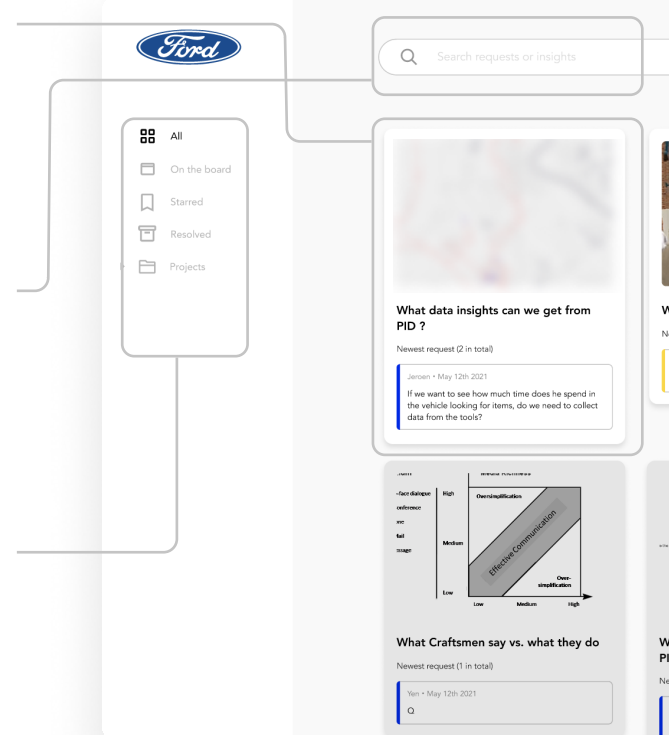
A presentation and slides needed to be prepared, the presenters have to introduce the background behind the requests, the purpose behind the requests. The slides need to contain visuals including diagrams from analysis, or images/photos that can explain the context.

1-2 The sidebar of the digital platform

In order to make GDI&A easier to sort the requests, the sidebar has four main elements to arrange and show the request, which are on the board, resolved, starred, viewed by project. In this way, they can view the requests by certain criteria and filter out the noise which causes distraction.

1-3 Search bar

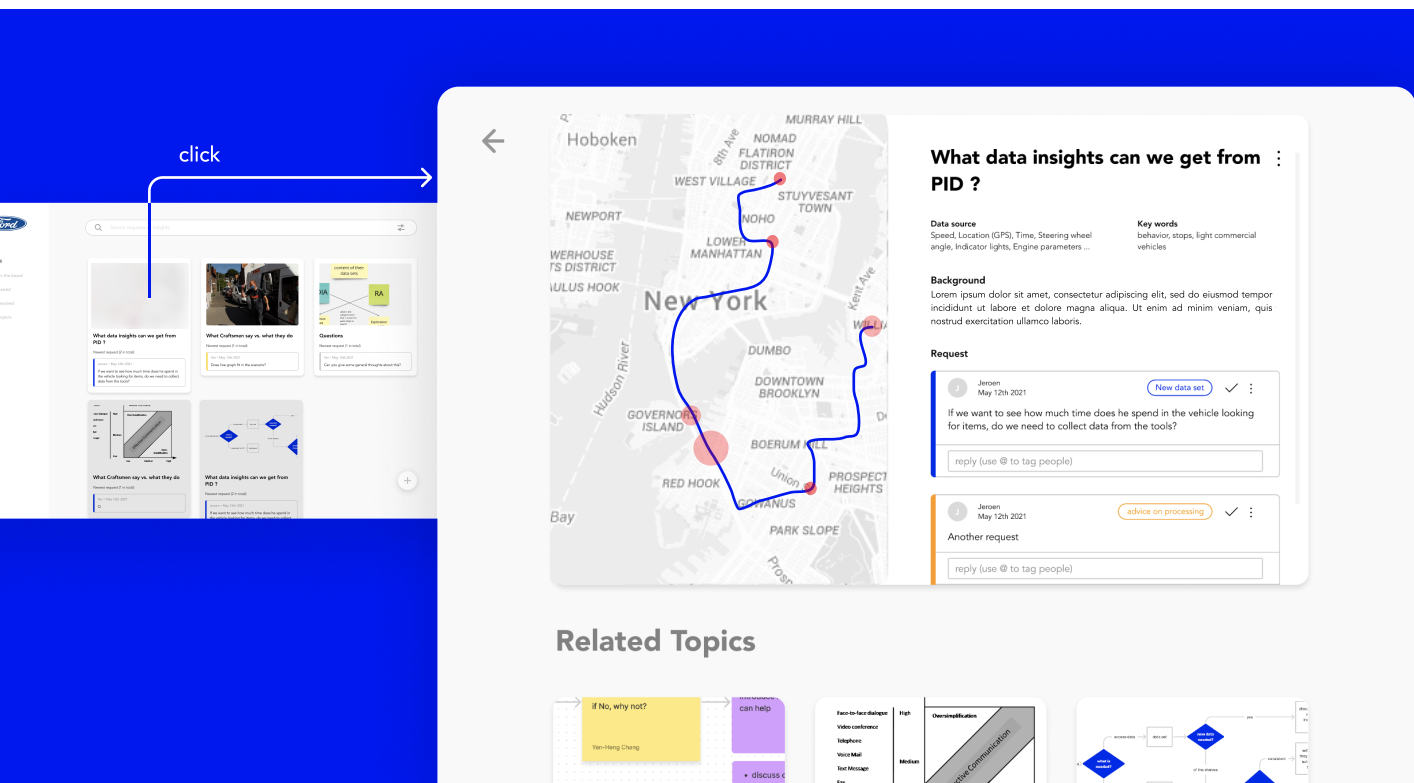
There is a search bar in the main page, which enables users to find certain cases, or find inspiration by relevant keywords (which are the elements in the request memo page).



2. Request memo page

When users click on the request memo, it will expand to a full page with more information (Figure 6.2). The request memo page consists of title, keywords, data source, pictures, short description of the background knowledge, and requests. Under the same topic, new requests can be generated in the same request memo page. Each request has tags of request types (explained in the following paragraph) and a reply blank, so the reply will not be confused with a different request. If the request is resolved, it will move to the lower section.

Figure 6.2: The digital platform prototype



2-1. Decision tree of request types

From the feedback from the evaluation test in chapter two, R&A pointed out that pre-defining the type of outputs can make further communication become easier. Therefore, I designed a decision tree to help R&A define their request types (Figure 6.3). The requests are defined in five different types based on the following questions :

Q1. What kind of output do they need?

The request giver needs to tell which kind of output they need, is it related to data collection or data analysis.

◀ If it is related to data analysis, then go to Q2.

◀ If it is related to data collection, then go to Q3.

→ Q2. Which process of data analysis needs help?

If the requester already has the data, which process do they need help, analysis or visualization?

▶ **Analyze/process**-GDI&A will advise on how to analyze to find out the meaning behind the data.

▶ **Visualize**-GDI&A will advise on how to visualize the data convincingly and reasonably.

→ Q3. Do we have the data?

If the request is related to data collection, they need to tell whether the data is available or not.

◀ If the data is off-the-shelves, then go to Q4;

▶ If new data needs to be collected- needs to be discussed with GDI&A whether they need to process new data from the data collector or whether new data source is needed

→ Q4 How often do we need the data

If the data is off-the-selves, the requester need to tell whether they will need it constantly or not.

▶ **one off analysis**- If the data is only needed once, or R&A has not seen the reason to keep collecting it in the future, GDI&A will help them access the data manually.

▶ **repetitive** - If R&A notices they will need this data set constantly, R&A needs to discuss with GDI&A whether a new script needs to be written or not. It helps R&A access the processed data autonomously without asking GDI&A.

