Enabling Data Driven Innovation Capabilities: A Study of Indonesian Companies

Master Thesis

By

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Executive Summary

Data Driven innovation (DDI) is crucial for fostering innovation within companies. Businesses gather vast amounts of data daily, and when effectively utilized, this data can drive innovation, helping companies thrive in the market and increase profits. Innovations may involve modifying internal activities or developing new products for customers. Implementing DDI helps companies grasp current conditions and develop suitable ideas for the market which lead to generating profitable outcomes. In order to do that, companies need to provide suitable offers for consumers that align with their needs and market situation. To achieve this, the company's employees, who act as executors, must possess capabilities to perform Data Driven Innovation (DDI), for instance the ability to process data, extract insights from data, and effectively communicate the findings. Nevertheless, there are organizations that still have an inadequate understanding of DDI, regardless of its importance. Furthermore, companies that currently employ DDI are actively seeking solutions to improve their processes. This research entails a study of Indonesian companies. As one of the most populated countries with a huge market and potential consumers, it is intriguing to discuss the practice of DDI in Indonesia. Furthermore, this area is not well explored in the current study. Therefore, this research fills in the knowledge needed and explores the entire DDI process by examining data-related actions, identifying associated capabilities and barriers, and formulating a strategy for improvement. The main research question is:

What are the capabilities needed to develop and enhance data driven innovation within the company?

In this research, DDI is divided into two types: DDI Business Processes and Product. DDI Business Processes include initiatives developed through data analysis to create internal improvements, such as new business lines, application features, or distribution networks. DDI Products focuses on innovations derived from data analysis to deliver new products or services to customers. This study examines both technical and non-technical capabilities. Technical capabilities refer to proficiency with technology tools, while non-technical capabilities include analytical thinking, effective communication, and efficient project management.

Using a qualitative approach, data was collected through interviews with 15 practitioners with at least three years of experience in DDI projects across various industries: FMCG, e-commerce, mobile application transportation, financial services, manufacturing, and home improvement. The interviews were analyzed and coded using Atlas.ti software. Thematic analysis and explanation building approaches were employed to identify patterns and generate results from the data.

The results show that both DDI business processes and products involve similar actions: data collection, data pulling, data refining, data analysis, innovation approval, designing innovation, executing innovation, and evaluating innovation. Despite the data centric perception of DDI, the results show that, in general, non-technical capabilities are found to be more significant than technical capabilities in both DDI types. Each DDI action is equipped with a set of associated capabilities, which are also ranked in order of importance in the result table, making it easier to identify which area to focus on when executing each action. Running DDI also presents challenges, the results indicate that key issues arise in the actions of data collection, data pulling, data analysis, innovation design, and innovation execution. The challenges are mainly related to data and analysis, stakeholder management, communication, and technical aspects. To address the issues and improve the DDI process, developing proficiency in analytical thinking is essential for data collection and analysis, and prioritizing communication skills is crucial for designing and executing innovative ideas. For data pulling, proficiency in basic data processing tools benefits DDI business processes, while expertise in extracting data from databases is necessary for DDI product development. The strategy for both DDIs is to concentrate on enhancing capabilities in the highlighted actions and related skills through company training and recruitment. While the DDI Business Process also involved mentoring sessions. This research also revealed interesting findings related to how DDI actually runs in the companies. The implementation of on-the-job

training and knowledge-sharing sessions turns out to be one of the most common and effective methods for developing capabilities for employees. In addition, the role of leaders is also noticeable, and top management's involvement is crucial in granting project approval and setting strategic direction.

From a scientific perspective, this research enhances our understanding of the DDI topic and provides a detailed depiction of all the activities involved in the process. Furthermore, the study of Indonesian companies has not yet been included in the existing literature. Therefore, this research not only broadens the understanding of the DDI topic but also provides specifics for a more focused scope. In practice, the results provide companies with a clear understanding of areas where their current DDI processes need improvement. This research outlines actions that companies can use to develop and enhance their DDI processes. The result also identifies the necessary capabilities and ranks them according to their importance. Understanding the entire process is crucial for companies looking to develop DDI projects, ensuring their personnel have the required skills and the projects run as expected. The report also highlights key challenges and corresponding strategy to improve DDI. Additionally, the findings provide valuable insights into the intriguing aspects of building capabilities and leadership roles in DDI, enabling companies to fully understand the process.

In conclusion, this research provides a comprehensive analysis of the steps involved in the DDI process, highlighting their capabilities, issues, and strategies to improve. This makes it easier for the company to understand the DDI process and identify the key elements that need attention. The findings emphasize the significant role of non-technical capabilities in both DDIs, suggesting areas the company should prioritize. The strategies were developed to improve the existing DDI process by prioritizing analytical thinking for data collection and analysis, as well as communication proficiency for designing and executing innovation. For data pulling, DDI business processes benefit from basic data processing skills, while DDI product development requires competence in extracting data from databases. To implement the strategy, companies should implement company training, tighten the recruitment process, and, specifically, conduct mentoring sessions in the DDI business process.

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1. Introduction

Data Driven Innovation (DDI) is essential for companies to enhance their business. An example of data-driven innovation can be seen in Grab Indonesia's approach, a mobile application providing transportation services. They use their data to strategically adjust some pick-up points, ensuring specific locations where drivers and passengers can meet. As a result, passengers are limited to selecting recommended pick-up points suggested by the app, which helps prevent congestion in the area. This initiative, driven by Grab's understanding of consumer behavior through data analysis, demonstrates the company's ability to use collected data to create innovative solutions (Grab Indonesia, 2020). By implementing this new initiative, it becomes more convenient to identify the pick-up area, potentially leading to an increase in customer satisfaction. From the regulatory standpoint, this could enhance the company's reputation by taking into account its contributions to public spaces.

A vast amount of information is collected daily. Technology enables the efficient collection of data by encoding and digitally storing it, leading to the creation of valuable datasets. The data generated is a valuable resource that offers a multitude of insights that might be advantageous for companies. Some people said that businesses gather more data than they know what to do with it, hence new skills and a new management style needed to generate insights from the data (McAfee & Brynjolfsson, 2012). With the evolving role of data in companies and the advancements in technology, it is necessary for companies to constantly adapt and be responsive to the changing circumstances. From data gathered, companies need to develop creative ideas on how to use it to improve performance, compete in the market, and ultimately increase profits. This is where innovation plays a crucial role. Innovation with data as basis are getting more attention from industrial companies, in order to develop solutions for customer's current and future needs (Eriksson & Heikkilä, 2023). OECD defines innovation as the "implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations" (OECD, 2005). Jimenez-Jimenez and Raquel (2011) highlights the significance of innovation in keeping company on track to achieve improved financial result and continue adaptation, while also offering technological solutions to various social or environmental concerns. We can infer that innovation from data for companies is crucial in the business.

In order to generate ideas and foster the creation of innovative solutions, it is important to effectively handle and evaluate data. Companies must possess a comprehensive understanding of the components of the DDI process in order to efficiently oversee it. This can be accomplished by scrutinizing the activities encompassed in the full DDI process. Understanding the multiple pieces required to implement data driven innovation capabilities efficiently is beneficial for companies who are just starting out on the big data adoption and also those that are already down the road (Alghamdi & Agag, 2023). Furthermore, individuals engaged in these operations must possess the requisite expertise. Eriksson and Heikkilä (2023) mentioned to succeed in data driven innovation, companies need to emphasize the development of organizational capabilities. Capability refers to organization's capacity to deploy resources using organizational processes to achieve the expected purpose (Amit & Schoemaker, 1993). Therefore, capabilities are crucial for company to successfully develop innovations from data. The objective of this research is to determine the necessary capabilities needed for DDI process within company, and to analyze strategy for enhancing these areas in order to improve the current DDI process.

Research has been carried out in the field of data driven innovation and capabilities, using various approaches and areas of focus. Exploration from the perspective of specific product and product life cycles has been examined by Dremel et al. (2020) and Briard et al. (2023). This study provides a thorough comprehension of the qualities of the product and engages in specific product context. Furthermore, Mortati et al. (2023), Pham et al. (2022), Förster et al. (2022), and Visvizi et al. (2021) have conducted research on the integration of a human-centric approach. This approach is intriguing as it discusses the human context as the executor associated with data-related

activities. Other discussion regarding the use of data in business processes area, including operations and redefining business processes was conducted by Colombari et al. (2023) and Troisi et al. (2020). Their studies present data and business processes in a conceptual manner, with a primary focus on a broader strategic perspective. Pikkarainen et al. (2020) and Isabelle et al. (2020) provided a detailed explanation of the factors that lead to success and the importance of data in the analytical process. These investigations are advantageous for comprehending the general state of affairs within the company. The study conducted by Trabucchi et al. (2017) and Sultana et al. (2022) explores the role of data in fostering innovation through the analysis of secondary data discuss about the influence of user generated data and customer relate to strategy of innovation. This methodical procedure combines knowledge from several sources, such as published articles and company websites. Wulff and Finnestrand (2023) conducted a study that specifically examined the methods and applications of data collection and utilization in order to enhance data-driven business activities. Meanwhile, the perspective of organizational and marketing capabilities technical and non-technical of B2B business was explored by Eriksson and Heikkilä (2023). These specialist studies offer profound insights into specific topics, which is beneficial for gaining a comprehensive understanding of a specific area. The selection process and summary of literature review can be found in Appendix A.

Based on the reviewed articles, the activities in the whole DDI process and its associated capabilities have not been extensively investigated. Specific discussion about product or customer perspective is insightful as supporting data to build innovation. However, the perspective of company as the executor of data activities has not been extensively examined, despite its crucial importance in gaining a thorough grasp of this topic. While employee perspectives can provide valuable insights as the individuals responsible for carrying out actions, there is lack detailed and tangible information on the actual data actions and capabilities related with technical and non-technical aspects. Additionally, the macroscopic viewpoints offered by existing research do not fully encompass the pragmatic circumstances that highlight the technical and non-technical skills necessary for implementation. Furthermore, the exploration focus on specific activities and department skills is useful for understanding a certain area. However, it is important to note that DDI actions and capabilities extend beyond individual departments and encompass both technical and non-technical components. Thus, we can conclude that the area of study needing further examination is the comprehensive process of DDI activities and the associated technical and non-technical capabilities required to conduct them effectively. This is the area that will be addressed by this research.

This research has specified the scope of study by discussing specific area to be further explored, which is Indonesia. According to World Bank estimates, Indonesia is in top five of largest populations in 2022, indicating high consumption and large market. However, the Indonesian private sector is characterized by low productivity, limited innovative capacity, and weak global integration metrics (World Bank, 2018). In contrast, the public sector in Indonesia and other developing countries has seen rapid innovation advancements over the past decade, partly due to general democratization and decentralization efforts (Widodo et al., 2022). With a huge market and consumption in Indonesia, innovation plays an important role for companies to thrive in the market. This intriguing situation has triggered this research to discuss DDI by taking studies of Indonesia's companies and contributing to the theoretical and practice perspectives of DDI. Some Indonesian articles were also reviewed, where they had a different focus related to data driven innovation and capabilities. The existing articles discussed the context of VRIN resources (Purba et al., 2022), specific elaboration about data management capabilities (Kadarsah et al., 2023), motivation role in innovation capability (Hasanah et al., 2022), focus on the element of intellectual capital (Lianto, 2023), and management capability effect (Sularso et al., 2024). The lack of existing studies about what actually happened during the DDI process in Indonesian companies encourages this research to deep dive into this topic, where this is a beneficial element of the birth of innovation within companies.

When people think about DDI, the first thing that comes to mind is typically the technical data processing. DDI encompasses not only data processing, but also the utilization of data sets to develop valuable insights, implement them effectively, and ultimately increase company

profitability. In the articles reviewed, there are extensive research and discussion regarding the non-technical aspects of DDI. The extensive discussion of non-technical elements is both intriguing and indicative of their significant relevance. According to Wulf and Finnestrand (2023), data availability in businesses has become more accessible to everyone, but the need for collaborative information for action in certain enterprises has not been recognized. This is related with non-technical element within the DDI process, where it is more focused on the ability to communicate effectively and work together as a team. This non-technical aspect also showed in Halper and Stodder (2017) study that mentioned the problems in creating a data-driven organization are mainly non-technical, for instance whether to use data to take decisive action or whether data is trusted. It is crucial for the organization to comprehend this non-technical element in order to successfully adopt it and improve the current procedure. Nevertheless, it is impossible to dissociate DDI from the technical components, as the data is analyzed using technological tools. Another useful aspect of the research is that by thoroughly examining the elements of DDI, we can understand the factors that hampered the process and require attention. This is beneficial because it ensures that the process runs smoothly and prevents issues, leading to the development of an improvement strategy. Thus, the fundamental takeaway is the necessity for a comprehensive analysis of DDI processes and capabilities, encompassing both technical and non-technical aspects. Furthermore, examining the issues and interpreting the findings will lead to the development of a strategy for improving DDI. As a result, this study aims to conduct a thorough analysis of data utilization as a catalyst for generating innovative ideas in the company. The main research question is:

What are the capabilities needed to develop and enhance data driven innovation within the company?

The DDI cases are varies depending on the company objective. In this research, DDI is divided into Business Process and Product. Business process refers to the methods and procedures that a firm employs to effectively manage and operate the organization in order to achieve its business objectives. Meanwhile, a product is directly associated with the result of what is offers to customer. The capabilities section involves analyzing and identifying the component of skill in the DDI process. Eriksson and Heikkila (2023) mentioned that organizational capability for the area of data driven innovation is multidimensional. In this research, capabilities categorize into two, technical and non-technical. Technical capabilities include the ability to operate tools and engineering skills, as well as programming, software competency, and infrastructure skills. Non-technical capabilities, on the other hand, include skills that are not technical, such as proficiency in analytical and critical thinking, communication, and project management.

We have the context and main research question for this study. Furthermore, to address the primary research topic, it is necessary to follow a series of stages to develop a thorough analysis. Thus, the sub-research questions are:

1. *What actions are involved in data driven innovation of business process and/or product?*
   This inquiry seeks to elucidate the activities that occurred during the data-driven innovation.

2. *What technical and/or non-technical capabilities that are essential for companies to implement data driven innovation in business process or product?*
   The goal is to determine what capabilities are needed for organizations to pursue the development of data driven innovation, which aligns with the actions from the previous question

3. *What are the barriers encountered during the process of data driven innovation?*
   This question aims to study the issues that arise in the process of developing data-driven innovation

4. *What strategies that can be follow to improve Data Driven Innovation process within the company?*
   This question has purpose to formulating strategy aim to improve DDI process in the company, derived from the identification of actions, capabilities, and issues arise gathered from the preceding questions

   In summary, this research will delve deeper into the identification of activities and associated capabilities within the DDI process. Furthermore, an examination of the issues related to DDI will be conducted. Consolidating all the results, an improvement strategy will also be developed. The improvement strategy is formulated by systematically organizing and categorizing the data, linking capabilities to specific actions and issues, examining the issues and improvement suggestions, and also considering the method to build capabilities within companies. This research aims to provide actionable insights and strategies that companies can implement to optimize their data-driven innovation efforts.

2. Theoretical Framework

This chapter describes the theoretical approach of this study, including how numerous theories and concepts linked to data driven innovation and capabilities are integrated and used. The theories will serve as the basis for how DDI and capabilities are divided for this research. It explains the foundational theories that underpin this research and how these concepts are essential for developing it.

2.1 Data Driven Innovation in Company

The importance of innovation in keeping companies on track to achieve better business results and constant adaptation is highlighted by the research, which also serves to provide technological solutions to several social or environmental issues (Jimenez-Jimenez & Raquel, 2011). According to Von Hippel (1998), generally, companies engage in innovation because they expect to obtain economic benefits from the resulting innovation. Companies can achieve continuous improvement by generating innovative ideas and adopting new methodologies that align with the social and economic context in which they operate (Schirone & Torkan, 2012). This suggests that the primary purpose of innovation is to ensure business survival and profitability, achieved by generating new ideas that align with market trends. In this research, the focus is on using data to generate innovative ideas. Data and information are the fundamental aspects of innovative technologies in this digitalization context, as well as the drivers of new opportunities and collaborations between industrial companies and service suppliers (Moreno et al., 2021).