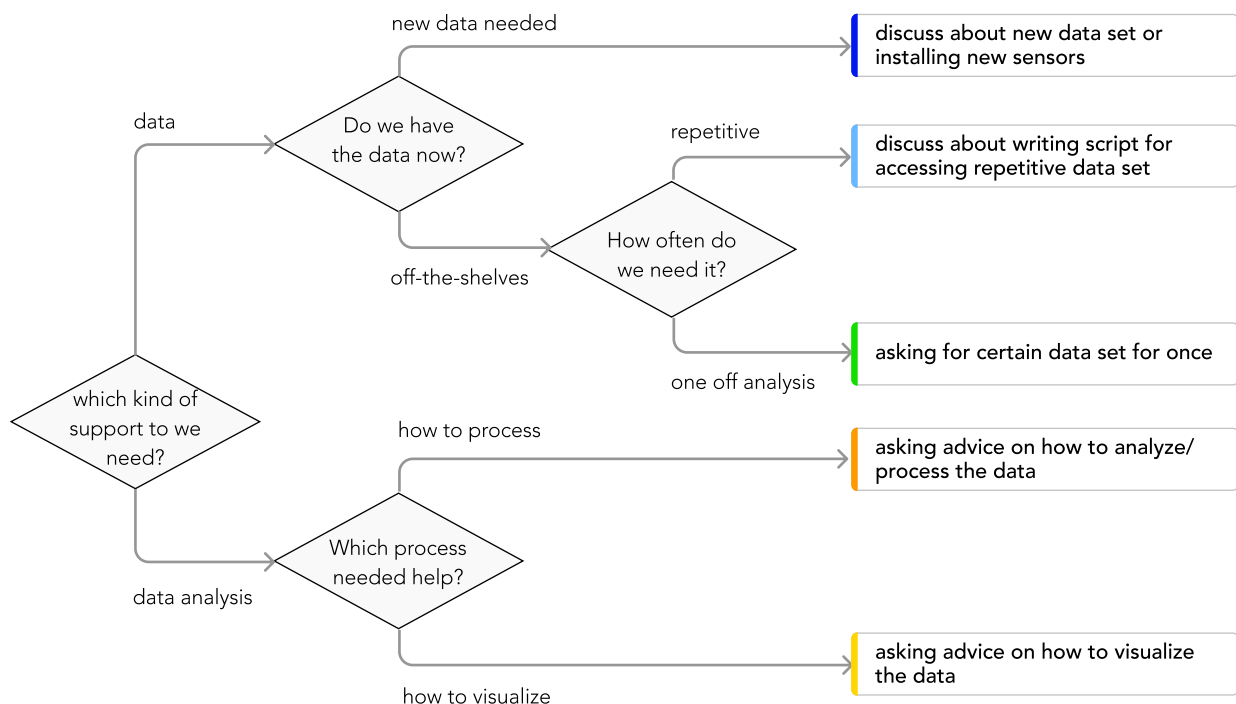


Figure 6.3: Decision tree of request types

Execution

Participants

The participants that were recruited are employees from R&A and GDI&A. In order to make sure that the principles and guidelines can be used in their teams besides the project they are conducting right now, more participants are recruited.

P1, P2, P3, P4: employees from R&A

P5, P6: employees from GDIA

Setup

The evaluation is conducted remotely in the online meeting environment while using an online prototype. The prototype is sent by link, the participants are asked to share their screen.

Execution

The evaluation is conducted with the employees from R&A and GDI&A individually. In the beginning I demonstrated and introduced the elements on the digital platform. Then, I ask the participant to imagine how they will use the platform in reality if they want to request something from R&A. This prototype is a material to see how the participants use it and how the prototype helps them. And a semi-structured interview will be held while participants are using the prototype at the same time.

R&A

1. Demonstrate the features to the participant
2. Ask the participant to recall an experience that they needed help with which is related to data
3. Ask the participant to explain how they will use it and share their thoughts

GDI&A

1. Demonstrate the features to the participant
2. Address a scenario that a request is posted from the problem owner
3. Ask the participant to explain how will they use it and share their thoughts

Different kinds of information and the level of sharing it

Keeping the information at a high level (more general and abstract) in the open environment helps the platform retain a manageable amount of information and understandable content for people outside the team to receive. Researchers from R&A are keen to have support from the technical aspects. Including having example codes for their project or seeing the result (especially the data visualization) from other cases in the organization. However, GDI&A suggests only abstract and general content should be on the digital platform, GDI&A believes too detailed and complex information makes the environment hard to maintain, moreover, people outside the team may get lost. Therefore, discussion about the technical side (codes) and deeper conversation should be hidden for external people. It does not mean the information is not important, but people can access them by request or by external links if they are not in the team.

P5

"I think (information) on the memo should be very high level, general, not on a development level. Otherwise, it is getting too big, hard to maintain."

P1

"I don't think it's a good idea to share all the information over here, it may be irrelevant for others, and sometimes it is confidential"

The process of proposing requests and further actions after it

Employees believe it is nice to start the requests with all the information set up, it helps the situation clear for the stakeholders. Especially for the data coaches, asynchronicity gives them the buffer to evaluate the situation, and features on the Request memo helps them understand faster.

Since asynchronous communication tools are still relatively limited compared to synchronous communication, employees may need further discussion or further technical demonstration besides words and image replies. Therefore, there are several actions the team members can take, including arrange for a meeting, link to external resources, and tag/link relevant colleagues.

Firstly, arranging further meetings is crucial for the collaboration. Especially at the beginning of the project, participants state that building consensus among team members can avoid spending time and effort on useless things.

Secondly, external links help people access more detailed information including places to share and demonstrate the code and slides of their presentation, besides, it helps to keep the information on the platform being cleaner.

Lastly, linking relevant articles/requests to other colleagues can reduce repetitive works for GDI&A, and R&A can review references for inspiration. Another case is when the data coach is busy now or knows someone is better for the specific request, it is a way to introduce other data expertise to take over the request.

P3

this is a nice thing to set up (background & request) ... and makes the situation clear.

I will suggest a meeting is always needed... A request can trigger a meeting... it can avoid going to the wrong direction, and you end up spending time and effort on the thing that is useless .

How can the features helps and be used

The features on the Request memo pages vary the way people receive the information. Keywords and data sources help the data coach understand the project faster. Furthermore, by digitalization

1. keywords enable the searching function and grouping relevant Request-Memo pages,
2. and the process is available to be tracked by viewing the requests and responses on the Request-Memo pages.

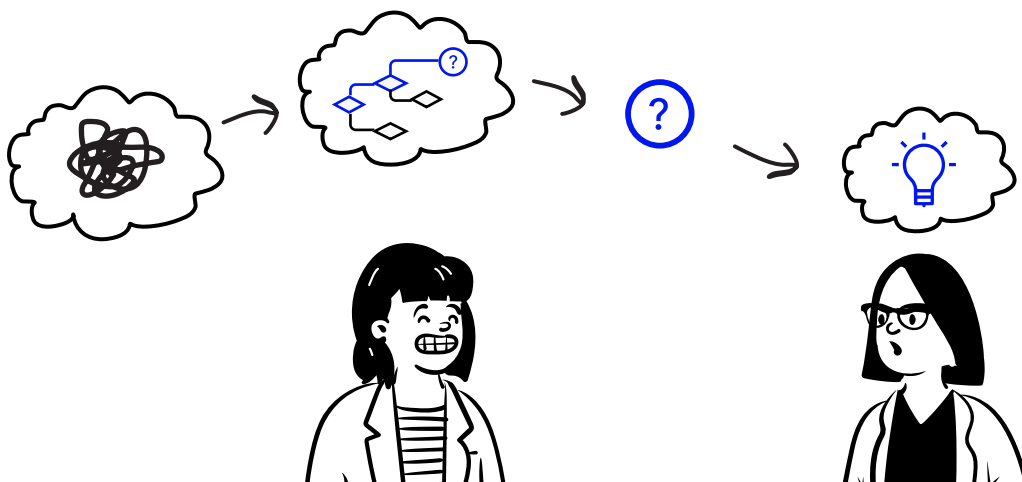
The decision tree of defining the request types is seen as one the most valuable elements from both R&A and GDI&A. Most employees from R&A agree that it helps them clarify their request, and GDI&A thinks the request type gives them clues to evaluate the request. Once the manager from GDI&A receives it, they can make a better judgment about who should cope with this request and how they will handle the problem. Defining the types creates a consensus among the team members on the requests that could happen. Team members can get it quickly when seeing the types.