Companies collect data from their internal activities or external sources like public websites or data agencies, which provide insights into various business aspects, including macroeconomics, market trends, and competitors. Over the years, data utilization in the company has significantly improved. In the past, data might only have been considered a company asset. Today, it functions as a vital resource for ideas to improve organizational performance. In the past, firms depended on manual ways to acquire and analyze data, leading to restricted insights and longer decision-making processes (Rao, 2021). For example, market research used to be manually collected by directly approaching respondents. Currently, all tasks may be accomplished using digital means, such as completing surveys and conducting interviews using an online platform. In the present day, data is gathered in a digital format, and sophisticated tools are employed to analyze it. Various types of data were collected, including demographic, preference, household, and others. This data is further evaluated according to the study requirements, utilizing thematic analysis to identify patterns and establish general themes; employing semantic analysis to uncover deeper meanings of words depending on their context; and analyzing correlations between different variables. Digital software has been used to gather and examine data in practical terms. Certain software, like SPSS and Atlas.ti, can be utilized by the general public, while other companies, such as Nielsen and Kantar, create their own proprietary software for internal use. As a result, with the advancement of technology, organizations are able to quickly react to market changes and meet customer demands. To stay competitive, organizations must effectively use this data to create new projects, as all market participants are doing the same. Sorescu (2017) examines how organizations use internal and external data to create new business models, emphasizing the connection between big data and innovation in business models. Therefore, with technological advancements, companies must improve their internal data performance. This underscores the importance of enhancing data related activities within the company to foster innovation. The theories and knowledge about the necessity of data driven innovation are necessary to develop the research further.

In the company context, numerous functions involved in innovation hold potential for practical exploration. Published research has classified different types of innovation based on their subject matter. For example, Sousa et al. (2018) categorized innovation into product, process, managerial, and marketing in the context of green innovation, while Damanpour (1991) distinguished between administrative and technological innovation. The innovation classification based on

current research provides numerous perspectives, such as the study's context and the factors that influence innovation. In line with the research scope, we classify innovation based on a company's business relationship and its alignment with the general conditions across various industries. According to a study by Fabijan et al. (2017), a company's primary purpose can extend to achieving sustainable growth, promoting innovation, and improving operational efficiency to facilitate long-term success in the market. Hence, this research divides innovation based on how companies operate to achieve their purpose, which is closely related to how they do their internal activities and the products they offer to the market. This is also aligned with the types of innovation offered by the OECD (2005), which include process and product innovation.

From the theories above and adjusting them to this research, we can infer that Data Driven Innovation (DDI) can be defined as the process of generating initiatives by evaluating data in order to identify opportunities for development based on existing circumstances or future objectives. These efforts are targeted at achieving certain enhancements that are in line with the company's objectives. Data-driven innovation (DDI) is classified into business processes and product. Business process innovation entails the development of new or enhanced procedures within the organization that are based on comprehensive data analysis. The scope of innovation revolves around company functions such as marketing, production, and supply chain activities. This also includes associated components like tools, communication lines, and work procedures. The role of innovation in the business process area is important, especially in relation to the efficiency and effectiveness of activities conducted within the company. Innovations provide distinct advantages for firms, aiding in achieving competitive advantages and superior business performance, underscoring the importance of innovation in driving business success (Turulja & Bajgorić, 2016). Effective business processes enable companies to perform well internally, which impacts outcomes. Hence, doing a thorough analysis and examination of the DDI business process activities promotes enhancements in corporate operations, ultimately resulting in improved end outputs. Troisi et al. (2023) mentioned the concept of data-driven innovation within business models, which highlights the role of data management, from collection to integration and analysis, in driving continuous improvement through the synthesis of incremental and radical innovation. Therefore, we can infer that recognizing the activities related to data is regarded as a significant part of comprehending DDI Business Process.

Product innovation refers to the development of novel or enhanced goods or services that are distinct from what the company has previously introduced, which the idea for those new products came from data analysis. Product innovation can manifest as either goods or services, depending on the nature of the deliverables the business seeks to provide. Product innovation involves a complex process of technological advancement, responding to changing customer needs, adapting to shorter product life cycles, and facing increased global competition (Nurhayati, 2018). The complexity of product innovation encourages a deeper understanding of the elements involved in the process. To examine DDI Product, this research investigates activities related to the process, including interactions such as external customer research collaborations. By examining both DDI Business Process and Product, this research aims to offer a comprehensive understanding of how multi-industry companies can optimize their operations and deliver value to customers.

Within the data-driven innovation (DDI) process, data undergoes processing and conversion into specific ideas. Gaining a comprehensive understanding of the complete process of data, starting from its original gathering to its ultimate utilization, is of utmost importance. The goal of this study is to provide a comprehensive understanding of DDI, including its components, capabilities, challenges, and improvement strategies. Sultana and Kyriazis (2021) outline a closed-loop process for data-driven innovation, consisting of seven steps: Product Conceptualization, Data Acquisition, Refinement, Storage and Retrieval, Distribution, Presentation, and Market Feedback. Their study highlights how these steps are significantly influenced by customer feedback in a changing digital environment. Wulff and Finnestrand (2022) emphasize the importance of data gathering, use, and sharing for organizations to become data-driven. The Analytics Value Chain, as described by Stein (2012) and Foster (2016), explains how value is increased through big data processing, reporting, and analytics. Different viewpoints and aims have an impact on various

techniques of data activities, as evidenced in the existing research. From the theories, it can be concluded that there are different contexts and results that are beneficial to understanding DDI from many perspectives. Adjusting to the situation and context, this research intends to offer of holistic view of the entire DDI process aiming to provide a comprehensive understanding of data-related activities in DDI by examining its aspects and identifying each step in the process. It will offer a practical perspective and contribute a novel viewpoint to the area.

2.2 Capabilities for Data Driven Innovation

To effectively extract data and generate new ideas, companies must possess specific skills. These skills are distributed among personnel based on their roles and functions within the organization. As data utilization in companies evolves, it is crucial to identify the necessary capabilities for effective data extraction and use. Companies must possess sufficient capabilities to effectively utilize the potential of data. With the advancement of technology and the emergence of big data analytics, data has now become a critical strategic asset for companies (Visvizi et al., 2021). Organizations have recognized the immense value that data holds in driving business decisions, enhancing operational efficiency, and fostering innovation (Iliadis & Russo, 2016). Therefore, examining these capabilities and identifying areas for improvement is essential, and this research will address these aspects. Data Driven Innovation (DDI) cannot be accomplished by individuals alone due to its collaborative nature, necessitating a diverse set of skills. According to study by Froehlich & Bitencourt (2019), capability in data driven innovation focuses on the conversion of knowledge and ideas into novel products, processes, and systems, resulting in benefits for both the organization and its stakeholders. In addition, the concept of technical capability in the context of data driven innovation encompasses the organization's ability to develop and utilize advanced technological tools and platforms for data collection, analysis, and interpretation, enabling the extraction of valuable insights and the identification of opportunities for innovation (Dorr et al., 2018; Pérez & Lozada, 2021). Hence, this research focuses on investigating the utilization of data for extracting new ideas and analyzing the actions involved in the DDI process. Existing articles generate various capabilities associated with the company. For instance, Innovation Capability (Subramaniam & Youndt, 2005; Akman & Yılmaz, 2008), Data Management Capability (Labadie & Legner, 2023), Dynamic Capability (Winter, 2003; Khaligh et al., 2020), and Environmental Capability (Dangelico & Pontrandolfo, 2013). Existing articles discuss capabilities from various perspectives, such as explaining specific topics, company objectives, and market & environmental factors. This research, then, complements these articles by offering additional perspectives, focusing on both technical and non-technical capabilities in a more practical manner within the context. This research aims to provide comprehensive knowledge on DDI, which currently spans a wide range of areas and offers unique contributions to companies. In this research, the scope centers on data driven innovation in business processes and products, with a particular emphasis on the conversion of data, information, and ideas into innovative outcomes. Thus, our attention is directed towards the components of actions involved in DDI, encompassing both technical and non-technical capabilities that are necessary.

Lu & Cai (2023) define technical capability as revolving around skills, resources, and knowledge. This definition emphasizes the importance of having the necessary expertise and resources to drive technical advancements and innovation within the organization. Amidst the current digital landscape, where data has significant importance, it is essential to assess technical capability in order to comprehend practical applications in the actual world. The core of technological capabilities is the organization's capacity to leverage existing technologies and to develop or integrate new technologies to create value (Eriksson & Heikkila¨, 2023). As data is collected and processed using technology, skills in operating the tools are essential for extracting meaningful insights. Thus, this research aims to examine technical capabilities across all DDI actions.

Throughout the DDI process, activities extend beyond mere technical data tasks. The core focus is on producing novel ideas based on data insights. This creation of new ideas constitutes innovation within the company. Eriksson and Heikkila¨ (2023) mentioned that one of the major challenges in building DDIs is figuring out what can be done with all the data that is available and

defining what kind of data is needed to create value. Hence, a profound understanding of data is essential in the field of DDI. Furthermore, beyond data-related activities, companies consist of different functions governed by formal and informal regulations. The DDI process requires interactions and adherence to certain regulations, emphasizing the significance of non-technical skills. In the company context, non-technical capability encompasses a range of essential skills that are crucial for organizational success, such as situation awareness, decision-making, communication, teamwork, leadership, stress management, and coping with fatigue (Johnston et al., 2011). Non-technical capability can include managerial and organizational dimensions that extend beyond technical advancements, emphasizing the importance of skills related to effective management, leadership, and organizational processes (Shafik, 2024). Non-technical capabilities reflect real world practices and are integral to comprehensive understanding. Therefore, this research aims to examine non-technical capabilities in the DDI process in order to identify essential elements required for each action.

In the previous chapter, we discussed the importance of DDI in the company and highlighted a lack of extensive research on DDI activities and capabilities. This chapter delves into the theoretical aspects of the topic, providing essential principles that will serve as the basis for the next steps. This chapter demonstrates the fundamental theories of DDI in principle, which also guide adjustments to this research. As the result, we have divided DDI into Business Process and Product, also Capabilities into Technical and Non-technical. This serves as the basis for further development in this research, including the methods for data collection and analysis. In further sections, we will develop a method derived from the principal mentioned in this chapter.

3. Research Method

We have discussed the scope of this research, and the theories provide the foundation for its development. This chapter describes the methodology used in this study, including the types of data collected and the data collection techniques. The method is determined based on the research objectives and theories, adapting to the situation while remaining technically agile in the real world. This chapter also describes the procedures used to analyze the data in order to produce the results.

3.1 Research Design and Method

The manifestation of Data Driven Innovation (DDI) within organizations can be described as a phenomenon. To further explore and dig into this phenomenon, this research employed a qualitative approach. This research, based on the theoretical foundation mentioned in the previous chapter, focused on the state of DDI in Business Process and Product, as well as the Technical and Non-technical capabilities that revolve around DDI. This research investigates DDI in various industries, using multiple Indonesian companies as case studies. We employed the approach of case studies to gain a realistic picture of the DDI within companies, aiming to produce a result that not only provides scientific knowledge but also facilitates practical implementation. The exploration method was used to examine and evaluate DDI processes, capabilities, barriers, and improvement strategies. To gain a deeper understanding using a qualitative approach, we collected data by conducting interviews with practitioners who have experience working on DDI. These sectors include e-commerce, technology companies (mobile app transportation services), manufacturing, financial services, FMCG (fast moving consumer goods), communication, and the home improvement industry. These companies are engaged in active competition in the market and consistently generate new ideas. Therefore, this is relevant to the DDI process, which we aim to analyze in our research.

The data for this research was acquired through interviews utilizing semi structured approach. The semi-structured approach was selected to delve deeper into the issue and discover novel insights without being constrained by a certain set of questions. Due to distance constraints, the interview was conducted via an online platform. The participants in this interview were practitioners who work in Indonesian companies, have expertise working in data-driven innovation projects, and have worked in reputable companies in major fields. Furthermore, the respondents include those who possess a minimum of 3 years of experience in the sector. The employee's extensive years of expertise make them capable of managing multiple projects and familiar with DDI.

The respondents selected for this research are individuals who work in varied company sectors, with the aim of exploring a wide variety of data driven innovation. Among the respondents, there are individuals holding job positions such as key account managers, product managers, supply chain lead, marketing strategic, and so on. This position has different scope and exposure to data driven innovation project. Key account managers in the FMCG industry collaborate with internal and external stakeholders, including suppliers and e-commerce businesses. They examine sales data for products and devise strategies to increase brand sales by implementing campaigns or introducing new product features. Meanwhile, Product Manager of a digital company is accountable for the creation of new features in cooperation with several departments. They examine data with indicators such as click-through rates of features, in order to understand customer interest and stimulate innovation for enhancing performance. Other respondents are part of the production and supply chain team at a manufacturing company. They are involved in the company's internal operations, working behind the scenes to ensure that the company's deliverables are produced efficiently and delivered to the intended customers. In addition, various roles such as business development, marketing, logistics, and strategists offer unique perspectives on the DDI project within their respective domains. This improves outcomes and provides a sense of generalization about the DDI process across all sectors of companies.

The industries in which the respondents work are currently the hyped businesses in Indonesia. The e-commerce industry in Indonesia is now seeing a surge in popularity and continues to thrive in a highly competitive market. Furthermore, the Tech Company operating in the Mobile Application industry is highly favored by consumers due to its significant contribution to transportation and logistics activities. Furthermore, industries such as FMCG, Telecommunication, and Manufacture are actively conducting their commercial operations, as they are responsible for producing essential goods and services for the population. Therefore, the company industry represents areas that are actively circulating in the Indonesian market and continue to demonstrate promise for business growth in the next few years. To provide further information, Table 1 presents an overview of the respondents that participated in this research.

Table 1 Overview of Respondents

Pseudonym	Industry	Job Position
Amethyst	FMCG	Key Account Manager
Beryl	Manufacture	Supply Chain
Citrine	E-commerce	Product Manager
Garnet	E-commerce	Business Development
Garnet	E-commerce	Project
Jade	Telecommunication	Finance
Morganite	Financial Service	Marketing Analytics
Opal	E-commerce	Business Development
Quartz	FMCG	Marketing
Ruby	Home Improvement	Business Development
Sapphire	Financial Service	Business Development
Spinel	Technology (Mobile Application)	Logistics
Topaz	FMCG	Key Account Manager
Tourmaline	Manufacture	Production
Zircon	Technology (Mobile Application)	Commercial

3.2 Data Collection

For data collection, respondents were selected from various roles in the company context examined in this study, reflecting the extensive use of data-driven innovation. Interviews were used as the primary data sources for this study. A total of 15 participants participated in this investigation. The interview was conducted virtually, employing a semi-structured method. Each interview had a duration of roughly 45–60 minutes, with the questions centering on the participants' encounters with data-driven innovation. The questions are about their involvement in DDI and the associated components, as well as the challenges and recommendations for improving the current DDI. The semi-structured method was chosen because it can be more flexible during the interview and accommodate the result of a comprehensive analysis of DDI's actual circumstances. The data collected consists of demographic information, including the job position and company industry of the respondents, as well as professional data on their experience in DDI projects. Additionally, the data includes perception and evaluation data on the respondents' opinions towards the DDI projects they have conducted. This is to achieve the research goal of providing a thorough and subtle understanding of the DDI procedure, including the various elements that influence its execution and results.

Companies are looking for new ways to use data and analytics to inform their decision-making, improve organizational processes, or create new methodologies to resolve challenges and create customer value (Brynjolfsson et al., 2011). Each DDI project may have a distinct function,

depending on its scope and requirements. Hence, it is vital to comprehend the fundamental aspects of the DDI project as stated by the respondent during the interview. Therefore, the interview began by asking questions about the context, then delving into further details. The first stage of the interview involved asking about the respondents' work experience and job tasks related to DDI. This was done to gain a deeper understanding of the topics that would be discussed later on. Because of the respondents' varying positions and industries, there may be variations in the terminology used to convey the same notion. Within the company setting, each individual possesses distinct approaches to managing various aspects of the organization. Utoyo (2019) highlights how the companies recognize their distinct opportunities and challenges; hence, they must effectively coordinate internal resources and competencies to foster innovation. Given the various conditions faced by the company during the interview, it is critical to inquire about the background in order to understand the context of the conversation. Next, it is necessary to assess their understanding within the framework of data and innovation. The interview aims to further understand the role of data within their profession and the way data is utilized in DDI project. Communication wise, those initial questions are used as the bridging to talk further about DDI projects. Furthermore, the aim is to fully comprehend the context of DDI, as mentioned by the respondents.

Moving forward, the questions examine the DDI process in depth by obtaining more specific information on the actions taken during the process. The questions aim to prompt further elaboration on the specific details of each action, the activities involved, and the individuals participating in each activity. Erikkson and Heikkala (2023) emphasized the significance of doing context-specific analysis and highlighted the fact that capabilities vary across different contexts. We already understood the context from previous questions, the next step is to examine the actions taken during the DDI process. This is to provide more detailed insights for further analysis of patterns and generalization of actions across industries. Verifying certain terms discussed during the interview is necessary to ensure mutual understanding, as respondents may occasionally explain using their own internal terminology. For example, certain participants said that they engage with the Business Intelligence team to extract data, while others simply stated that they request data from the Data Analytics team. Meanwhile, both teams have the same purpose to pull the data from the database. In this scenario, the interviewer needs to confirm with the respondent the task and scope of the relevant team, as well as their participation in the DDI process.

During the interview, the question prompted respondents to provide a detailed explanation of the action involved in the DDI process. Respondents may offer a variety of responses in their explanation, either explicitly or implicitly. They may provide examples to clarify their statement. For instance, respondents highlighted that the data they receive is in raw format and must be manually inputted into the company's dashboard for additional analysis. This suggests that the data must be organized and tidied up to ensure uniform formatting before it can be included in the internal dashboard. This implies that a process of data refining is necessary. This type of response needs to be checked to ensure the inclusion of detailed data processing actions. Moreover, in order to ensure that all respondents have a uniform understanding of the topic, it is necessary to provide examples that will aid them in answering the question as expected. The example does not intend to guide people towards a certain response but rather serves as a broad sample to explain the significance of issues. For example, when asking about the process involved in DDI, the question could be, "How was the information obtained?" or "What actions were taken with the collected information?". This could lead them to explain more about the specifics of the action involved in the DDI process.

When giving the answers, respondents may disclose multiple pieces of information, some of which may contain implicit messages. For example, while presenting their data analysis process, they may inadvertently disclose the difficulties encountered in that particular case. These are the factors that should be noted, as they are essential components for analyzing and developing an improvement approach. Furthermore, it is essential to focus on the interview guidelines and address the key elements of the questions. However, interviewers should be responsive and involved in the conversation rather than rigorously following the guidelines. Active engagement

in the interview can enable respondents to feel more comfortable sharing information, which leads to more useful insights.

The following questions are about capabilities, challenges, and areas for improvement. These topics may be indirectly mentioned when respondents discuss DDI's actions. However, in certain situations where there is insufficient explanation, the interviewer also needs to explicitly inquire about it. The elements of capability, issues, and improvement are components of the actions that responders may have already described. The experience can be exhausting and unpleasant if the questions are overly formal and appear to be repetitive in nature. The interviewer should be more involved, so that the respondent senses the interviewer's passion and curiosity and is encouraged to disclose more information. For instance, when inquiring about the challenge in DDI, the question could be more specific, such as: "What is the duration of the entire process?" or "How do you convey the results to the relevant stakeholders?". By asking such questions, they may be compelled to provide additional information regarding the project's timeline and the reasons for its expedited or delayed progress, and they may elaborate on the necessity of obtaining approval from the department head prior to implementation. Ultimately, the drafting of guidelines is important, but ensuring effective implementation, active participation, and deep engagement with respondents is essential for obtaining thorough information. Additional information and further details about the interview guidelines can be found in Appendix B.

3.3 Data Analysis

Following the collection of data from the interview, the transcription of the interview results was processed and analyzed using Atlas.ti, a software specifically designed for qualitative data analysis. The transcriptions were coded and classified according to the identified components of the DDI process indicated by the participants. Coding was utilized to examine the actions associated with the entire DDI process. This required identifying the answer and determining the pattern in order to draw a conclusion. This was analyzed by determining the most commonly reported answers by respondents, then grouping similar patterns into the same category. In general, thematic analysis was used to locate patterns in the data sets and identify common themes that could be used to make generalizations in the coding process.

The initial aspect to investigate is the DDI types reported by each respondent. This research classifies DDI into two types: DDI Business Process and DDI Product. The determination of DDI types is based on the innovative projects. DDI Business Process is the output of data analysis that directly impacts the company's activities, such as the creation of new business lines, the modification of work procedures, or the improvement of existing activities. DDI Product refers to the end result of data analysis, which is the creation of a new product that offers something new to the customer.

After the classification of DDI has been decided, the next analysis is focused on the purpose of data and innovation, aiming to gain a comprehensive understanding of the context discussed by each respondent. This helps to lead the code in a more systematic manner and anchors the analysis to the context for future discussions. Generalization was employed for this code. The specified purpose is simply to assist with analysis and formulating strategy, there is no need to overgeneralize the findings of this part.

The major coding revolves around DDI actions, which are then divided into several parts based on the identified actions. In order to uncover common points and generalize actions and capabilities, thematic analysis was conducted on the data sets to detect patterns. Given that respondents may provide lengthy narratives as answers, it is crucial to meticulously and attentively identify the answers, particularly by paying close attention to implicit statements that convey underlying messages. Furthermore, respondents may provide additional information about each process, such as the specific software or tools used for data extraction or the components involved in data analysis. These points provide valuable insights into the result, particularly when formulating the strategy. It is critical to pay close attention while analyzing respondents' answers in order to acquire a full picture and identify specific DDI actions. The table below shows an example of how to identify the activities and which elements should be inspected

when putting in the code. The underlined words are used to identify respondents' responses and categorize them.

Transcription	Code
<u>The data were collected automatically once customer use our application</u>. The data collected related with the order, which covers customer orders detail and merchant who provide the products. <u>Additional data collected from market research by conduct interview</u> with the partners regarding their satisfaction and feedback towards our service.	DDI Product – Data Collection
We <u>get the data using internal dashboard</u> to see our product performance in sales, area contributions, and growth. Then we also <u>use external data from government official data</u> for GDP and census in the specific area.	DDI Business Process – Data Pulling
The data conveyed from several sources, data agencies and internal. Each data source has different format and units. Therefore, <u>the data needs to be converted and tidy up before we do analysis</u>	DDI Product – Data Refining
We want to <u>expand our business</u> to online platform which presented new opportunity. To develop this business expansion, we needed to <u>analyze data to sense whether the platform works and how much revenue could be achieved, as well as the customer type</u> on that platform. We <u>negotiate with potential partners and sharing data regarding category in the market and our brand performance.</u> Many departments involved in this process: <u>finance team calculated profitability, brand team channel differentiation, and supply chain team discussed warehouse setups</u>. These discussions were held before making any decisions	DDI Business Process – Data Analysis
There is trial before we implemented new production line. Once we choose the alternative to be implemented, we will procure additional machinery and other items needed. Then <u>the machines will be set up, and they need to be tested</u>. Other things that need to be <u>tested include manpower, training manpower, and conducting production trials step by step until the desired the product achieved the expected quality.</u>	DDI Business Process – Design Innovation
Once the merchant deal with our offer and payment has been made, <u>we will do the execution</u> which also involves the marketing team to <u>run the campaign</u>. The marketing team has accessibility to <u>raise the campaign and make it happen</u> because they have live access to the app	DDI Business Process – Execute Innovation
To <u>monitor</u> our new programs, the dashboard was created. <u>Dashboard used to monitor</u> performance in daily basis and <u>team weekly meeting to discuss short term issues and action points needed.</u> <u>Bigger evaluation</u> held in quarterly meeting with higher level management.	DDI Product – Evaluation

To effectively present the overall outcome, it is necessary to display the actions of DDI in a clear and comprehensible format. Visualization in the form of a table or diagram could be used, and an explanation in the form of a narrative may also be required.

After discovering all the DDI actions and identifying other notable points, the next step is to evaluate the capabilities of both DDIs. The capabilities were determined by identifying the most prevalent responses from the respondents, as well as by conducting thematic analysis. However, it is necessary to conduct additional scrutiny of this matter as respondents may not always provide precise answers, therefore requiring further analysis of their responses. Examining actions and capabilities can be challenging because respondents may answer using their own internal terminology and comprehension. During the coding phase, this will be recognized, making it simple to detect the pattern and employ more generalized code that can represent the phrases. We may repeat this generalization process until we find the appropriate pattern and code that accurately reflects the action and its capabilities. When engaging in code generalization or detailing, we shall revisit the study objectives and the scope of the project. Given our focus on actions and capabilities, we assessed the generalization based on the extent to which the activity affected the DDI process and how it differed from practical viewpoints. The explanation-building technique was employed to conduct a thorough study of the relationship between capabilities and corresponding actions.

Up until this stage, the primary outcome is the identification of actions and capabilities in both DDI Business Process and Product. These are the essential findings that need to be analyzed before going to the next analysis, which is to develop strategy for improvement. Hence, it may be necessary to thoroughly review and verify the coding, generalization, as well as the correlation between actions and capabilities.

In the next analysis, we will utilize the same approach to identify other elements in DDI, including the issues, suggestions on improvement, and how to build capabilities within the companies. The applied approach involves determining the most commonly reported factors by respondents. However, when it comes to these topics, respondents may provide more broad responses that do not specifically emphasize the activities in question. Consequently, in addition to doing thematic analysis and making generalizations based on the coding, a more in-depth technique of explanation building was employed. This meant carefully looking for and studying patterns to find links between ideas from the parts of DDI that had already been looked at: the purpose of data and innovation, DDI's actions and capabilities, as well as the problems that had been found and suggestions for how to make them better. The final analysis deliverable is formulating a strategy to improve DDI Business Process and Product, developed based on the outcomes derived from prior analysis. The proposed strategy aims to improve the DDI process by emphasizing specific actions and capabilities that align with the scope of this research, resulting in focused and precise areas for improvement.

In this chapter, we have structured the methodology thoroughly, starting with data collection and how to run data analysis. The next chapter will elaborate on the results of this research once we have collected the data and conducted an analysis of the interview transcription.

4. Data Driven Innovation Actions and Capabilities

This chapter presents in-depth analysis of the interview findings of Data Driven Innovation (DDI) Business Process and Products in Indonesian companies. The result shows the actions involved in both DDI, deep dive into capabilities revolve around each action and the rank of capabilities importance, also the identification of issues. This result then interpreted to crate strategy on how to improve DDI process

4.1 Result Overview
There are 15 respondents participated in the interview. They are practitioner who has experience in DDI projects, and the respondents has diverse background in job position and company industry. The result was examined by analyzing interview transcriptions and coding based on the classification and generalization. The result classified DDI into two types, DDI Business Process and DDI Product:

- Data Driven Innovation – Business Process (9 out of 16 respondents)
  Innovation in Business Process involves various activities carried out by different respondents. These activities include the creation of new distribution network by Respondent 2, the expansion of business through the creation of channel development by Respondent 5, 10, 11, and 13, the initiative related with company operational flow and production by Respondent 6 and 14, and the formulation of an effective internal partnership process by Respondent 12 and 15.
- Data Driven Innovation – Product (7 out of 16 respondents)
  Product innovation is revolved around to the creation of new product (goods), which is carried out by Respondent 1 and 9. It also involves the development of new services for customers, which is done by Respondent 3, 7, and 12. Then, it is also includes the offering of partnership proposals, which is done by Respondent 4 and 8.

For each of DDI, deeper identification of actions was performed. This is done by analyzing the pattern and most common mentioned by respondents. The result shows:

Table 3 DDI Business Process - Action Code Recap

Actions Code in DDI Business Process	Mentioned	Respondent Number
Data Collection	9 out of 9	2,5,6,10,11,12,13,14,15
Data Pulling	9 out of 9	2,5,6,10,11,12,13,14,15
Data Refining	6 out of 9	5,6,10,11,13,15
Data Analysis	9 out of 9	2,5,6,10,11,12,13,14,15
Approval Innovation	8 out of 9	2,5,6,11,12,13,14,15
Designing Innovation	9 out of 9	2,5,6,10,11,12,13,14,15
Execution Innovation	8 out of 9	2,5,6,11,12,13,14,15
Evaluate Innovation	8 out of 9	2,5,6,11,12,13,14,15

Table 4 DDI Product - Action Code Recap

Actions Code in DDI Product	Mentioned	Respondent Number
Data Collection	7 out of 7	1,3,4,7,8,9,12
Data Pulling	7 out of 7	1,3,4,7,8,9,12
Data Refining	7 out of 7	1,3,4,7,8,9,12

Data Analysis	7 out of 7	1,3,4,7,8,9,12
Approval Innovation	4 out of 7	3,4,8,9
Designing Innovation	7 out of 7	1,3,4,7,8,9,12
Execution Innovation	7 out of 7	1,3,4,7,8,9,12
Evaluate Innovation	7 out of 7	1,3,4,7,8,9,12

For each action, there are associated capabilities identified. The capabilities examined by looking at the most mentioned capabilities and how many times it is mentioned by respondents. The capabilities mentioned by respondents are usually in the more operational manner which also include their internal terms, hence the identification of capabilities needed to be generalized so it could represent the whole set mentioned by respondents. Capabilities identified divided into technical and non-technical. Table 5 shows the response of respondents and how it is generalized to the capabilities.