P6

"The categorizations is very simple, you have data source, keywords, background, and request are very helpful, for me, it is enough to understand"

P3

"This is very good with this four boxes (decision box of request types). I think it is the most valuable thing on this platform, maybe you should put in a more obvious place so people can view on it easily.



The principle of knowledge sharing

The level of sharing the details of information depends on how close the people are related to the project (Austin Govella, 2019). It helps to filter out irrelevant information and noise for the audience that is not in the project team. Based on the insights synthesized from the evaluation, the principle is purposed here to clarify which information should be shared with the organization, and which should not. (answer to research object 1: To what degree does the information need to be shared with different people in the organization?)(Figure 6.4).

High-level information can be viewed by people from the organization in an open environment. High-level information includes a brief introduction of the project and the requests under that project's context. More detailed discussions and technical demonstrations should only be shared only among the team members. However, colleagues who are not in the project team can access the information through external links (Github, Bluescape, SharePoint) or by asking to join the team.

Team members who owns the Request memo page can edit the information, and set confidential content that is not allowed to be shared publicly. Team members can track the project on their own page by viewing the requests and answers that are on their Request memo page, which helps them to avoid proposing repetitive requests.

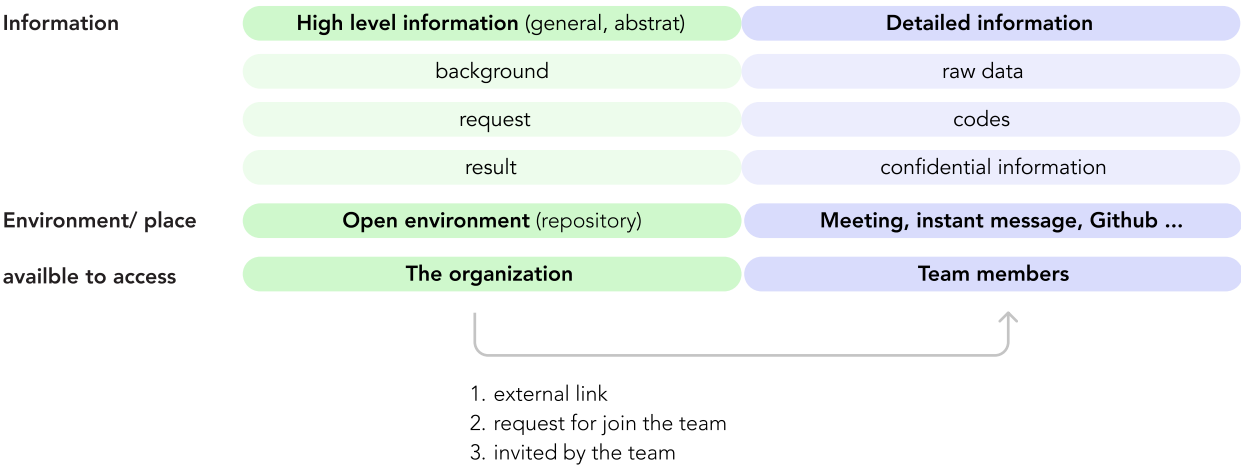


Figure 6.4: Different levels of information are shared among the organization

Guideline for information exchange in the collaboration

Syntesized from the result from the evaluation, a structure is purposed to show how information exchange in collaboration(Figure 6.5). This structure act as a guideline to manage the knowledge in the collaboration between data scientists and the requesters (answer to research object 2: What are the suitable procedures for R&A and GDI&A using the mediums and the elements?).

Firstly, the profile of the project should be built up in an asynchronous collaboration environment. It needs to include an introduction, images, and keywords.

Then, the requests will be delivered under the page of the project profile. With the information on the project profile and the request, the manager of the data scientist team can decide which colleagues and strategies are the best fit for the requester. It will be the starting point of the information flow in each collaboration between data scientists and the requesters.

When the collaboration starts, team members can decide further communication based on the complexity and importance of the requests.

Once the requesters have new problems, they can check on other cases of repetitive/similar requests. If requesters still have the problem, then a new request will be delivered under the project profile.

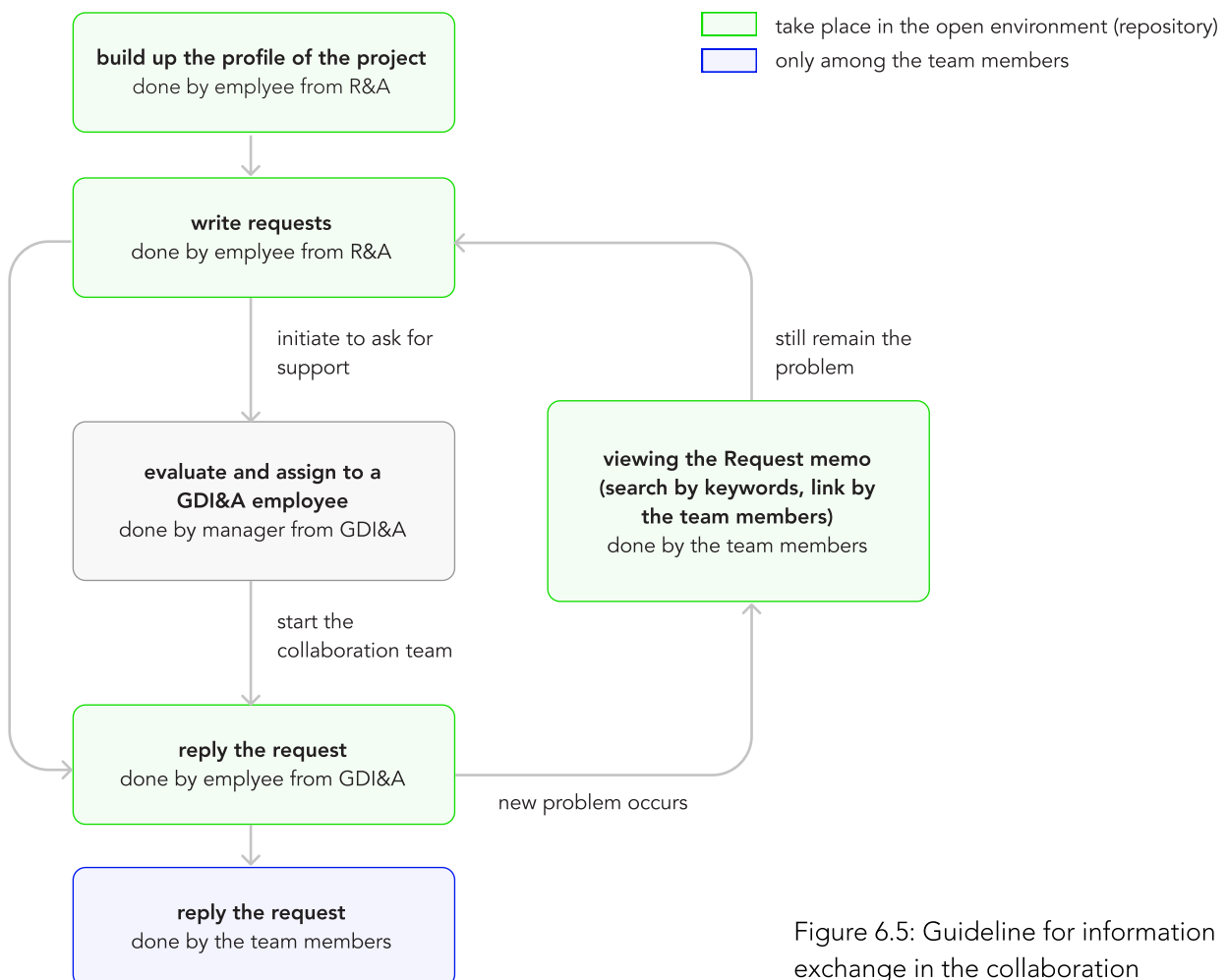
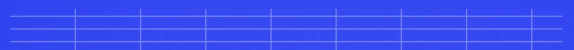


Figure 6.5: Guideline for information exchange in the collaboration

Decision tree of request types

The decision tree of defining the request types is regarded as a valuable feature from both data coaches and requesters. It helps two teams build up consensus about the requests, requesters clarify their problems, lastly, data coaches evaluate the requests. Therefore, it is suggested that a decision tree of request type should exist in each collaboration. If the decision tree does not perfectly fit the collaboration in the specific case, team members should design one together.