Table 5 DDI Capabilities Code

Response	Type	Capabilities
Competency in Microsoft Excel, Power Point, Visual Basic, Tableau	Capabilities Technical	Proficiency in using basic data processing and visualization tools
Fluency in SQL programming for extracting database	Capabilities Technical	Competency in extracting data from databases
Ability of do coding and programming skill with the purpose to build new feature, execute campaign, create dashboard	Capabilities Technical	Advance proficiency in software development tools
Fluency in using and operating company dashboard such as Power BI and SAP, internal company dashboard	Capabilities Technical	Fluency in using basic company dashboard
Skillful and familiar in using external software such as data agency software or partner's dashboard	Capabilities Technical	Proficiency in operating external data dashboard
Ability of programming language for simulation and modelling purpose, such as python	Capabilities Technical	Skilful in utilizing modelling and simulation tools
Skillful to do document management digitally, such as google docs and google sheets	Capabilities Technical	Competent in managing documents related to circulated data
Ability to demonstrate analytical skill, such as understanding the significance and identifying the data needed, reading the pattern, do forecasting or estimating data as the basis of decision making	Capabilities Non-Technical	Skilful in understanding data purpose and identifying necessary data types, sense of estimating and forecasting, recognizing data patterns, and facilitating decision-making processes
Have critical thinking mindset, able to observe the situation and identify problem, generate insights from set of data, can give perspectives from different angles, and thinking out of the box	Capabilities Non-Technical	Competence in identifying problems, developing various insights, considering numerous perspectives, and thinking innovatively

Shows a professional attitude and personal attribute, diligence, resilient and have motivation, has initiative and independent, want to learn new things and go extra mile, has leadership attitude for individual and team	Capabilities Non-Technical	Demonstrated self-motivation, initiative, and leadership qualities
Skilful in interpersonal skills, persuade and negotiate, presentation and communicate the findings and sells the product, and interaction in teamwork, gain information from external	Capabilities Non-Technical	Fluent in interpersonal communication, negotiation, presentation, and teamwork
Able to manage related stakeholder expectation, accommodate different interest, maintain relationships with stakeholders	Capabilities Non-Technical	Competence in managing relationships and interactions with stakeholders
Fluency in managing project in daily basis monitoring and updates, running the project	Capabilities Non-Technical	Proficient in managing projects throughout all stages, from planning to execution

This relation of capabilities and actions was identified by analyzing the most mentioned of response related with it when respondents explaining their DDI activities. Table 6 to 9 shows the identification of capabilities associated with each action:

Table 6 DDI Business Process - Recap of Actions and Capabilities Technical

Capabilities Technical in DDI Business Process	Mentioned in Actions							
	Data Collection	Data Pulling	Data Refining	Data Analysis	Approval Innovation	Design Innovation	Execution Innovation	Evaluate Innovation
Proficiency in using basic data processing and visualization tools	4 out of 9	5 out of 9	6 out of 9	7 out of 9	0 out of 9	4 out of 9	1 out of 9	5 out of 9
Competency in extracting data from databases	0 out of 9	4 out of 9	0 out of 9	0 out of 9	0 out of 9	0 out of 9	0 out of 9	0 out of 9
Advance proficiency in software development tools	0 out of 9	0 out of 9	0 out of 9	0 out of 9	0 out of 9	0 out of 9	3 out of 9	0 out of 9
Fluency in using basic company dashboard	1 out of 9	4 out of 9	1 out of 9	1 out of 9	0 out of 9	0 out of 9	0 out of 9	4 out of 9
Proficiency in operating external data dashboard	0 out of 9	1 out of 9	0 out of 9	0 out of 9	0 out of 9	0 out of 9	0 out of 9	1 out of 9
Skilful in utilizing modelling and simulation tools	0 out of 9	0 out of 9	0 out of 9	0 out of 9	0 out of 9	2 out of 9	0 out of 9	0 out of 9
Competent in managing documents related to circulated data	1 out of 9	3 out of 9	1 out of 9	1 out of 9	0 out of 9	0 out of 9	0 out of 9	1 out of 9

Table 7 DDI Business Process - Recap of Actions and Capabilities Non-technical

Capabilities Non - technical in DDI Business Process	Mentioned in Actions							
	Data Collection	Data Pulling	Data Refining	Data Analysis	Approval Innovation	Design Innovation	Execution Innovation	Evaluate Innovation
Skilful in understanding data purpose and identifying necessary data types, sense of estimating and forecasting, recognizing data patterns, and	7 out of 9	6 out of 9	2 out of 9	9 out of 9	1 out of 9	5 out of 9	0 out of 9	8 out of 9

	Data Collection	Data Pulling	Data Refining	Data Analysis	Approval Innovation	Design Innovation	Execution Innovation	Evaluate Innovation
facilitating decision-making processes								
Competence in identifying problems, developing various insights, considering numerous perspectives, and thinking innovatively	6 out of 9	2 out of 9	0 out of 9	7 out of 9	0 out of 9	0 out of 9	0 out of 9	2 out of 9
Demonstrated self-motivation, initiative, and leadership qualities	0 out of 9	1 out of 9	0 out of 9	5 out of 9	0 out of 9	0 out of 9	1 out of 9	1 out of 9
Fluent in interpersonal communication, negotiation, presentation, and teamwork	6 out of 9	2 out of 9	1 out of 9	5 out of 9	7 out of 9	9 out of 9	9 out of 9	5 out of 9
Competence in managing relationships and interactions with stakeholders	2 out of 9	0 out of 9	0 out of 9	2 out of 9	1 out of 9	2 out of 9	3 out of 9	2 out of 9

Table 8 DDI Product - Recap of Actions and Capabilities Technical

Capabilities Technical in DDI Product	Mentioned in Actions							
	Data Collection	Data Pulling	Data Refining	Data Analysis	Approval Innovation	Design Innovation	Execution Innovation	Evaluate Innovation
Proficiency in using basic data processing and visualization tools	3 out of 7	2 out of 7	4 out of 7	5 out of 7	0 out of 7	1 out of 7	2 out of 7	1 out of 7
Competency in extracting data from databases	1 out of 7	5 out of 7	0 out of 7	0 out of 7	0 out of 7	0 out of 7	0 out of 7	0 out of 7
Advance proficiency in software development tools	0 out of 7	0 out of 7	0 out of 7	0 out of 7	0 out of 7	0 out of 7	4 out of 7	0 out of 7
Fluency in using basic company dashboard	0 out of 7	4 out of 7	1 out of 7	0 out of 7	0 out of 7	0 out of 7	0 out of 7	4 out of 7
Proficiency in operating external data dashboard	0 out of 7	2 out of 7	0 out of 7	0 out of 7	0 out of 7	0 out of 7	0 out of 7	2 out of 7
Skilful in utilizing modelling and simulation tools	0 out of 7	0 out of 7	0 out of 7	0 out of 7	0 out of 7	1 out of 7	0 out of 7	0 out of 7
Competent in managing documents related to circulated data	1 out of 7	3 out of 7	3 out of 7	0 out of 7	0 out of 7	2 out of 7	0 out of 7	0 out of 7

Table 9 DDI Product - Recap of Actions and Capabilities Non-technical

Capabilities Non - technical in DDI Product	Mentioned in Actions							
	Data Collection	Data Pulling	Data Refining	Data Analysis	Approval Innovation	Design Innovation	Execution Innovation	Evaluate Innovation
Skillful in understanding data purpose and identifying necessary data types, sense of estimating and forecasting, recognizing data patterns, and facilitating decision-making processes	7 out of 7	2 out of 7	0 out of 7	7 out of 7	0 out of 7	3 out of 7	0 out of 7	7 out of 7
Competence in identifying problems, developing various insights, considering numerous perspectives, and thinking innovatively	2 out of 7	0 out of 7	0 out of 7	6 out of 7	0 out of 7	2 out of 7	0 out of 7	6 out of 7
Demonstrated self motivation, initiative, and leadership qualities	0 out of 7	0 out of 7	0 out of 7	2 out of 7	0 out of 7	0 out of 7	0 out of 7	1 out of 7
Fluent in interpersonal communication, negotiation, presentation, and teamwork	7 out of 7	7 out of 7	0 out of 7	4 out of 7	6 out of 7	7 out of 7	7 out of 7	0 out of 7

Competence in managing relationships and interactions with stakeholders	1 out of 7	0 out of 7	0 out of 7	0 out of 7	1 out of 7	1 out of 7	2 out of 7	0 out of 7
Proficient in managing projects throughout all stages, from planning to execution	0 out of 7	0 out of 7	0 out of 7	0 out of 7	0 out of 7	0 out of 7	4 out of 7	0 out of 7

In addition, respondents also mentioned the issues they faced during the DDI process. The response was identified and generalized as shown in Table 10, so the phrase could represent the intended issues. Aside from that, the associated action with the issue was also identified. The issues mentioned do not explicitly point to a single action; rather, they encompass a variety of actions. For example, data and analysis issues are closely related to data activities, while stakeholder management is related to design and execution. The next subchapter provides a detailed explanation of the issues associated with each action.

Table 10 DDI Issues Code

Response	Issues
Challenge in people support, internal and external collaboration, middleman problem in accommodating stakeholder interests	Stakeholder Management
Challenge during data collection with different sources and types, different timeline of data completion from internal and external	Data
Problem in determine methodology, wrong forecasting result, questionable analysis result	Analysis
Issues to execute due to system and feature limitation, technical matters with the tools	Technical Issue
Difficult to coordinate and interact cross department	Communication

Table 11 Recap of DDI Issues

Issues	Mentioned by Respondents
Stakeholder Management	6 out of 9 (in DDI Business Process)
Data	3 out of 9 (in DDI Business Process)
Analysis	3 out of 9 (in DDI Business Process)
Data	3 out of 7 (in DDI Product)
Technical Issue	3 out of 7 (in DDI Product)
Communication	3 out of 7 (in DDI Product)

The results of all the identified actions, capabilities, and issues is presented in Table X. Within each table, there are actions encompassed in the DDI process and corresponding capabilities associated with each action. The cells are marked with various highlight colors to indicate the relative importance of capabilities in a specific action. The cells indicate that the capabilities indicated in "green highlight" were the most frequently stated in the interview, those highlighted in orange were the second most discussed, and those highlighted in yellow were the third most mentioned. Issues during the DDI process are listed at the bottom of the tables, and the actions where the issues occurred are indicated by the "X" sign.

Table 12 DDI Business Process – Consolidated Actions, Capabilities, and Issues

Innovation Type: Business Process	Actions							
Capabilities Technical	Data Collection	Data Pulling	Data Refining	Data Analysis	Approval Innovation	Design Innovation	Execution Innovation	Evaluate Innovation
Proficiency in using basic data processing and visualization tools	green	green	green	green		green	yellow	green
Competency in extracting data from databases		orange						
Advance proficiency in software development tools							green	
Fluency in using basic company dashboard	yellow	orange	yellow	yellow				orange
Proficiency in operating external data dashboard		yellow						yellow
Skillful in utilizing modelling and simulation tools						yellow		
Competent in managing documents related to circulated data	yellow	orange	yellow	yellow				yellow
Capabilities Non Technical	Data Collection	Data Pulling	Data Refining	Data Analysis	Approval Innovation	Design Innovation	Execution Innovation	Evaluate Innovation
Skillful in understanding data purpose and identifying necessary data types, sense of estimating and forecasting, recognizing data patterns, and facilitating decision-making processes	green	green	green	green	yellow	orange		green
Competence in identifying problems, developing various insights, considering numerous perspectives, and thinking innovatively	orange	yellow		orange				yellow
Demonstrated self motivation, initiative, and leadership qualities		yellow		orange			yellow	
Fluent in interpersonal communication, negotiation, presentation, and teamwork	orange	yellow	yellow	orange	green	green	green	orange
Competence in managing relationships and interactions with stakeholders	yellow			yellow	yellow	yellow	yellow	yellow
Issue	Data Collection	Data Pulling	Data Refining	Data Analysis	Approval Innovation	Design Innovation	Execution Innovation	Evaluate Innovation
Stakeholder Management	X	X		X		X	X	
Data and Analysis	X	X		X				

Table 13 DDI Product – Consolidated Actions, Capabilities, and Issues

Innovation Type: Product	Actions							
Capabilities Technical	Data Collection	Data Pulling	Data Refining	Data Analysis	Approval Innovation	Design Innovation	Execution Innovation	Evaluate Innovation
Proficiency in using basic data processing and visualization tools	green	yellow	green	green		yellow	yellow	yellow
Competency in extracting data from databases	yellow	green						
Advance proficiency in software development tools							green	
Fluency in using basic company dashboard		orange	yellow					green
Proficiency in operating external data dashboard		yellow						yellow
Skillful in utilizing modelling and simulation tools						yellow		
Competent in managing documents related to circulated data	yellow	orange	orange			green		
Capabilities Non Technical	Data Collection	Data Pulling	Data Refining	Data Analysis	Approval Innovation	Design Innovation	Execution Innovation	Evaluate Innovation
Skillful in understanding data purpose and identifying necessary data types, sense of estimating and forecasting, recognizing data patterns, and facilitating decision-making processes	green	yellow		green		yellow		green
Competence in identifying problems, developing various insights, considering numerous perspectives, and thinking innovatively	yellow			orange		yellow		orange
Demonstrated self motivation, initiative, and leadership qualities				yellow				yellow
Fluent in interpersonal communication, negotiation, presentation, and teamwork	green	green		orange	green	green	green	
Competence in managing relationships and interactions with stakeholders	yellow			yellow		yellow	orange	
Proficient in managing projects throughout all stages, from planning to execution							orange	
Issue	Data Collection	Data Pulling	Data Refining	Data Analysis	Approval Innovation	Design Innovation	Execution Innovation	Evaluate Innovation
Data	X	X		X				
Technical Issue		X					X	
Communication						X	X	

4.2 Capabilities in Data Driven Innovation Actions

The interview focused on exploring respondents' involvement in data driven innovation projects they have undertaken. The focus is to delve into the activities involved in data driven innovation and the corresponding capabilities associated with those activities. The activities are determined according to the respondent's job responsibilities and level of exposure.

From the interview result, both DDI Business Process and Product have same series of data driven innovation actions, including Data Collection, Data Pulling, Data Refining, Data Analysis, Approval Innovation, Designing Innovation, Execution of Innovation, and Evaluation of Innovation. This finding indicates the same pattern in DDI process, despite different type of innovation outcome. Companies have broad range of opportunities for innovation, and it appears that the type of innovation outcome does not necessarily impact the activities taken in the process. The exciting aspect, however, was how the actions interacted and iterated throughout the entire DDI activities. Respondent 11's case illustrates the back-and-forth steps involved in developing a business expansion effort before implementing the innovation. The DDI process involves certain steps, but the actual project may not always adhere to these steps; instead, it may involve back-and-forth

actions as the project progresses. For instance, the supervisor may need to approve the parameters or method several times, requiring revisions until the approval is granted. Meanwhile, once the final results are presented, not only the supervisor but also the director level must grant approval before implementing the innovation. Therefore, the process involved constant back-and-forth in securing approval and revising the methodology and analysis.

"It is challenging to convince management regarding the methodology in this project. During the process, for methodology, approval is needed from my director, but for final proposals, approval is needed from the director, CEO, and BOD" (Business Development, Financial Service Company)

Another finding from the results is that within the data-driven innovation process, both the DDI business process and the product have higher importance for non-technical capabilities compared to technical capabilities. The DDI Business Process contributes slightly more to non-technical capabilities than the DDI Product. This is primarily driven by capabilities related with analytical skill in understanding the data and personal attributes such as motivation and initiative. Interpreting from the findings in DDI business process, this involves various internal actions across all DDI actions. This emphasizes the importance of analytical skills for managing both technical and non-technical activities. During the development of the DDI Business Process for distribution network, Respondent 2 explicitly mentioned the role of analytical skills and encouraged the team to utilize data.

"I always emphasize to my team that having data is one thing, but without analyzing and dissecting it, we won't gain any insights. They need to understand the significance and usefulness of the data. If they just present data without analysis, it's useless." (Supply Chain Team, Manufacture Company)

In terms of personal attributes, this is related to the role of business processes as a means of enhancing corporate operational activity. Personal attributes play a significant role in the DDI business process, as they originate internally and are executed internally as well. This was also demonstrated by the way in which Respondents 11 and 15, as team leads, emphasized the significance of personal attributes, where team members learn by doing the job directly (on-the-job training). Therefore, personal motivation and a professional attitude are needed for them to be able to grasp the task quickly.

The subsequent subchapters will delve into each action and its corresponding capabilities. The section will emphasize the key functionalities of each action and their interdependencies. The importance of various capabilities was analyzed based on the most prevalent responses from respondents describing their activities during the DDI process. Therefore, it is crucial to consider not only the "green highlight" aspects but also the whole set of capabilities needed in each action, which include the "orange and yellow highlight." These capabilities represent a necessary set of competencies for performing the actions.

4.2.1 Data Collection
Data collection is the systematic gathering of data in which individuals directly participate and have control over the data, including supplying metrics or measurements and deciding on the necessary sorts of data. Data gathering can be performed either by the company itself or by a third party. Overall, according to respondents' answers, non-technical capabilities contribute more to data collection in both DDI business processes and products. However, technical capabilities are also acknowledged as necessary for this action.

4.2.1.1 Data Collection in DDI Business Process
In DDI Business Process, the most significant Non-technical Capability is the skill to understand data purpose and identifying necessary data. During this process, data was collected and maintained by internal, regardless of whether the activities were conducted internally or

externally. Thus, it can be concluded that obtaining a legitimate and trustworthy data source requires the understanding of data itself. This also requires recognizing what type of data will be useful for future analysis. As demonstrated in Respondent 2, the data was collected internally, and each team member understands what information should be reported. The data that is collected internally depends on the company's needs and what they think is useful.