07 Conclusion



The project aims to improve the information flow between researchers (R&A) and data scientists (GDI&A) in Ford. Throughout the whole research, several activities have been conducted to analyze the information flow from different angles.

The primary outcomes and contributions of this thesis are (1) found out the missing information in the collaboration, (2) purposed a guideline for information exchange in the collaboration between R&A and GDI&A, (3) and provide a classification for them to identify the request in the collaboration.

Missing information in the collaboration

The research found there are two main problems that influence the information flow between R&A and GDI&A. First, the context behind the request from R&A is not shared with the data scientist (GDI&A). It influences how data expertise can provide accurate support and suggestion, moreover, it influences their engagement in the collaboration. The second problem is that there is not a repository that stores cases and requests that are related to data analysis. R&A could not view reference cases to learn data analysis and visualization. GDI&A needs to cope with the repetitive requests since the cases and requests are not documented in a systematic way.

Guideline for information exchange in the collaboration

Knowledge management activities - The research shows that address a request with its context is better to start it through asynchronous communication. Therefore, the guideline suggests building up the project profile and address the request on the open environment in the organization first. Then data expertise can evaluate the situation and come up with suitable strategies to support the requesters. Once the team members find the situation is complex and important, then a meeting should be held. Lastly, when new problems occur, the team members can use the repository to find the answer that is already asked before or for inspiration.

The level of knowledge sharing - High-level information is suggested to be shared in the open environment, it enables data scientists to reduce double works by referring relevant cases to requesters; detailed information includes technical demonstration and fractal information should leave from the open environment. It helps to reduce the noise and irrelevant information for those who are not in the project team.

Classification of the request types

Classification of the request types helps the requesters to clarify their problem, also helps the data scientist understand and evaluate the situation faster. Besides, it is easy and cost-effective to implement.

7.2 Recommendation & limitation

From a solution for R&A and GDI&A expands to a larger scope in the organization

This project first aims to solve the problem between R&A and GDI&A, however, from the first phase of problem definition, I have noticed that one of the requirements is to make the result of the cases and the requests transparent. It is to say if the platform embeds more information, GDI&A can reduce their works if there are more requests they can link and refer to; R&A can gain more inspiration with more results that have been exhibited. The fact that the solution is designed for employees in Ford who work together on projects that involve data, the solution has the potential to be implemented in Connected Data Forum (CDF), employees can benefit from the solution, also more users means the knowledge network becomes richer.

Different steps/approaches to implement the guideline

In the last evaluation, a digital platform prototype is designed. It aims to collect the insights that can synthesize into guidelines for R&A and GDI&A to implement. The guideline is the final deliverable in this project since to build up a digital platform needs to invest lots of effort and time. However, it is not possible in Ford, at least in the short term.

Since releasing a digital platform is not feasible for now, it becomes important to keep the guideline as principles in future collaboration. The guideline provides R&A and GDI&A some criteria to look into the collaboration tool on the market. The asynchronous collaboration tool needs to be able to insert various sources including images and links and be able to set the authorization for viewing, commenting, and editing. Based on the criteria, R&A and GDI&A can evaluate whether the tools they used can achieve or not, otherwise they can adapt tools like Notion, Coda which fit the criteria.

However, the decision tree of defining the request types is relatively feasible for Ford. Data coaches and requesters can benefit from it without investing too much time and effort. They need to have a workshop or a meeting to define all the requests to a decision tree that covers all of the scenarios they may meet. After defining the request types, they can make their communication more effective and less ambiguous with the request types tags.

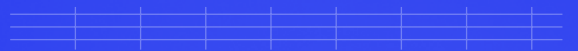
The awareness of choosing to communicate in an open environment or through a more personal channel

As the guideline recommends, high-level information and requests should be shown in the open environment, it requires the participants to maintain the content on the profile. In the best situation, the requests and the reply should bring out the context and process of the project, at the same time, the team members also need to be aware that the content should not be too wordy and trivial. They should keep those contents out of the open environment and have those conversations through instant messages or another communication system. It needs to count on employees' awareness to define which content should be in the open environment or not.

Need to explain the benefit that motivates stakeholders to share their project's information with the organization

Another challenge to implement the guideline is that other employees or clients who seek data support need to see their benefit to convince them to share their information and requests. From the interview, R&A are less willing to share their information compared to GDI&A. However, only if more profiles are built up, the repository can become more powerful with its richness. It is considered a big move that will change the culture a lot since the requests are communicated in a more personal way.

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09

9.1 Evaluation 1

Interview questions:

what are the goal they want to achieve

can you explain why you are more interested in certain steps?

what does it mean to you (explain separately)?

What is the reason that makes you want to enhance in that steps?

what are the missing part

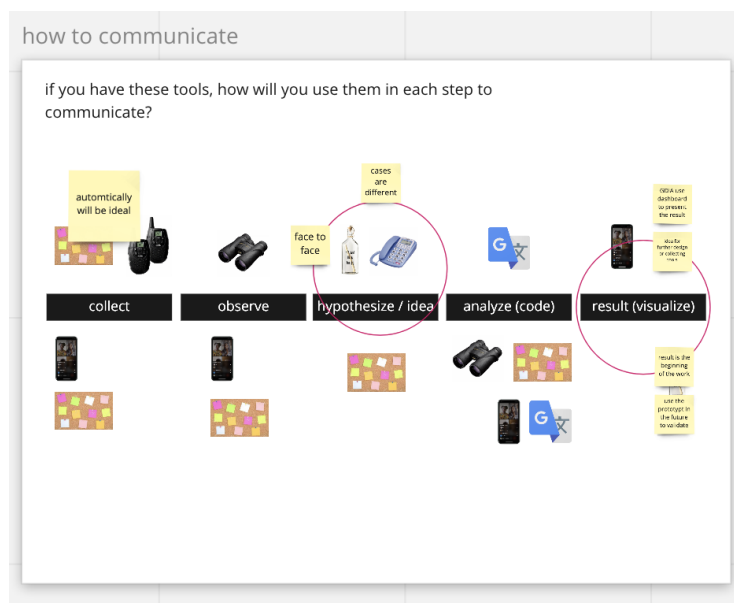
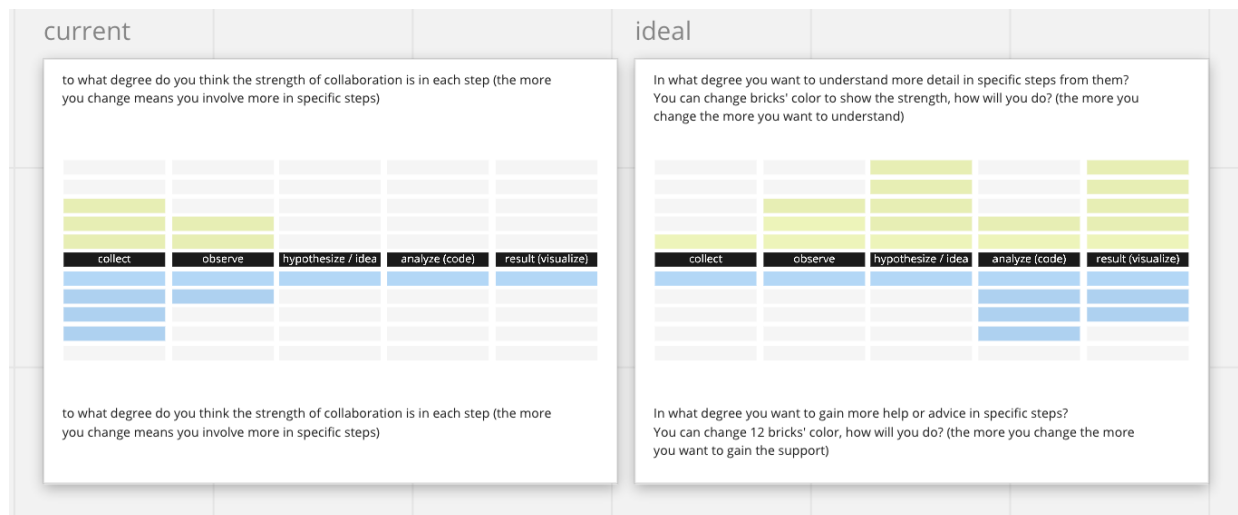
I saw you guys has different level on {certain steps}, why?