"My team maintains this data internally. For activities using third-party services, my team records and ensures the information needed was collected, such as cost, customer delivery windows, or customer custom request"(Supply Chain Team, Manufacture Company)

Regarding Technical Capabilities, the respondent in the DDI Business Process emphasized that the most crucial aspect is proficiency in using basic data processing tools. Data processing tools include Microsoft Excel for gathering information and documenting actions. The interview reveals that the majority of respondents are highly inclined to utilize Microsoft Excel while handling data. Therefore, possessing proficiency in this software is considered a fundamental requirement for workers involved in DDI initiatives.

4.2.1.2 Data Collection in DDI Product

In DDI Product, the most important Non-technical Capabilities is also the ability to understand the purpose of the data and identify necessary data. Multiple sources and types of data are gathered, making it essential to determine the precise data required for subsequent analysis. Furthermore, proficiency in communication skills is also highlighted as a crucial requirement for Data Collection in DDI Product. Engaging with external entities requires skill to effectively communicate and get the necessary information for the analysis. While working on the development of a new product in the e-commerce industry, Respondent 1 emphasized the significance of interpersonal skills in gaining further data and insights about market conditions, which can be useful methods for company strategy.

"In addition to using existing data, I also seek information from partners to understand market and competitor sales trends and their effective features, while planning our strategy. This information serves as a benchmark to determine if our products can effectively implement these trends" (Key Account Manager, FMCG Company)

Meanwhile, for Technical Capabilities in DDI Product, proficiency in basic data processing is important. Respondents also stated that they frequently use Microsoft Excel to collect and record data as needed.

4.2.1.3 Data Collection Issue

Data Collection is one of the actions that address the issues mentioned by respondents in both DDI Business Process and Product. Given that data is a vital component of DDI, any problems related to it are a significant worry as they can impact the entire process. Some of the issues mentioned by Respondent 1 include varying timelines for data collection completion, scattered data sources as stated by Respondents 9 and 14, difficulties in collecting complete data from partners and hierarchy approval from internals as faced by Respondents 13 and 7, and concern about data source validity as stated by Respondent 10. In addition, the issue of stakeholder management arises in DDI Business Process. The acquired data is strongly correlated with the team's capability to carry out the tasks. However, a notable issue that arises in this activity is the disparity in skills among team members. Respondent 2 and 6 shared their experiences and explained that they address the issue by giving special attention and implementing internal team knowledge sharing to ensure that everyone possesses the same set of capabilities.

"I encourage my team member with more data experience to share his skills with other team members. My team, for example, should rotate reports. When a new report comes up, everyone

should be capable of creating it, and I make sure to maintain a consistent skill level among my team members" (Supply Chain Team, Manufacture Company)

4.2.2 Data Pulling

Data pulling refers to the process by which the company pulls the specific data it needs. This activity can be done internally or by using a third-party service such as a data agency. According to the interview results, both respondents involved in DDI Business Process and Product agree that Capability in the technical aspect is the most important factor for this activity.

4.2.2.1 Data Pulling in DDI Business Process

In DDI Business Process, Technical Capability related with proficiency in data processing tools is the most important skill needed. The majority of respondents agree that they use Microsoft Excel for data collection. The data they acquired can originate from both internal and external sources, however the data pulling process is often conducted internally. In addition, the data is shared internally among multiple departments, hence it is more effective to employ basic tools such as Microsoft Excel. Respondent 14 emphasized the importance of internal data and its controlled distribution through limited and basic software to reach relevant departments in the company.

"The data is sent via email in Excel format and is password-protected. If data is shared within a system, it would be difficult to control access because the data is confidential and limited in visibility to only a few individuals" (Production Team, Manufacture Company)

The ability to understand data and find relevant data is the most important aspect of non-technical capability for the DDI Business Process. Because many actions are carried out internally, staff must be able to dissect and determine what types and facts of data are required from the massive amounts of data collected.

4.2.2.2 Data Pulling in DDI Product

The primary technical capability required for the DDI Product is proficiency in extracting data from databases using advanced programming languages like SQL. There is a large amount of data and facts collected on the product, hence a high level of expertise in data retrieval is required. Furthermore, for initiative purposes, the analysis is thorough, and the data required is unique from the regular data utilized for monitoring. Respondents 3, 4, 7, 8, and 12 from a digital company acknowledged the need of SQL abilities for data extraction. The function of the Business Intelligence (BI) Team as SQL experts for data pulling is available at the company, however some of them also require their team to include a SQL team because they did the data pulling themselves. The ability to analyze data was assessed based on the need to use specific software for daily tasks. Respondent 12 stated her experience regarding how advanced SQL skills turn out to be needed for team members, whereas not all current team members have sufficient ability. Hence, they learn from each other and provide informal training and coding templates to ensure the actions can run smoothly and not depend only on one person's expertise. Respondent 4 also mentioned the importance of advanced programming language skills for the Business Intelligence Department to be able to pull data for ad hoc and unique datasets.

"Because everything starts with the data, our team members must be occupied by SQL to pull the data from our data warehouse. These SQL skills are a requirement for recruiting my team members" (Logistics Team, Tech Company)

Fluency in communication, which involves negotiation and persuading people, is essential to the non-technical capabilities component of this action. This is evident in situations where other departments must execute data pulling, as demonstrated in the cases of respondents 4 and 8, who require specific data requests to be made to the Business Intelligence Team. The ability to interact

and communicate with different teams is required in order for them to agree to deliver the task according to our expectations.

4.2.2.3 Data Pulling Issue

Data related tasks are a significant focus of the DDI Business Process and Product. In the context of Data Pulling, the process involves selecting and dissecting the precise type and factual information that will be utilized for analysis. Therefore, the careful selection and extraction of data play a crucial role.

Within the DDI Business Process, challenges arise in the areas of stakeholder management and data-related operations. Respondent 14 emphasized the significance of collaborating with other departments due to the fact that data extraction is carried out by those departments, and occasionally the data requires adjustments. Furthermore, Respondents 10 and 11 also highlighted the challenges of obtaining accurate and trustworthy data, as they acquired information from public websites where fraudulent content is prevalent.

"One of the challenges is determining the source of the data, which I need to verify. If the data originates from an official government website, I must verify its legitimacy before determining if it contains updated data. If the obtained website is unclear, we will look to see if there is an official website related to that data" (Business Development, Home Improvement Company)

Meanwhile, in the DDI product, data pulling concerns are related to data and technical issues. According to Respondent 9, historical data from prior years is required for new product development purposes. Old data is typically not documented in the systems, hence, it must be retrieved manually. Furthermore, Respondent 4 reported instances where their local business intelligence team lacked the necessary technical skills to retrieve specific data. The issues raised have the potential to impede the entire process. Meanwhile, these challenges are controllable, and the company should use its authority to simplify the internal system.

"One of the problems we faced during the project was that our local BI team didn't have the technical capability to track specific assets. Therefore, my team had to reach out to the regional BI, which took more time and effort" (Business Development, E-commerce Company)

4.2.3 Data Refining

Data refining is the process of organizing data in a structured format that is suitable for analysis. To provide accurate insights and enable effective analysis, it is essential to standardize the data, considering its diverse sources and formats. The interview results show that both DDI Business Process and Product indicate that Capability Technical is of utmost importance in this action.

4.2.3.1 Data Refining in DDI Business Process

In DDI Business Process, Technical Capability of competency in using basic data processing is crucial. In Data Refining, Microsoft Excel remains the most popular tool identified by respondents, as it has in prior phases. Though the majority of operations are performed internally, there are several sorts of actions in Business Process that require different types of data to be converted to uniform formats. Respondent 10 emphasizes the necessity of this action, stating that team members must tidy up the format before conducting the analysis. Aside from that, the non-technical capabilities of understanding data are shown to be the most significant aspect of the DDI business process. When cleaning data, the employee should grasp the metrics and units in order to align them with the same format and avoid misleading results in the analysis. This non-technical capability also showed in Respondent 13 case, where each e-commerce partner uses a different term on the dashboard, which requires further discussion to ensure the same understanding.

4.2.3.1 Data Refining in DDI Product

In DDI Product, the most highlighted capability is technical, which is related to proficiency in using basic data processing. In this context, Microsoft Excel is still the most commonly used software. The result obtained by data extraction remains in its original raw format, particularly when it is performed by another team, such as Business Intelligence. As a result, the responsible team must modify the data to match their expected format based on the intended analysis. Respondents 1, 4, and 8 emphasize the necessity of data refinement prior to integrating internal data and conducting further research. Data refinement may appear to be mere administrative work, but in reality, it is a time-consuming operation that often requires committed individuals to clean up the data. Therefore, ensuring that the data is in a suitable format is crucial for conducting accurate analysis, making data refinement an integral part of the DDI action.

4.2.4 Data Analysis

Data analysis encompasses any type of data processing that is intended to derive insights from it, such as dissecting, categorizing, calculating, manipulating, and so on. The types of analysis conducted during the data-driven innovation process vary depending on the company's goals. Respondents agree that both DDI Business Process and Product get the most benefit from Non-Technical Capability, specifically the capability of analytical thinking for data processing, forecasting, pattern detection, and drawing conclusions for decision making. Data analysis is the most significant data related action since the result determines what type of innovation will be implemented or proposed for approval by top management. Both DDI Business Process and Product provide the same response for crucial Technical Capabilities, which include proficiency in data processing and visualization tools. Data Analysis activities combine technical and non-technical capabilities to completely do the task involved manage data, identify patterns, and ultimately derive conclusions from the data.

4.2.4.1 Data Analysis in DDI Business Process

Data analysis in the DDI Business Process is typically performed internally because it is closely tied to internal corporate business and activities. Non-technical Capability required for this context is how they can analyze data based on the purpose, whereas Technical Capability is most likely still associated with using Microsoft Excel and visualization tools such as Microsoft Power Point or presentation tools to display the results of analysis. Respondent 13 noted that it takes months to determine whether it is worthwhile to develop new online stores for one of her company's brands. The analysis is related to market analysis, calculates costs and profits, and determines whether the new store would help them achieve their goals. In terms of internal activities, Respondent 14 mentioned that there are different studies that need to be done before determining production strategy. The team delves into each affected element, examining how to fulfill demand, how many machines should be added, the production line scenario, manpower allocation, inventory and quality control, and so on. It can be inferred that data analysis is the foundation of innovation, and it is extremely serious in terms of the capabilities required. Because multiple parties are involved in these operations, data analysis also entails rigorous discussions to consolidate the analytical results from various teams participating in the project.

"When developing a new sales channel, the process involved extensive discussions over several months. The process involves numerous departments: Finance Team calculated profitability, Brand Team discussed channel differentiation, Supply Chain Team determined warehouse setups. These discussions were held before making any decisions" (Key Account Manager, FMCG Company)

4.2.4.2 Data Analysis in DDI Product

In DDI Product, most respondents agree that the most important matter is Non-technical Capability of proficiency in performing analytical skills and Technical Capability of using data processing and visualization tools. Because designing a product involves a variety of data sources, both technical and non-technical capabilities are required to combine and identify connections

and stories from the massive amount of data, leading to creative concept for new product. They also require the ability to visualize and express the idea to the many parties involved. This procedure includes numerous analyses and may involve other parties, such as a market research and media agency, field team, and distribution partners. Respondent 9 mentioned that many factors must be analyzed before deciding on new product development, such as the Brand Team analyzing the market situation using external data provided by the agency, aligning with Sales Team data on primary and secondary sales, and conducting a survey with a market research agency to determine product acceptance from customers. For this activities, employees underwent software training provided by the data agency to better understand the data provided. Furthermore, Respondent 9 mentioned the company's regular training of marketing skills to ensure the team has comprehensive knowledge in the business area. The customer's involvement is also important because they will be using the product. In addition, Respondent 12 mentioned that the process of creating a new website dashboard required extensive data research. The process began with the internal team conducting an analysis of customer orders, which led them to discover potential customer segments. Subsequently, the team collaborated with the Research Team to directly inquire with customers about how the company might assist them through their services. After doing a thorough analysis of what customers needed, they determined that creating a new website platform would be the most suitable solution. It is concluded that a thorough examination of several data sets is necessary, and even more data collection is required to support the development of a new product. Data analysis is a crucial process that requires a clear understanding of the objective behind introducing a new product. In this context, the purpose could be to attract new customers or maintain existing ones. During the data study process, new findings may emerge, such as the identification of additional data requirements or the need for further study in different sectors.

Respondent 3 elaborates on the development process for the new feature provided on the online platform in the role of product manager. The process begins with observing the situation, formulating hypotheses, conducting a thorough analysis, and determining what needs to be developed to address issues or enhance performance.

"I oversee what happened by monitoring performance and deep diving the existing data, from there, I get my hypothesis. Then I asked my Data Analyst Team to conduct Quantitative Analysis, and Research Analytics to conduct Qualitative Analysis. Next, I consolidate all the data, conduct a thorough analysis, and further develop strategies to enhance performance" (Product Manager, E-commerce Company)

4.2.4.3 Data Analysis Issue

The issues related with Data activities can't be separated from Data Analysis action, as this is the primary activity for generating ideas. Stakeholder management and data analysis are key issues in the DDI Business Process. Aside from the differences in skill sets within the team, one of the issues about stakeholder management is the support of internal stakeholders. As reported by Respondent 10, higher level management is hesitant when the team explains the process and analysis they want to conduct to expand the company's business, but finally the team can solve it by mastering the data and creating a convincing analysis. Internal stakeholder support is required not just for approval but also for other activities connected to collaboration in Data Analysis. This is also highlighted by Respondent 6, 14, and 15, where they had extensive interactions with various parties while developing the idea. Aside from that, data and analysis issues also affected this action, especially regarding data validity and reliability. Respondents 11 and 14, who work in the company expansion and production planning fields, emphasized the necessity of clear and exact data for efficient processes and effective innovation. If an idea or decision is made based on ambiguous and unreliable data, it might lead to inaccurate interpretation and negatively impact the cost spent. Furthermore, the perspective and interest from other related team also need to be consider in order to make decisions.

"The problem arises when validating information for other teams, as they have different perspectives on the project. This requires further discussion and takes time. My team needs to reaffirm the initiative's worthiness and potential profitability." (Business Development, Financial Service Company)

Meanwhile, in the DDI Product, the issue is focused on data. This relates to how the framework and methodology were planned for the analysis. Respondent 7 highlighted that during data analysis, certain elements that should be incorporated into the analysis framework may be discovered spontaneously. As a consequence, there was a lack of necessary information that might have been addressed by either repeating the previous processes or finding alternative methods to adjust the analysis, while still ensuring accurate insights.

4.2.5 Approval Innovation
This stage entailed obtaining authorization for innovation before moving on to the next steps, which included design and execution. In most cases, authorization for innovation is granted by individuals or a board of directors who occupy authoritative positions within the company, such as the board of directors or C-level executives. Both the DDI business process and product show the same pattern, highlighting the significance of non-technical capabilities, particularly fluency in communication skills.

4.2.5.1 Approval Innovation in DDI Business Process
The scope of DDI Business Process is closely connected to changes in internal activities. This requires fluency in communication to propose the approval and ensure that all relevant departments are informed of the latest updates. As a result, the level of approval varies depending on how much the initiative affects other departments. Respondent 5 emphasized the importance of proposing and gaining approval from the regional team for developing innovations related to a new business line. In companies operating across multiple countries, introducing new innovations can have implications for other regions. For example, the Regional Team may assess whether the innovation could be implemented in other countries. If they decide to proceed, extensive preparation and adjustments will be necessary. When suggesting internal innovations, the department head should be aware of the changes and ensure the team stays informed. Additionally, approval for innovation also involves approving its elements, such as costs and manpower allocation. Respondent 15 mentioned the importance of budget approval for her team to move forward with her partnership proposal. Similarly, Respondent 14 mentioned how the proposed production plan also includes details about manpower allocation. Apart from engaging with higher-level management, there is extensive communication with leaders from other departments, highlighting the importance of clear communication to ensure alignment among all involved parties.