does that caused a lot of afford for you to do so?

what is the desirable communication way from R&A and GDI&A

why do you chose certain tools to those steps? (ask them to explain the creation they make on canvas 2)

Result:



Quotes:



9.2 Evaluation 2

The online introduction sent before the evaluation

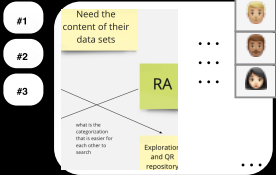
<https://www.figma.com/proto/8hhqGgjaO4II07vnPeta1p/GP?node-id=199%3A60&scaling=scale-down&page-id=155%3A2&starting-point-node-id=199%3A60>

3 Communication mediums


We are going to try in the user test

We'll try them out in the User. Test to find out the characteristics of each communication way

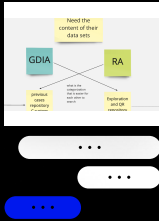
#1 Meeting



#2 Memo



#3 Chat



#1

Meeting with slides

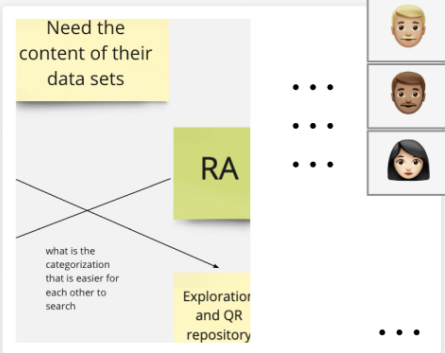
I would like you to have a short presentation with slides in 3-7 min. (don't need to be too much, but please make it sounds like a story! you can also copy from your previous presentation in the team)

The content can be the findings or insights that you found in your research (data exploration, workshop, observation)

#1

#2

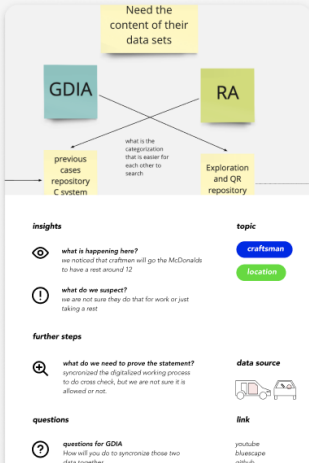
#3



#2

Insight Memo

close up



Select the questions to start composing the card, you don't need to fill in all of the questions

insights (what)

- 👁 what is interesting happening here?
- ❗ what do we suspect?

further steps (why & how)

- 🔗 how can we implement it in the future development?
- 🔍 what do we need to prove the insight? (data or research)
- ★ why is this insight important to us?


questions

- ❓

It just a Render
So I would like to invite you to fill in the
memo in Miro page! (click the logo)

I will turn them into the cards you see, and
use in the User Test!

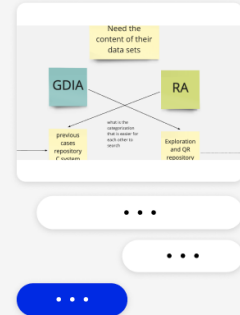
Thank you very much for your cooperation!




#3

Online Chat

a informal and direct way to
communicate with short
messages



navigate to
Miro Board



Hi, welcome !
after you finished
the slides, please
summarize them
in 10-20 memos!

can be one,
can be two,
can be 3-5
memos

#1 name the
card with a
title
(not
mandatory)

#2 click
on the
card

#3 put relevant
visuals (pics,
screenshots, images/
flowcharts) on it

#4 add the
comments
that you think
is important or
worth sharing

show a question and
answer to your team/need
to use of inspiration in
what's new to make sure
it was already a problem
and/or for someone

Name the memo

details

Data source
USA car data, PID GPS

please insert pictures or flow chart over here

insights
what is interesting happening here?
what do we suspect?

further steps
how can we implement it in the future development?
what do we need to prove the insight? (data or research)
why is this insight important to us?

questions
(2 for GDIA, not mandatory)

link (if needed)

Example

details

Data source
USA car data, PID GPS

Sprint 1 1. high linkage 2. low linkage

Sprint 2 1v2

#final 1v2

insights
what is interesting happening here?
we noticed that craftsmen will go the McDonalds to have a rest around 12
what do we suspect?
we are not sure they do that for work or just taking a rest

further steps
what do we need to prove the insight? (data or research)
synchronize the digitalized working process to do cross check, but we are not sure it is allowed
or not.

questions
how will you do to synchronize those two data together

link (if needed)

instruction in the evaluation:

GDIA

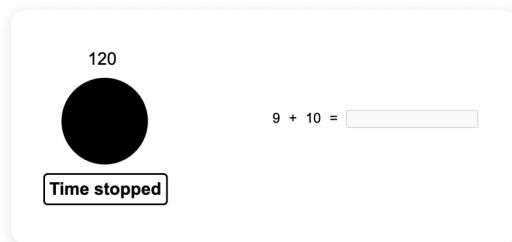
1. prepare for the online meeting, share the screen
2. start the evaluation, communicate with R&A (5min) and doing the calculation at the same time (2min)
3. fill in the questionnaire.

GDIA

1. prepare for the online meeting, share the screen
2. start the evaluation, communicate with GDI&A (5min).
3. fill in the questionnaire.

The link to working simulation

<https://codepen.io/yoyoman-II/pen/MWpxgop>



General instruction

Receiver (GDIA)

1. preparation

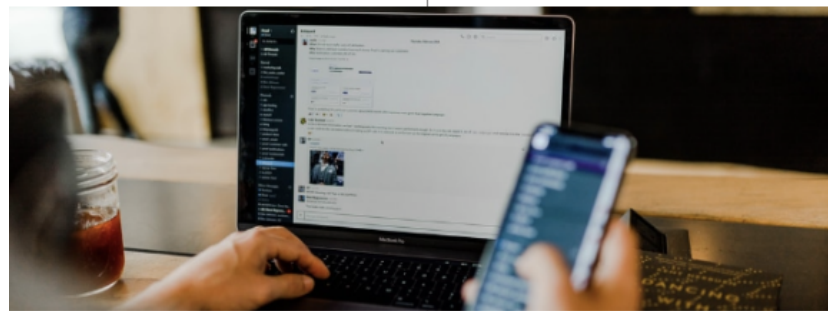
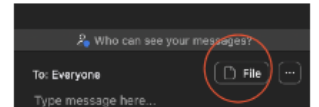
- share your screen
- open the working simulation
- mind the message from chat



Giver (R&A)

1. preparation

- prepare your material (picture and content)



2. mission

- work on your own task
- understand the information from R&A

You have an obligation to do your task for 2 minutes in total, you pause the clock and check the chat anytime.

Use the chat to communicate, you can maximum ask 2 Qs

Working simulation - interaction website.



3. explain

- explain what you've learned from R&A

4. evaluate



2. mission

- deliver the information for GDIA
- try to let them understand

You have to convey the result and insights from your research to R&A in each communication medium, and try to answer their question by chatting.

3. explain


- listen to what they share, evaluate the communication works or not


4. evaluate



Questionnaire

Communication Medium Test

 yoyotvmomotv@gmail.com (未分享) [切换帐户](#)



*必填

How's the information received?

In the "meeting with slides" session question 3 don't need to be answer

1. How do you think the information is delivered? *

012345

fractional

☐

☐

☐

☐

☐

☐

logical

2. To what degree you think you understand the content? (Do you still remain some questions?) *

012345

still vague (0%)

☐

☐

☐

☐

☐

☐

understand most of the thing (100%)

3. Do you find the content itself inspiring? *

012345

no (0%)

☐

☐

☐


☐


☐

☐

inspiring (100%)

Communication Medium Test

 yoyotvmomotv@gmail.com (未分享) [切换帐户](#)



*必填

How do you feel?

In the "meeting with slides" session question 3 don't need to be answer

1. How mentally demanding was it for you to catch up those information? *

012345

easy to absorb

☐

☐

☐

☐

☐

☐

hard to absorb

2. How insecure and discouraged feeling while communicating or receiving *

012345

very low (confident)

☐

☐

☐

☐

☐

☐

very high (insecure)

3. You have a strong eager to ask them directly (verbally) in the moment (don't need to fill in while doing the meeting session)

012345

not at all

☐

☐

☐

☐

☐

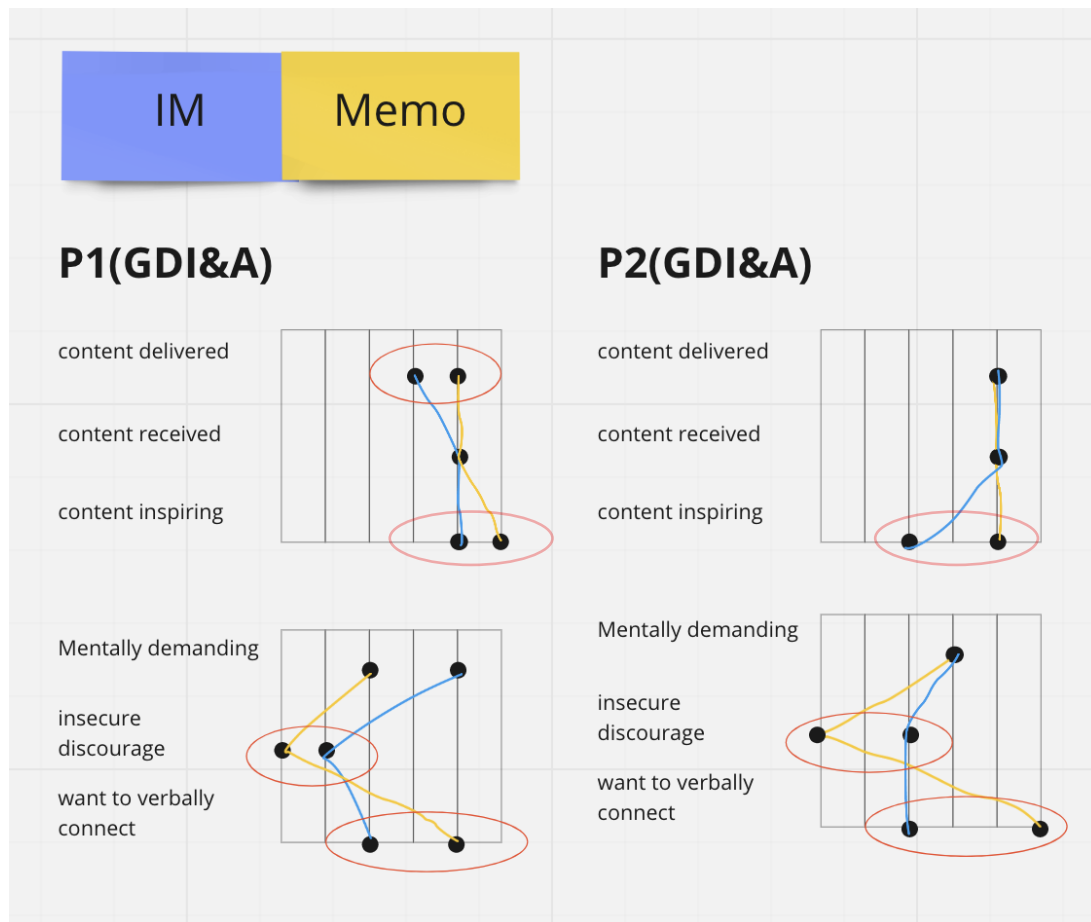
☐

very strong

Following the previous question, can you name why?

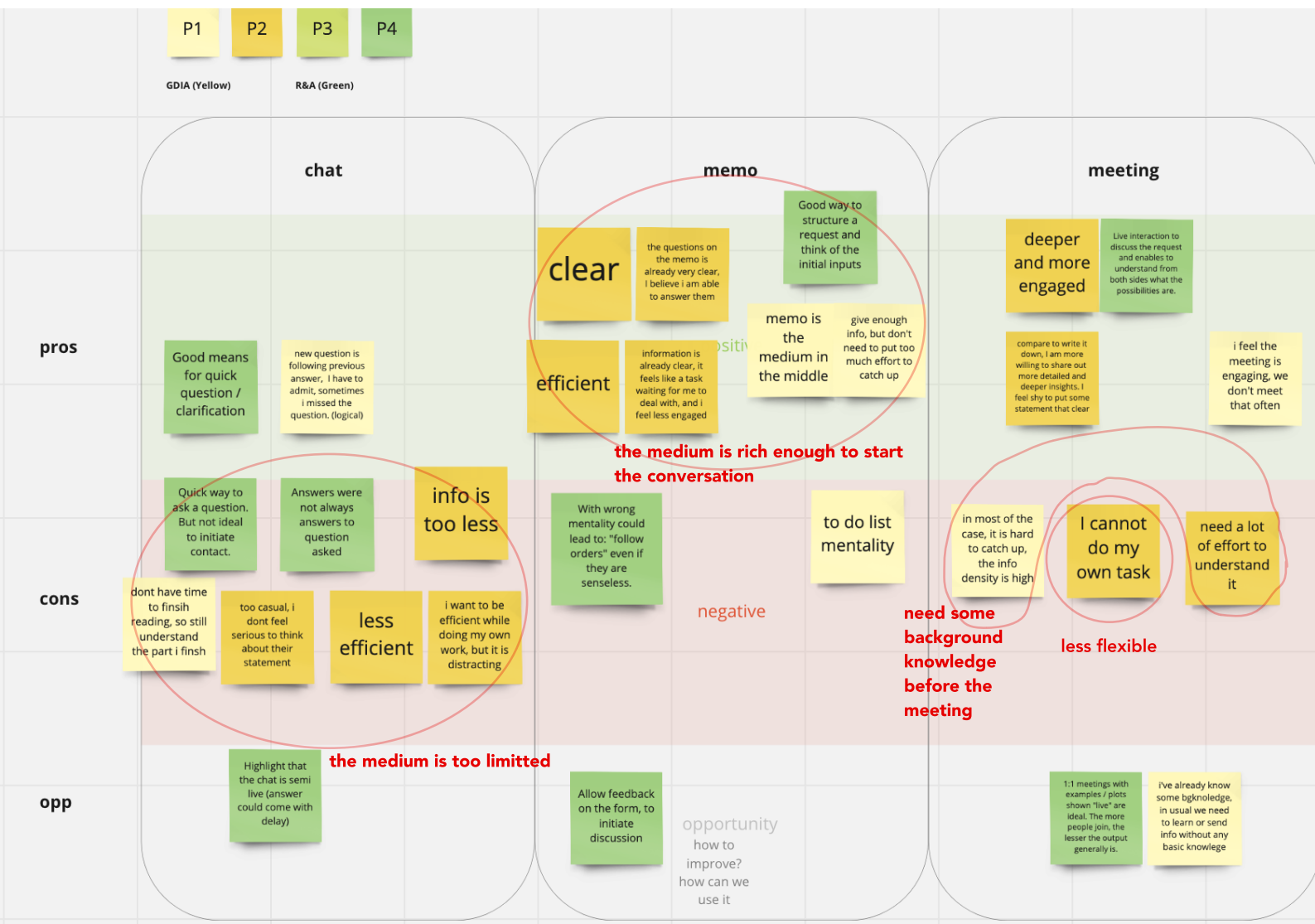
您的回答

Result of evaluation (questionnaire) :