4.2.5.2 Approval Innovation in DDI Product
In DDI products, communication skills are also important for obtaining approval. The interview results highlight that when creating a new product, it's essential to not just seek approval from internal stakeholders, but also to gather feedback on how customers perceive and accept the product. This feedback can be gathered through product testing or market research using third party services. The results of these tests will be considered by top management when deciding whether the product is worth releasing or not. Launching a new product requires careful consideration because once it is launched, it represents the company image and can affect the company's reputation. Respondent 8 mentioned that when introducing new program for partners on the e-commerce platform, upper management didn't approve all scenarios at once. They did it gradually to avoid negative reactions from partners. Additionally, when the initiative was being developed, various stakeholders had different agendas, making the approval process critical to ensuring everyone is satisfied and their ideas are appropriately considered.

Respondent 4 highlights the approval process, which is not as simple as just giving a signature but also considering the different interests of higher-level and lower-level positions and partners.

"We proposed some scenarios, but the directors are concerned regarding our price offers to partners. After formulating and reaching conclusions that we believe can accommodate the interests of various parties, we presented them to our department head. After getting approval from the department head, we presented them to our executive director, who ultimately decided whether this initiative could be applied or not." (Business Development, E-commerce Company)

4.2.6 Designing Innovation

Designing innovation is an action that involves specifying the execution and detail requirements for the implementation. This process includes creating simulations or models, conducting trials or tests, predefining requirements, updating company rules or job scopes, and considering how improvements can be made during the execution. From the interviews, it's clear that non-technical capability is crucial in both DDI Business Process and Product. Competency in communication, presentation, and teamwork is the key for Designing Innovation.

4.2.6.1 Designing Innovation in DDI Business Process

In DDI Business Process, competency of communication, presentation, and teamwork is important in designing innovation. When designing innovation, there is extensive communication with other departments about both the main innovation and its supporting documents. The supporting documents include activities such as updating regulations and adjusting job procedures. For example, Respondent 6 changed their team's job scope to match a new method of checking customer invoices. Updating procedures is important to guide team members on how to apply the new method correctly, especially since it affects targets, costs, and workloads. So, the procedures act as tools to ensure they aim for the target. Designing also involves creating models and simulations to make sure the initiative can actually be carried out. Respondents 12 and 14 mentioned how they simulate and model innovations before implementing them in the systems. There are other teams involved in making the simulations. During these simulations, new discoveries or findings might affect how the plan is executed. This simulation helps prevent failure and minimizes risks. From here, we can conclude that being able to communicate the requirements and details of the innovation clearly is crucial to making sure everyone understands the objective while designing innovation.

"We collaborate with the data scientist team to create simulations. During these simulations, many iterations were conducted until we found the effective combination we were looking for." (Logistic Team, Tech Company)

In terms of Technical Capabilities, proficiency in basic data processing is also important in DDI Business Processes. During innovation design, data processing and visualization tools serve as ways to convey ideas and concepts to other departments. In addition to communication skills, visualization can help people easily grasp new rules or understand what is new.

4.2.6.2 Designing Innovation in DDI Product

Meanwhile, at DDI Product, fluency in communication skills is the main focus, as product development necessitates interaction with internal and external parties. In the midst of designing innovation activities, tasks are continually passed from one team to another. When assigning these tasks, clear communication is essential to ensure alignment with the previous department. This was shown in Respondent 12's experience, where feedback and adjustments from other teams closely involved with partners were needed during the innovation design process to gain a comprehensive perspective. Designing product innovations for goods involves many external parties, particularly in distribution. Various aspects, such as promotional activities and distribution areas, need to be coordinated to align with production and material procurement

timelines. Respondent 9 highlighted the complexity of this process, emphasizing the need for effective interpersonal communication to manage the entire process and ensure everyone is on the same page.

"Managing stock and distribution is not a simple task. For instance, distributing goods across the country or targeting smaller regions, along with addressing related issues such as advertising and ensuring the readiness of both old and new inventory, is a complex task. Another task involves changing product details, which can impact the work of other departments, such as installing new machines for production and managing production timelines" (Brand Team, FMCG Company)

Furthermore, Technical Capabilities required in DDI Product is the competency to manage the circulation of documents and data. Because multiple parties are involved, efficient documentation management is critical for staying on track with the initial plan and making necessary adjustments.

4.2.6.2 Designing Innovation Issue

Designing Innovation is also a key aspect in addressing DDI issues. In DDI Business Processes, issues often revolve around stakeholder management. With various departments involved, stakeholders have other tasks besides our project to handle. Therefore, managing stakeholders to prioritize our project while acknowledging their other responsibilities is vital. Respondents 5 and 14 shared their experiences working with other teams, such as the Business Intelligence Team and Engineering Team, where they sought assistance for their projects but had to compromise on other tasks. In addition, communication emerges as a common issue in DDI Product. When new initiatives arise, socialization is necessary to ensure everyone understands the timeline and key points of the innovation. Managing and maintaining the flow of information, especially when it moves from internal to external channels through several parties, can be challenging. Addressing communication issues is critical because they can impact the project timeline, as Respondent 7 highlighted when informing partners about a new program. The estimated timeline for informing all partners about the programs turns out to be underestimated, and additional time is needed to fully execute the program with all partners understanding the details.

"My team closely interacts with the other team to educate them on how to improve the performance of the partners they handle, socializing about what and when assessments are made. The communication process turns out to be challenging and requires more time than our allocated timeline" (Business Development, E-commerce Company)

4.2.7 Execute Innovation

This action is about implementing innovation into the system or formally launching the product or service to customers. The execution could be either carried out directly by the project lead team or assigned to another team. Nevertheless, the lead team remains involved and has visibility to control the implementation process. Overall, participants engaged in the DDI Business Process and DDI Product agree that non-technical capability is the most crucial factor, particularly in communication proficiency.

4.2.7.1 Execute Innovation in DDI Business Product

In DDI Business Process, effective communication is essential due to the collaboration among different departments during execution. This involves ensuring that others can implement the innovation in the system as expected. External parties may also be involved, requiring the internal team to define specifications and communicate expectations. For instance, when establishing a new distribution network, Respondent 2 needed to communicate with third party logistics regarding distribution routes and customer delivery preferences. In addition, aligning internal and external execution is vital, as demonstrated by Respondent 15, who needs to coordinate with Marketing Team to execute the Campaign, once the partner has signed and paid for campaign

participation. This proves how communication proficiency is crucial in DDI Business Process since execution involves multiple teams. Respondent 13 demonstrates how communication is critical when executing innovation, as they collaborate with third parties to run one of their sales services.

"My team acts as a bridge between the brand and the platform. We decided to use an enabler service to manage our online store in e-commerce platform. Therefore, we need to closely communicate with the enabler to prepare the store." (Key Account Manager, FMCG Company)

In terms of Technical Capabilities in DDI Business Process, competency in software development tools is critical, especially given the importance of technology in today's business, particularly for digital enterprises.

4.2.7.2 Execute Innovation in DDI Product

Similarly, in the DDI product, communication proficiency plays a central role. When communicating with external parties during execution, details may require adjustment in the field. Respondent 1 describes an incident in which adjustments were required for campaign execution. Only the partner side possesses the capability to make these adjustments, thus necessitating communication about the necessary modifications. In addition to carefully planning and executing the innovation creation process, companies also need to consider the strategy of selling the new product to their customers. Respondent 12 emphasized the need to sell the recently created dashboard to a specific target audience, necessitating effective communication regarding the advantages of the product. As a result, having excellent communication skills is critical when implementing innovation.

Respondent 7 also emphasized that other departments were responsible for the execution, necessitating communication and other team agreements to effectively deliver the innovation to the intended consumers.

"After the UX requirements are finished, I communicate with the product team and get their buy-in because they are responsible for app design. This is done so that their API can be connected to the results of my team's work, and the results can be visualized in the application" (Marketing Team, Financial Service Company)

The most crucial capability for the DDI Product's Technical Capabilities is proficiency in software development tools. When it comes to implementing a product in a digital organization, the relevant department must have programming language skills in order to incorporate innovative features into the application. This is demonstrated in the responses of Respondent 3, 7, and 12, where they actively cooperate with the developer team to incorporate the innovation into the program.

4.2.7.3 Execute Innovation Issue

There are concerns with this action that must be addressed, because execution is where innovation is truly implemented and determines whether it will be successful or not. Stakeholder management is one of the most frequent issues that come up in DDI Business Process. Several parties with varying agendas and interests are involved in implementing innovation with other departments. This is the point at which the middleman problem appears, leaving the project manager perplexed about how to strike a balance between the many interests. The top management roles that are frequently mentioned during DDI activities are directly related to how they drive innovation. Therefore, they hold specific expectations and place significant importance on the outcomes of DDI initiatives. However, there are also other parties that have different concerns, such as partners and customers. Respondents 4 and 8 encounter this scenario when

they draft partnership offers, where partners want the best possible deal but top management has a profit target in mind.

"My position is to find a balance between what management wants and the field conditions faced by the commercial team. Because the direction is top-down and ambitious based solely on data, my role is to represent the commercial team and find a middle-ground solution" (Business Development, E-commerce Company)

Meanwhile, in DDI Product, the issues are related to technical and communication issues. There are circumstances in which the implementation of innovation cannot proceed as planned due to technical constraints, such as when the feature is not yet fully developed or when unforeseen technological issues arise. Respondent 1 stated that the e-commerce platform was unable to effectively implement the desired feature due to its lack of maturity in development. Therefore, in this situation, the innovation must be adjusted or delayed until the system is ready. Regarding the communication issue, it closely relates to the manner in which information is communicated to the individuals who are in charge of implementing innovation in the field. Respondents 8 and 9 also emphasize the need to effectively communicate even the smallest detail during the implementation process with the relevant team, in order to prevent any misunderstandings.

4.2.8 Evaluate Innovation
Evaluation is the systematic observation and assessment of the innovation's implementation. The process involves regular assessments that may trigger further actions such as improvement, alteration, or discontinuation of the innovation. The relevant team typically conducts regular monitoring to follow the implementation of innovation and determine the next action steps to be taken. Overall, respondents agree that non-technical capability is the most important aspect when evaluating both the DDI business process and the product.

4.2.8.1 Evaluate Innovation in DDI Business Product
Proficiency in data comprehension and pattern recognition is crucial for non-technical capabilities in the DDI Business Process. Furthermore, the use of fundamental data processing technologies, particularly Microsoft Excel, plays an important role in this endeavor. When evaluating the DDI business process, it is crucial to monitor the implementation and thoroughly document the activities. In order to achieve an effective evaluation that is aligned with the initial purpose of innovation, it is crucial to be able to identify the matrices that need to be tracked. Respondent 6 highlighted the team's practice of creating a to-do list to monitor the completion of required tasks and routinely reporting to gain a deeper understanding of any unexpected issues that may develop. There is also a necessity for tools to monitor daily progress and record all activities. Respondent 2 highlights the importance of each team member having the ability to create report documents. Hence, if there are people with more knowledge and skill, they will train other team members so they have the same skill and can create the report. This report is then useful for them to examine whether they have already achieved the target and decide on the next action points. Nevertheless, the data was used to enhance performance and even generate new innovations based on the evaluation results. Therefore, non-technical capabilities are necessary to effectively evaluate and respond promptly to the dynamic condition.

4.2.8.2 Evaluate Innovation in DDI Product
In the context of the DDI product, a crucial aspect is the non-technical ability to possess a high level of competency in comprehending data. When evaluating the entire process of the DDI product, a substantial amount of documentation is required, as it involves both internal and external parties. Hence, it is critical to have the ability to recognize significant data and interpret patterns in order to conduct a thorough evaluation that can effectively inform the result. Furthermore, in terms of technical capabilities, proficiency in utilizing the company dashboard is essential, as this is where the accumulated data is visualized. Due to the large volume of data, the

company dashboard was developed to improve information visualization and filtering based on the specific needs of different departments. In the present day, internal dashboards have become increasingly prevalent. This facilitates the monitoring of company performance by various employment levels, including those in higher positions, who will be able to monitor the performance easily using the dashboard. Respondents 3, 4, and 8 highlighted the utility of this dashboard in monitoring daily performance. Nevertheless, aside from the use of dashboards, accurately determining a company's performance outcome is the most critical factor in determining action points to improve product performance.

4.3 Issues and Strategy for Improvement

Based on the interview results, several issues have been examined. The explanation given by respondents does not always explicitly point out specific actions, hence, further interpretation is needed to generalize and put it into the identification of DDI actions. Furthermore, respondents' suggestions are also being considered when deciding the area for improvement. Consolidating all of the findings, a strategy for improving DDI was developed.

4.3.1 Formulating Strategy for Improvement

During the interview, we not only identified the highlighted issues but also analyzed the respondent's suggestions on how to improve the DDI process while considering these issues. The primary area suggested for development in both the DDI Business Process and Product is the Data and Analytical aspects. Respondent 10, 11, and 14 emphasize the improvement needed in the area of Data and Analysis in DDI Business Process, specifically regarding valid data sources, background studies to decide on parameters of analysis, and forecasting analysis. Meanwhile, for the DDI Product, Respondent 1,7,9, and 12 highlight the importance of enhancing data planning, data organization, and data utilization.

"When developing the idea, we use historical order data from one of our partners as a benchmark to build up a new platform. However, I think if we also explore other partners who have different business sectors, it might give more general insights that can be used as benchmarks" (Logistic Team, Tech Company)

This highlights the importance and supports the argument of focusing on the actions of data collection, data pulling, and data analysis. The respondents also emphasize the need to improve data validity and reliability, as well as analysis techniques such as predicting and identifying correlations among data sets, for the purpose of maximizing profits and forecasting markets.

Additionally, DDI Business Process and Product communicate closely with other parties. Respondents highlighted the need for improvement in the process of designing and executing innovation, as communication and interactions play a crucial role in this process. In relation to the DDI product, suggestions for improving timeline management also arise, as these tasks typically require collaboration among several stakeholders and are frequently the cause of delays. Respondents 3 and 8 highlight their collaboration with other team members and acknowledge that they often exceed the given time, necessitating adjustments to the plan.

"When creating a feature, the developer team frequently underestimates the amount of time required, resulting in the requirement for additional time. In another situation, more time is required since it turns out that more complex development happens due to other associated features." (Product Manager, E-commerce Company)

Consolidating all the findings, we can conclude that to enhance the DDI process, the strategy is to focus on the actions of data collection, data pulling, data analysis, and designing and executing innovation. To develop the strategy, we will further discuss the capabilities associated with these

actions and adjust how the company can actually build capabilities to improve DDI based on the area of focus.