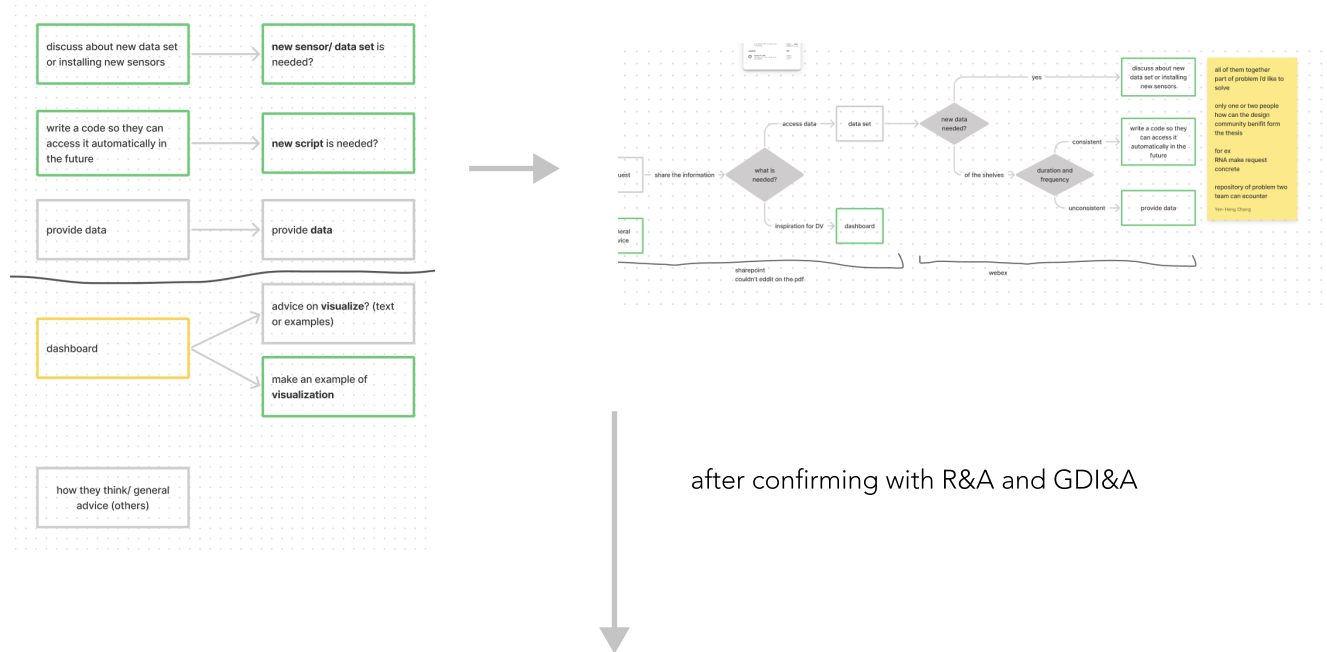
GDI&A find it more inspiring when communicate through memo, which makes them want to discuss with others to learn more detailed about it.

Quotes:

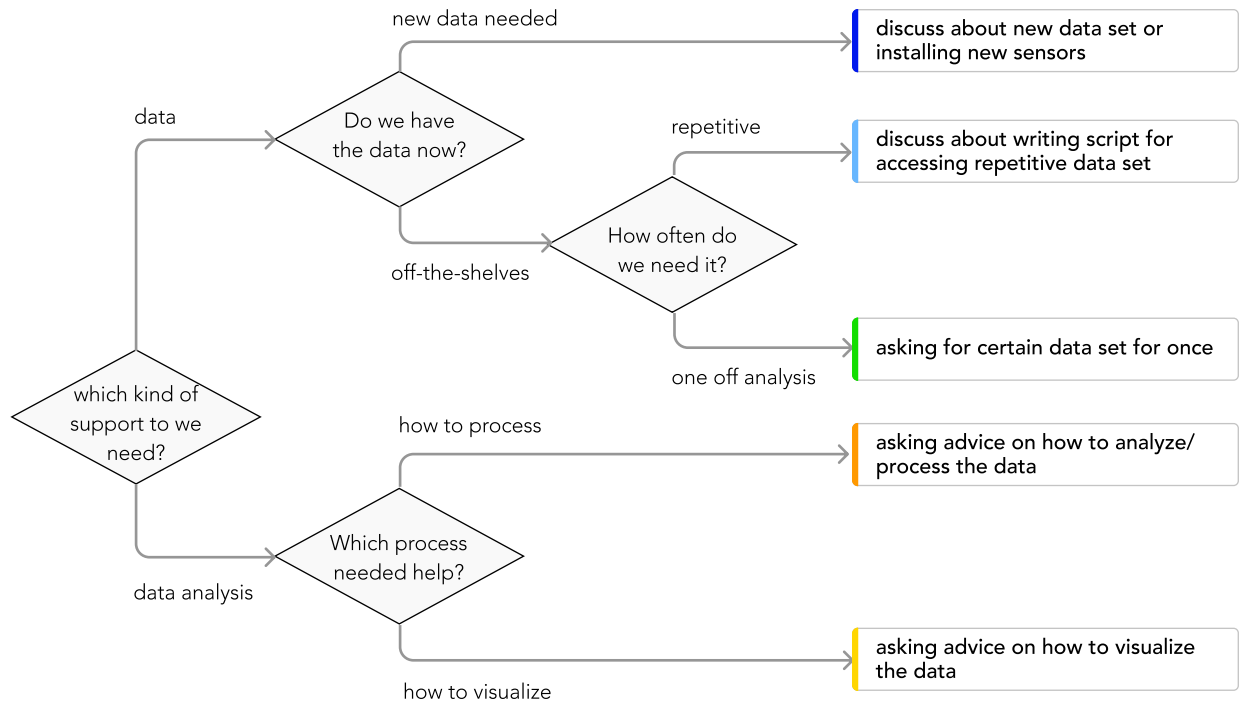


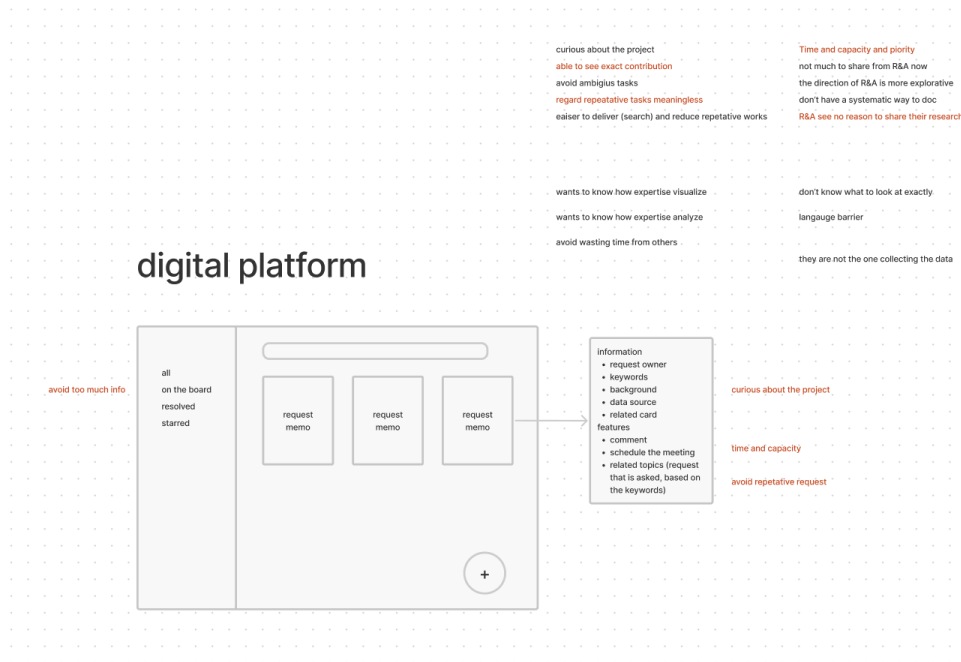
9.3 Evaluation 3

developing the decision tree of request types and the digital platform:



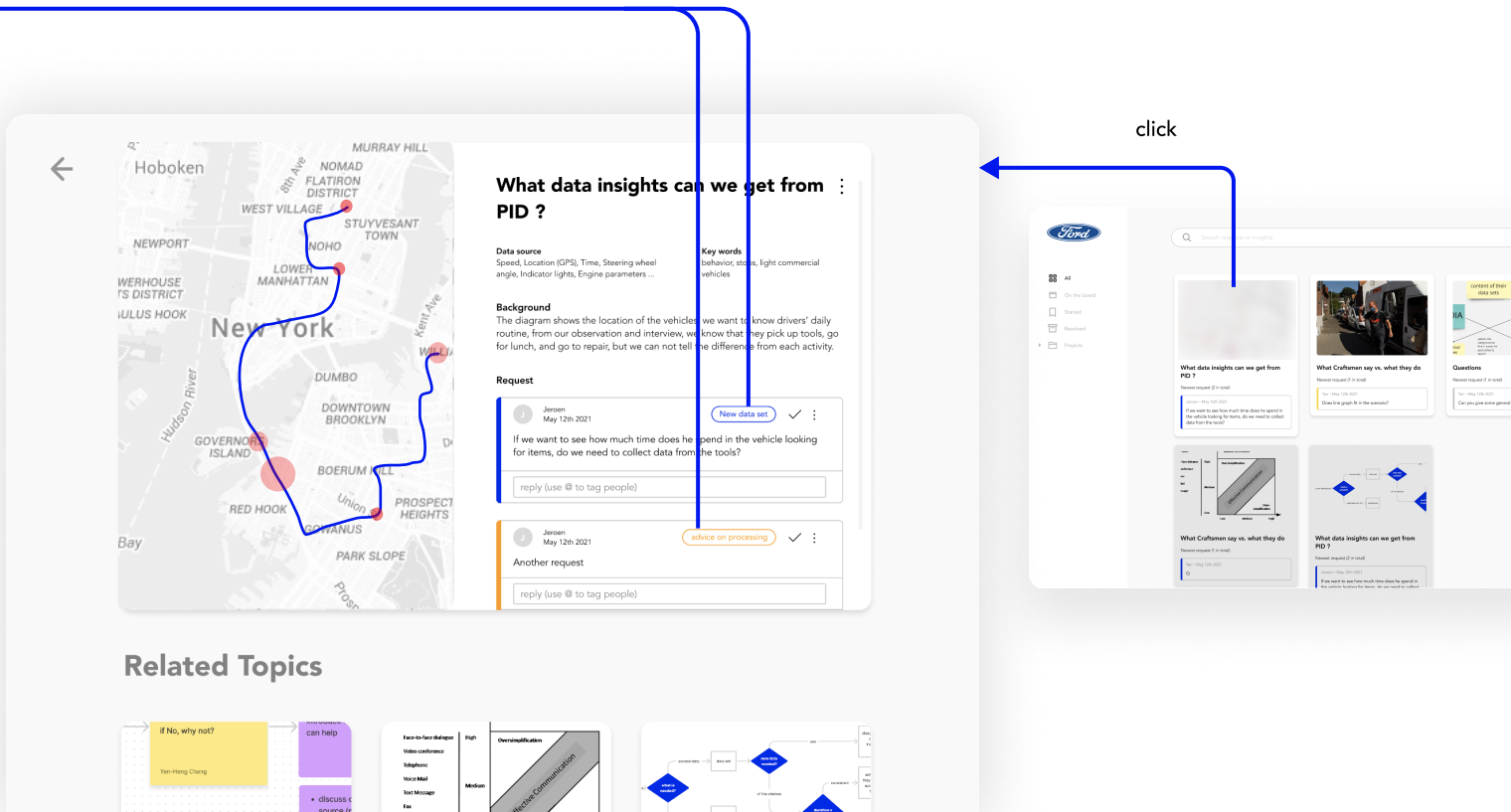
after confirming with R&A and GDI&A



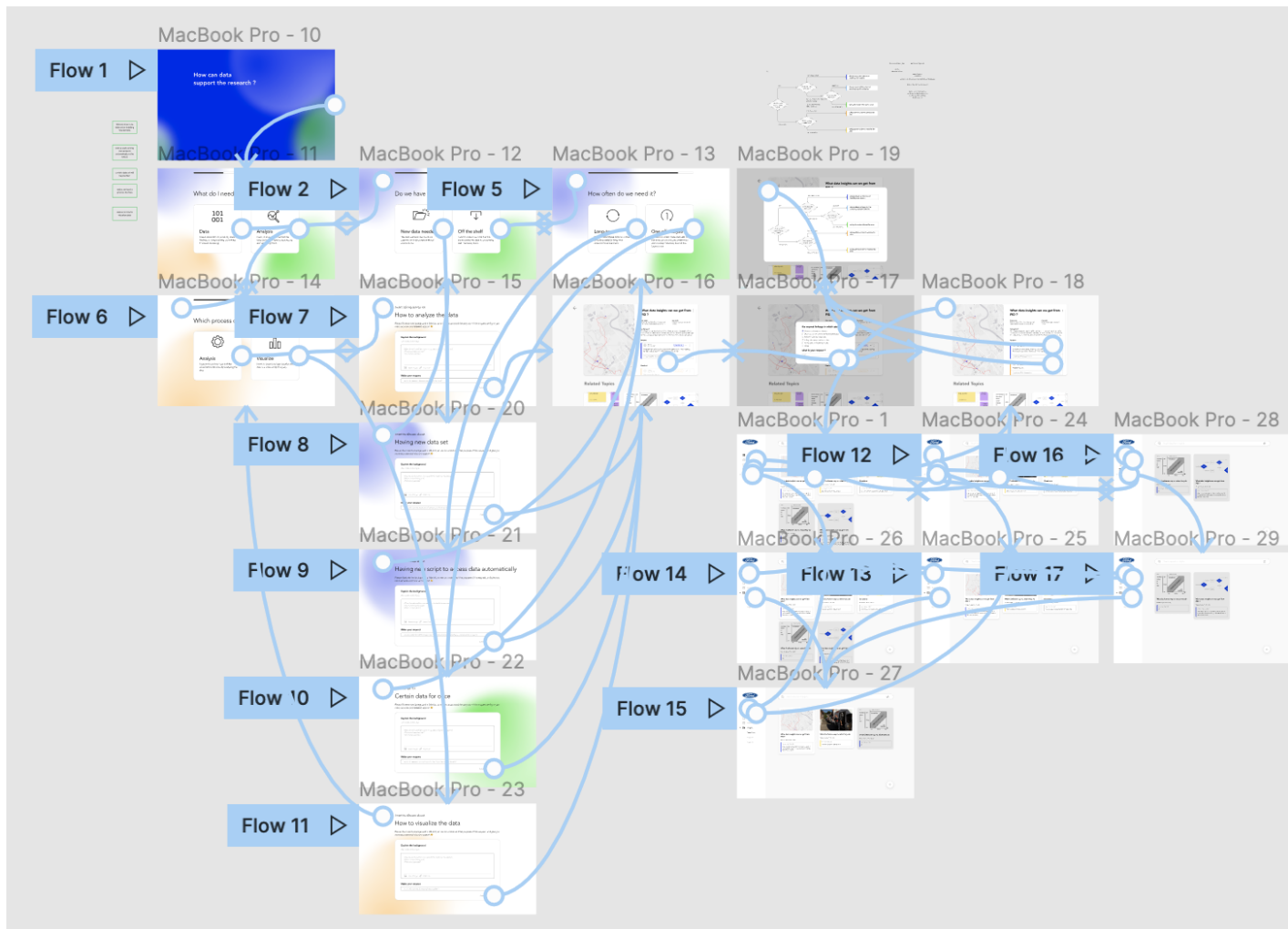


The digital platform is inspired by the Request memo from last evaluation. Therefore it includes elements that are from Request memo, including title, introduction, images, tags, keywords. Request types are newly added.

Request types



developing the digital platform prototype:



Digital platform prototype

<https://www.figma.com/proto/cMVlo5v9jTLC6keaBTgKUG/Untitled?node-id=1%3A2&starting-point-node-id=100%3A496&scaling=scale-down>