Table 14 DDI Business Process - Issues with highlighted capabilities in each related action

Innovation Type: Business Process	Actions							
Capabilities Technical	Data Collection	Data Pulling	Data Refining	Data Analysis	Approval Innovation	Design Innovation	Execution Innovation	Evaluate Innovation
Proficiency in using basic data processing and visualization tools								
Competency in extracting data from databases								
Advance proficiency in software development tools								
Fluency in using basic company dashboard								
Proficiency in operating external data dashboard								
Skillful in utilizing modelling and simulation tools								
Competent in managing documents related to circulated data								
Capabilities Non Technical	Data Collection	Data Pulling	Data Refining	Data Analysis	Approval Innovation	Design Innovation	Execution Innovation	Evaluate Innovation
Skillful in understanding data purpose and identifying necessary data types, sense of estimating and forecasting, recognizing data patterns, and facilitating decision-making processes								
Competence in identifying problems, developing various insights, considering numerous perspectives, and thinking innovatively								
Demonstrated self motivation, initiative, and leadership qualities								
Fluent in interpersonal communication, negotiation, presentation, and teamwork								
Competence in managing relationships and interactions with stakeholders								
Issue	Data Collection	Data Pulling	Data Refining	Data Analysis	Approval Innovation	Design Innovation	Execution Innovation	Evaluate Innovation
Stakeholder Management	X	X		X		X	X	
Data and Analysis	X	X		X				

Table 15 DDI Product- Issues with highlighted capabilities in each related action

Innovation Type: Product	Actions							
Capabilities Technical	Data Collection	Data Pulling	Data Refining	Data Analysis	Approval Innovation	Design Innovation	Execution Innovation	Evaluate Innovation
Proficiency in using basic data processing and visualization tools	green	yellow	green	green		yellow	yellow	yellow
Competency in extracting data from databases	yellow	shaded						
Advance proficiency in software development tools							green	
Fluency in using basic company dashboard		orange	yellow					green
Proficiency in operating external data dashboard		yellow						yellow
Skillful in utilizing modelling and simulation tools						yellow		
Competent in managing documents related to circulated data	yellow	orange	orange			green		
Capabilities Non Technical	Data Collection	Data Pulling	Data Refining	Data Analysis	Approval Innovation	Design Innovation	Execution Innovation	Evaluate Innovation
Skillful in understanding data purpose and identifying necessary data types, sense of estimating and forecasting, recognizing data patterns, and facilitating decision-making processes	shaded	yellow		shaded		yellow		green
Competence in identifying problems, developing various insights, considering numerous perspectives, and thinking innovatively	yellow			orange		yellow		orange
Demonstrated self motivation, initiative, and leadership qualities				yellow				yellow
Fluent in interpersonal communication, negotiation, presentation, and teamwork	green			orange	green	shaded	shaded	
Competence in managing relationships and interactions with stakeholders	yellow				yellow	yellow		
Proficient in managing projects throughout all stages, from planning to execution							orange	
Issue	Data Collection	Data Pulling	Data Refining	Data Analysis	Approval Innovation	Design Innovation	Execution Innovation	Evaluate Innovation
Data	X	X		X				
Technical Issue		X					X	
Communication						X	X	

4.3.2 Strategy for Improvement

We already know that the areas to focus on in enhancing DDI related to data activities are Data Collection, Data Pulling, and Data Analysis. In addition, the activity of Designing Innovation and Executing Innovation emphasizes the need for collaboration and communication both within and beyond the firm. Besides, we have insights from the results about what type of capability has the most important contribution to each action.Thus, in order to enhance the data-driven innovation process, it is crucial to focus on developing capabilities in the areas that hold the greatest significance. As shown in Tables 4 and 5, the shaded cells represent the capabilities that should be highlighted for improvement. The highlighted capabilities are selected based on the highest importance rank in each action, as determined by the interview findings.

The interview results indicate that there are various methods available within the company to enhance DDI capabilities. The most mentioned method in DDI Business Process is doing Company Training, Recruitment Process, and Mentoring Session. Meanwhile in DDI Product, the most

common answer is to do Company Training and Recruitment Process. Therefore, we can infer that the strategy for improvement within the company could be developed using the method of building capabilities by focusing on the highlighted actions and capabilities.

4.3.2.1 Data Collection and Data Analysis

Regarding data collection and analysis, it is important for both the DDI business process and product to prioritize improving the competence of non-technical capabilities, specifically in analytical thinking skills. This will enable a better understanding of the data, the identification of necessary data, proficient data processing (including forecasting), and effective utilization of data as decision-making tools. The strategy to improve a company's performance in this field is to conduct company training related to this area, with a specific focus on the department where the employee works. For example, in the marketing department, employees must attend training to understand marketing metrics and the important elements for analysis. Other teams, such as finance, require training on financial elements and how to manage budgeting at the company level. Respondents 5 and 9 mention how company training is needed and adjusted to each department's needs.

"To ensure the team's capabilities, we conduct trainings tailored to the specific needs of each department, supplemented by practical exercises. Therefore, the training goes beyond mere theory and incorporates real-life case examples" (Project Marketing, E-commerce Company)

"For managers at the managerial level and above, training is mandatory twice a year and is overseen by our superiors, related to strategic and management skills. Promotional candidates must complete some of the required training" (Production Team, Manufacture Company)

Another strategy for data collection and analysis in both DDIs is to filter the personnel during the recruitment process, specifically to select candidates who have sufficient analytical skills as expected. The results show that specific requirements for both hard and soft skills were needed and examined during the selection process to ensure that the hired employee had the necessary skillsets to do DDI activities. Respondents 7 and 11 emphasized in their responses that they make sure the team possesses the necessary skills.

"The candidate's sense of business is assessed by how they explain, understand, and articulate the data during the test in the recruitment process. It is often found that the candidates have excellent technical skills but are weak in analytical skills" (Analytics Marketing, Financial Service Company)

"During the recruitment process, I present a case study to candidates, requiring them to respond and develop a comprehensive solution. I would like to see their way of thinking and assess whether it is sufficient for this position" (Commercial, Tech Company)

In the DDI business process, mentoring sessions are frequently mentioned as a means to ensure that personnel fulfill their capabilities. A mentoring session is a method in which individuals receive assistance in understanding the job task and learning how to deal with issues. In mentoring sessions, the mentor is not only the supervisor but can also be a peer. One of the highlighted answers comes from Respondent 6, where the manager serves as a mentor to the staff, guiding them in their data analysis methods.

"I dedicate my time to teaching my team. First, I will give a brief explanation and ask them to process some data. Then, I will let them work directly with the data and try to process it according to their own senses. After that, I will evaluate and have discussions with them about how they read the data; if there is any correction needed, then I will teach them" (Finance Team, Telecommunication Company)

4.3.2.2 Data Pulling

To improve data pulling, both DDI improvements should focus on technical capabilities. Enhancing proficiency in data processing and visualization skills is crucial for the DDI Business Process. Meanwhile, the DDI product primarily focuses on proficiency in utilizing data extraction applications like SQL. According to the strategy for improvement, company training in this area is critical to ensuring employees have the same knowledge and skillsets needed for technical activities related to their job description. Respondent 14, who works in DDI Business Process, mentioned how supervisors have the role of deciding what kind of technical training is needed by the staff, and technical training usually concerns their related job tasks, such as Excel and PowerPoint. On the other hand, for the DDI product, more complex technical capabilities to extract data are needed, such as to enhance their programming and SQL skills. Respondent 7 mentioned that the company commonly facilitates team training, whether internal or external, with a flexible budget, and encourages them to participate in trainings.

The next strategy is to tighten the recruitment process and test their technical skills during the selection process. Each team has its own requirements to determine at which level the candidates must pass in order to be selected. In the DDI Business Process, Respondent 2 highlights the requirements and tests to select team members using the basic formulas that are usually used in daily tasks.

"During the recruitment process, I test candidates on basic data processing tasks in Microsoft Excel, such as pivot tables, data manipulation, graph creation, and other basic tasks. Even though I'm hiring for staff-level positions, I ensure they can think about how to process and present data" (Supply Chain Team, Manufacture Company)

Meanwhile, Respondent 12, who works in DDI Product, emphasizes the need for certain levels of SQL skills to join the team. These skills were previously not mandatory, but the requirement has been updated to make them one of the main skillsets needed.

"After benchmarking with other similar teams, we determined that a SQL team was necessary to meet our team's requirements. During the recruitment process, SQL tests were conducted, and we collaborated with an SQL expert to check the answer" (Logistics Team, Tech Company)

The mentoring session also applies to the data pulling process. Respondent 2 explained how the team implements regular reporting rules. This means each team member should be able to learn how to technically create the reports; hence, they need to learn from their peers or ask their supervisor. Respondents 10, 11, and 14 also highlighted how they groom the team members to improve their capabilities.

"I teach my subordinates, especially how to make strategic presentations. I share knowledge and experience with my subordinates so that they can adapt their learning methods, particularly those related to data processing and presentation making. Also, I encourage they learn from other teams that make strategic presentations." (Business Development, Financial Service Company)

4.3.2.3 Design and Execution Innovation

Meanwhile, in designing innovation and execution, both the DDI business process and product require a strong emphasis on improving competencies in interpersonal communication, negotiation, and teamwork. The activities are closely tied to collaborating with internal and external parties, highlighting the need for communication to ensure success.

To improve these actions in relation to company training, the strategy is to facilitate soft skills training that can be adjusted to each department's needs. Respondents 2, 4, 5, and 14 emphasized the importance of supervisors and HR in conducting and ensuring the team receives the

necessary training, including soft skills training. For example, the trainings cover topics such as effective communication, delivering presentations, and resolving partner management issues. In the meantime, companies are focusing their recruitment strategy on examining candidates' experience in handling issues from their previous jobs or life experiences. For instance, Respondent 8 mentions that during the interview process, project management experiences will be examined.

"When interviewing candidates, I dig into detailed skills from previous work experiences to see how familiar candidates are with data and how big of a project they have experience managing. This method allows me to assess their project management skills, as we require individuals with specific experience to manage large-scale projects" (Business Development, E-commerce Company)

For the mentoring session, knowledge sharing from more experienced people is important to improve their capabilities. Respondent 15 stated that a one-on-one session was held, and the manager worked closely with team members and mentored them on how to engage with partners. During the design of innovation, respondents 8 and 11 highlight how they groom their subordinates by involving them in meetings and activities that include other teams and higher-level positions. The purpose of this is so the subordinates can see the real situation of the activities, take note of what could be adapted and what is right or wrong, and take that as learning.

5. Discussion and Recommendation

This chapter will present interesting findings from the research. The discussion will focus on the results and discoveries, their correlation with current published research, and their practical implications. Additionally, we will address future recommendations for potential areas of exploration in future research, as well as the limitations of this study.

5.1 Discussion

5.1.1 The Importance of Non-technical Capabilities

Non-technical capabilities emerged as the most important skills required in both DDI Business Processes and Product. These capabilities encompass not only working with and thinking about data, but also personal attributes and social skills such as communication, stakeholder management, and project management.

When people hear "Data Driven Innovation," they often assume it is solely about data and technical matters involving big computers and advanced software. While proficiency with data processing tools is important, the true essence of working with data lies in understanding and deriving insights from it. In order to understand the data, employees need to know the context and purpose of the data and innovation itself. The potential offered by intelligent technologies requires proactive human involvement to extract value from data (Chen et al., 2015).

People responsible for the DDI project need to have both the skills and motivation to carry out related tasks, including technical data analysis and deriving insights from the data. They should also possess personal attributes like self-motivation and a willingness to improve. The DDI process extends beyond just the idea phase. To foster good innovation, the initial data processing and execution need careful planning and implementation. Those involved in DDI should be able to decide what types of data to collect, how to communicate with stakeholders, handle technical execution, determine evaluation metrics, and more. Wulff and Finnestrand (2022) point out that while data is digitized and collected automatically, the decision on what data to record is made by those performing the tasks, requiring knowledge to meet expectations. This highlights the importance of human judgment, which goes beyond machine-related activities.

Effective communication skills are crucial for interacting with various teams involved in the process, including both internal and external parties. Research by Ayuso et al. (2011) indicates that knowledge gained from interactions with stakeholders contributes to a company's sustainable innovation. Collaborating with these parties provides different perspectives, insights, and knowledge that foster innovative ideas. Xu et al. (2022) emphasized the importance of good communication in conveying data analysis insights to stakeholders. This includes not only communicating analysis results but also coordinating tasks, such as asking other teams to pull data or requesting support from logistics partners. Interpersonal skills ensure that all parties have a shared understanding of the innovation, which is essential for executing details as expected. Effective communication also involves negotiating and persuading stakeholders to agree with and support our plans. Interacting with external parties can also be beneficial to the company. Ernst and Rübsaamen (2010) highlighted that integrating external information and diverse functional skills into the innovation process increases the likelihood of success. However, it's important to limit the use of external information to what is applicable to the business. For example, data agencies might share information on a country's macroeconomic conditions and product category growth, which can be beneficial. Still, companies should not blindly accept all external information. It's crucial to understand the context and consider internal factors to set realistic ambitions suitable for the company's market position. It can be deduced that non-technical skills are essential in the context of Data Driven Innovation (DDI) for both Business Processes and Products. Furthermore, it is important to note that the entire DDI process encompasses more than simply data. This research supported Visvizi et al. (2021), who argued that innovation inherently involves technological, human, knowledge-based, social, and relational elements.

From a practical perspective, respondents frequently emphasized the importance of non-technical capabilities. They mentioned that basic technical skills are sufficient, but the ability to generate insights from data is more crucial. Non-technical capabilities are also a key consideration when recruiting team members. Respondents highlighted that non-technical capabilities are vital for interpreting and applying data insights effectively. They noted that these capabilities enable better collaboration and decision-making across departments. Nonetheless, the balance between technical and non-technical skills depends on the specific tasks assigned to the personnel. For desk jobs involving administrative tasks, technical skills should be prioritized. In contrast, for roles that involve client interaction, non-technical skills are more crucial.

From this discussion, we can conclude that the importance of non-technical skills is evident in both theory and practice. However, the degree of importance varies based on the job and the company's needs.

5.1.2 Building Capabilities Within the Company

Throughout the DDI process, the management of capabilities is closely intertwined with the personnel involved in the relevant teams. The recruitment process and training are some of the methods that companies use to ensure the existence of needed capabilities. During recruitment, the selection process plays an important role in filtering and selecting personnel with the necessary skills. Meanwhile, company training helps employees increase their capabilities in doing their tasks. However, an intriguing aspect revealed by this research is the informal methods employed to enhance personnel capabilities within the process.

On-the-job training, frequently cited in the findings, emerges as a popular method for training employees. Engaging in tasks involving external parties allows employees to accumulate the experience and knowledge necessary for mastering activities. Theoretical knowledge is important, but practical experience is crucial because it gives employees a real world understanding of situations. Hence, on-the-job training has become a common approach for building capabilities within companies, proven effective by leaders in grooming employees. Continuous skill development through on-the-job and off-the-job training programs can enhance employee creativity and innovation, ultimately benefiting the organization (Boadu et al., 2018). This highlights the individual and organizational benefits of on-the-job training. However, companies must approach on-the-job training cautiously, as employees may face situations they are not yet experienced enough to handle. For example, if an employee makes informal agreements or engages in sensitive discussions with partners, it could harm the company's professional image. Similarly, if an employee speaks on behalf of the company without consulting their managers, it could negatively affect public perception. Constant monitoring and guidance are necessary to inform employees about the rules and prevent actions that could damage the company's reputation and project an unprofessional image.

Additionally, the implementation of knowledge-sharing sessions within teams is another noteworthy method of knowledge transfer. While formal company training programs are valuable, they may prove too generic for real-world tasks. In contrast, team-based knowledge-sharing sessions focus specifically on the tasks performed daily in a less formal and rigid setting, fostering a relaxed atmosphere conducive to open communication. This approach also aids in bridging knowledge gaps within teams. By embracing both formal training and informal knowledge-sharing practices, companies can effectively bolster personnel capabilities, ensuring adeptness in navigating the complexities of the DDI process. According to Sekareza et al. (2022), facilitating knowledge sharing among employees enables the dissemination of collective knowledge within an organization, leading to efficient resource utilization and innovation. Additionally, sharing knowledge in a more flexible manner can speed up the process of spreading information, eliminating the need to wait for scheduled training sessions. This method can be more time and cost efficient. When employees gain new knowledge, they become more capable, which enhances job efficiency. With more efficient processes, employees can dedicate more time to valuable tasks that generate innovative ideas. Consequently, this not only enhances the skills of employees but also contributes to improving the overall company performance.

5.1.3 The Role of Leadership

The results of this study regarding data and innovation also highlight the consistent acknowledgement among respondents of the pivotal role played by top management in DDI activities. While DDI ideally emerges from data analysis and the cultivation of ideas rooted in quantifiable data sources, the organizational hierarchy within companies necessitates the recognition of higher positions with distinct scopes and responsibilities. The role of top management goes beyond mere approval, they hold leadership positions and are responsible for setting the direction of the company. Individuals in these roles typically possess expertise in business domains or extensive industry experience, underscoring their significance in guiding innovation initiatives. This underscores the assertion by Kwon et al. (2022) that innovation requires more than just innovative concepts; it necessitates financial backing, creative human resources, well-structured organizations, and appropriate regulatory frameworks to foster developmental processes. These elements are integrated throughout the entire company, and leaders have the capacity and authority to manage them. The leader's role is crucial because they can implement the DDI approach within the company. Leaders may also have different agendas, which should be considered during DDI development.

Several respondents concurred on the crucial role of top management in initiating and deciding on new initiatives. High-level executives also serve as valuable information sources during the data analysis phase, providing insights or historical perspectives on previous initiatives within the company. This underscores the importance of organizational functions, including leadership, in driving innovation processes. Effective leadership facilitates companies in acquiring, utilizing, and disseminating corporate knowledge, thereby enhancing the adoption and implementation of new business concepts (Shahzad et al., 2021). To achieve effective leadership, leaders must possess adequate skills and knowledge, which enable them to make decisions and give the right suggestions or constructive feedback for the company. Kadarsah et al. (2023) mentioned that knowledge-oriented leadership significantly influences innovation capabilities, particularly in explorative innovation, and indirectly impacts both explorative and exploitative innovation through the maturity of data analytics. This highlights the pivotal role of leaders not only in DDI processes but also in all company activities that may intersect with DDI initiatives. Therefore, leaders must possess the requisite skills and knowledge to drive business in the right direction and manage DDI activities effectively.

5.2 Recommendation

5.2.1 Implication

In the DDI process, various actions and associated capabilities are crucial for the project's success. Different departments within a company have unique functions, expertise, and responsibilities, making multi-department collaboration essential for the DDI process. Each action in DDI requires specific capabilities, varying in importance. For example, data pulling demands programming skills and software proficiency, while data analysis prioritizes analytical and critical thinking skills. Companies must ensure that personnel involved in specific activities possess the necessary skills. Non-technical capabilities are vital for generating ideas, fostering teamwork, and executing projects, regardless of whether the innovation relates to business processes or products. Although actions within both types of DDI follow similar patterns, they differ in the scope of innovations created and their impact on the company. Non-technical skills are also important for effective communication between departments during the study and discussion phases. Additionally, companies should address issues that arise in the current DDI process to improve the quality of particular actions. This involves recognizing the necessary steps and components of DDI and understanding what actions the company should take to improve their current DDI process. When the organization faces issues with project delays, it is crucial to prioritize the enhancement of project management abilities among the individuals heading the project.

Top management plays a critical role in providing direction, which is typically delivered in broad, general terms without detailed operational guidance. Ensuring that both higher-level management and the operational teams share a common understanding is vital to meeting expectations. In order to accomplish this, it is crucial to have regular updates and reporting to ensure that all parties have a clear understanding of the present situation and are in agreement regarding potential action steps. Conducting weekly meetings to discuss internal team progress and monthly meetings to involve all project team members can provide everyone with the same knowledge of the project and comprehension of each other. Forming a dedicated project team can be advantageous in bigger companies, as it serves as an intermediary between top management and staff. This team can effectively support the goals of senior executives while also comprehending the current circumstances at the operational level, acting as both a consultant to senior management and a spokesperson for employees.

In terms of building capabilities, it is not solely the responsibility of the company but also of the individuals involved, including leaders and team members. The company, as the facilitator, and the employees, as participants, need to actively engage and be encouraged to improve their skills. For example, the HR department should provide and share training programs with the entire company. Leaders should consistently monitor their team members' participation, and team members should actively support and participate in these trainings. Furthermore, this can be integrated into company policy, such as requiring employees to complete a certain amount of training each year or qualify for promotions. Implementing such regulations ensures that employees receive skill training as they advance within the company.

This research contributes by providing empirical results that reflect the reality of DDI projects. While there are already theories on DDI, this also provides insights from practitioners who have implemented these projects. Consequently, the findings contribute to understanding how the data supports or contradicts common perceptions of the DDI process. This research gives valuable insights into the practical execution of DDI processes and highlights areas for improvement.

5.2.2 Limitation and Future Research

This research has several limitations. The study involved a total of 15 respondents, which may not fully cover the diverse range of companies and industries in Indonesia. Due to time limitations, this research was not able to explore more sectors and gather perspectives from different job positions. Adding more participants from different sectors might give more insights about the actions and capabilities involved in DDI. For instance, such a perspective from a practitioner in the creative industry might bring additional capability for understanding niche sectors. Therefore, it is important to consider the industry sector when interpreting the results of this study. Additionally, the interviews were conducted online, which may have restricted the ability to capture non-verbal expressions and nuances. Time constraints and differences in respondents' schedules might also have impacted the depth and completeness of the responses. Because the respondents were employees with various tasks and responsibilities, there is a possibility of incomplete or biased answers. The researcher's analysis also contains potential biases that could impact the research's outcome. This research analysis is influenced by the academic perspective of engineering and management. The same topic explored by a purely engineering approach might result in a more technical explanation of technology, tools, and machines, less from a management point of view. Nevertheless, this research should be considered primarily for academic purposes and treated decently.

Future research could benefit from exploring other regions to gain unique insights into the conditions of the DDI process in those areas. The country's unique market and characteristics might affect the types of DDI projects conducted. This DDI project could potentially lead to different DDI processes involved in the process of idea development. Additionally, more diverse industries could bring different perspectives on actions and capabilities. Data from a wide range of industry sectors could provide various details of the DDI process component, which can potentially leading to different priorities and rankings of capabilities in the actions. For the interview methods, conducting the interview in person can provide other perspectives. The

researcher can perceive the respondent's emotional state, which provides more opportunities to explore the narrative in depth. Additionally, the interviewer may find it easier to communicate their own emotions. Furthermore, different perspectives on data analysis could potentially yield diverse results for the research. This could potentially enrich how to implement the process in practice from other perspectives and bring knowledge to the people who are indirectly involved or affected by DDI projects.

6. Conclusion

In this research, we set out to explore Data Driven Innovation (DDI) in Business Processes and Product within Indonesian companies. Indonesia, one of the most populated countries with a large market and consumption, presents an intriguing topic for discussion. Furthermore, previous studies have not sufficiently explored the phenomenon of DDI in Indonesia. As a result, this research aims to fill the knowledge gap from a scientific perspective while also introducing the element of DDI practice. We conducted interviews with experienced practitioners in DDI projects to uncover the actions involved in DDI, along with the associated technical and non-technical capabilities. Furthermore, this study investigated the barriers encountered and developed strategies to improve the DDI process in future instances.

Revisiting the main research question, it asks about the capabilities required for developing a data-driven innovation process and strategies to enhance it. The research findings indicate that non-technical capabilities significantly contribute to the entire DDI process, despite the data-driven nature of the phenomenon. The result also provides a more comprehensive understanding by detailing the actions involved in the DDI process, their associated capabilities, and the main issues. It is also showing the importance and rank of capability for each of the actions involved in the DDI. Furthermore, this research identifies common issues that arise in the DDI process and identifies areas for improvement to enhance the overall process. In order to improve DDI in both business processes and products, it is crucial to prioritize the development of analytical thinking capabilities for data collection and data analysis actions. This involves understanding the data, being able to recognize data patterns, and making effective decisions. Additionally, by enhancing design innovation and execution, one can achieve improvements by prioritizing communication proficiency. This includes negotiating the project design with related stakeholders to accommodate different agendas, as well as effectively communicating the new project to partners to ensure their willingness to join. In terms of data pulling, DDI business processes benefit from proficiency in basic data processing tools such as Microsoft Excel, while DDI Product require competence in extracting data from databases using tools like SQL. The strategy to improve both DDI is to focus on the highlighted actions while also building up capabilities by implementing company training, tightening recruitment process, and, specifically for DDI Business Process also by conducting mentoring session. Our research also reveals interesting findings, indicating that on-the-job training is a common method and that the implementation of knowledge-sharing sessions effectively addresses knowledge deficiencies within team members. Another intriguing insight is the substantial influence of top management on DDI projects. Their participation is essential not only for obtaining project approval but also for establishing the company's strategic direction. Top management is frequently involved in the DDI process, so it is important to consider their agenda when developing DDI projects.

In conclusion, this study provides a comprehensive analysis of DDI and its associated capabilities. It is also interpreted further to develop a strategy for improvement for the DDI process. This research contributes to academic understanding, filling the knowledge gap on the designated topic while offering practical insights for implementation within companies.

References

Akman, G. and Yılmaz, C. (2008). Innovative capability, innovation strategy and market orientation: an empirical analysis in turkish software industry. International Journal of Innovation Management, 12(01), 69-111. https://doi.org/10.1142/s1363919608001923

Alghamdi, O., & Agag, G. (2023). Competitive advantage: A longitudinal analysis of the roles of data-driven innovation capabilities, marketing agility, and market turbulence. *Journal of Retailing and Consumer Services*, *76*, 103547. https://doi.org/10.1016/j.jretconser.2023.103547

Alwis, R. S., & Hartmann, E. (2008). The use of tacit knowledge within innovative companies: knowledge management in innovative enterprises. *Journal of Knowledge Management*, *12*(1), 133–147. https://doi.org/10.1108/13673270810852449

Amit, R., & Schoemaker, P. J. H. (1993). Strategic assets and organizational rent. Strategic Management Journal, 14(1), 33–46. https://www.jstor.org/stable/2486548

Ayuso, S., Rodríguez, M. Á., García-Castro, R., & Ariño, M. Á. (2011). Does stakeholder engagement promote sustainable innovation orientation?. Industrial Management &Amp; Data Systems, 111(9), 1399-1417. https://doi.org/10.1108/02635571111182764

Babachenko, L., Verbytska, A., & Lysenko, I. (2023). Product innovation policy as a component of marketing activities of companies in b2c and b2b markets. Market Infrastructure, (73). https://doi.org/10.32782/infrastruct73-6

Barney, J. (1991). Firm resources and sustained competitive advantage. Journal of Management, 17(1), 99–120. https://doi.org/10.1177/014920639101700108

Bleier, A., Goldfarb, A., & Tucker, C. (2020). Consumer privacy and the future of data-based innovation and marketing. *International Journal of Research in Marketing*, *37*(3), 466–480. https://doi.org/10.1016/j.ijresmar.2020.03.006

Boadu, F., Xie, Y., Du, Y., & Dwomo-Fokuo, E. (2018). Mnes subsidiary training and development and firm innovative performance: the moderating effects of tacit and explicit knowledge received from headquarters. Sustainability, 10(11), 4208. https://doi.org/10.3390/su10114208

Briard, T., Jean, C., Aoussat, A., & Véron, P. (2023). Challenges for data-driven design in early physical product design: A scientific and industrial perspective. *Computers in Industry*, *145*, 103814. https://doi.org/10.1016/j.compind.2022.103814

Brynjolfsson, E., Hitt, L. M., & Kim, H. H. (2011). Strength in numbers: How does data-driven decisionmaking affect firm performance?. Available at SSRN 1819486.

Colombari, R., Geuna, A., Helper, S., Martins, R., Paolucci, E., Ricci, R., & Seamans, R. (2023). The interplay between data-driven decision-making and digitalization: A firm-level survey of the Italian and U.S. automotive industries. *International Journal of Production Economics*, *255*, 108718. https://doi.org/10.1016/j.ijpe.2022.108718

Chen, D.Q., Preston, D.S. and Swink, M. (2015), "How the use of big data analytics affects value creation in supply chain management", Journal of Management Information Systems, Vol. 32 No. 4, pp. 4-39.

Crowe, S., et al. (2011). The case study approach. BMC Medical Research Methodology, 11(1). https://doi.org/10.1186/1471-2288-11-100

Damanpour, F. (1991). Organizational innovation: A meta-analysis of effects of determinants and moderators. Academy of management journal, 34(3), 555-590.

Dangelico, R. and Pontrandolfo, P. (2013). Being 'green and competitive': the impact of environmental actions and collaborations on firm performance. Business Strategy and the Environment, 24(6), 413-430. https://doi.org/10.1002/bse.1828

Dorr, D. A., Cohen, D. J., & Adler-Milstein, J. (2018). Data-driven diffusion of innovations: successes and challenges in 3 large-scale innovative delivery models. Health Affairs, 37(2), 257-265. https://doi.org/10.1377/hlthaff.2017.1133

Dremel, C., Herterich, M. M., Wulf, J., & Brocke, J. V. (2020). Actualizing big data analytics affordances: A revelatory case study. *Information & Management*, *57*(1), 103121. https://doi.org/10.1016/j.im.2018.10.007

Eisenhardt, K. M. (1989). Building Theories from Case Study Research. Academy of Management Review, 14(4), 532. https://doi.org/10.2307/258557

Eriksson, T., & Heikkilä, J. (2023). Capabilities for data-driven innovation in B2B industrial companies. *Industrial Marketing Management*, *111*, 158–172. https://doi.org/10.1016/j.indmarman.2023.04.005

Ernst, H., Hoyer, W. D., & Rübsaamen, C. (2010). Sales, marketing, and research-and-development cooperation across new product development stages: implications for success. Journal of Marketing, 74(5), 80-92.

Fabijan, A., Dmitriev, P., Olsson, H., & Bosch, J. (2017). The evolution of continuous experimentation in software product development: from data to a data-driven organization at scale.. https://doi.org/10.1109/icse.2017.76

Flyvbjerg, B. (2006). Five misunderstandings about Case-Study research. Qualitative Inquiry, 12(2), 219–245. https://doi.org/10.1177/1077800405284363

Förster, M., Bansemir, B., & Roth, A. (2022). Employee perspectives on value realization from data within data-driven business models. *Electronic Markets*, *32*(2), 767–806. https://doi.org/10.1007/

Foster, N. (2016). The value of data: Applying analytics in the enterprise. International Journal of Data Science, 7(3), 256-269.

Froehlich, C. and Bitencourt, C. C. (2019). As capacidades dinâmicas para o desenvolvimento da capacidade de inovação. Revista De Administração Da UFSM, 12(2), 286-301. https://doi.org/10.5902/1983465918308

Garry, T. (2018). Business-to-Consumer (B2C) Marketing. In: Augier, M., Teece, D.J. (eds) The Palgrave Encyclopedia of Strategic Management. Palgrave Macmillan, London. https://doi.org/10.1057/978-1-137-00772-8_22

Grab Indonesia. (2020, March 16). Berikan lebih banyak layanan & fitur inovatif, Grab Manfaatkan Big Data | Grab ID. Retrieved from https://www.grab.com/id/press/tech-product/berikan-lebih-banyak-layanan-fitur-inovatif-grab-manfaatkan-big-data/

Granados, C. B., Ayala, Y., & Rámos-Mejía, M. (2024). Is it substantive or just symbolic? Understanding innovation theater in organisations: The case of technology-based innovation. *Technovation*, *129*, 102880. https://doi.org/10.1016/j.technovation.2023.102880

Halper, F., & Stodder, D. (2017). What it takes to be data-driven. TDWI Best Practices Report, December, Issue. Retrieved from https://media.bitpipe.com/io_14x/io_141315/item_1674359/TDWI_BPReport_Q417.pdfs12525-021-00504-0

Hippel, E. V. (1988). The sources of innovation. New York, NY: Oxford University Press. Retrieved from http://bvbr.bib-bvb.de:8991/F?func=service&doc_library=BVB01&local_base=BVB01&doc_number=000505051&sequence=000002&line_number=0001&func_code=DB_RECORDS&service_type=MEDIA.

Iliadis, A. and Russo, F. (2016). Critical data studies: an introduction. Big Data & Society, 3(2), 205395171667423. https://doi.org/10.1177/2053951716674238

Isabelle, D. A., Westerlund, M., Mane, M., & Leminen, S. (2020). The Role of Analytics in Data-Driven Business Models of Multi-Sided Platforms: An exploration in the food industry. *Technology Innovation Management Review*, *10*(7), 4–15. https://doi.org/10.22215/timreview/1371

Jimenez-Jimenez, D., & Raquel, S. (2011). Innovation, organizational learning, and performance. Journal of Business Research, 64(4), 408–417.

Jin, P., Mangla, S. K., & Song, M. (2021). Moving towards a sustainable and innovative city: Internal urban traffic accessibility and high-level innovation based on platform monitoring data. *International Journal of Production Economics*, *235*, 108086. https://doi.org/10.1016/j.ijpe.2021.108086

Johnston, P., Fioratou, E., & Flin, R. (2011). Non-technical skills in histopathology: definition and discussion. Histopathology, 59(3), 359-367. https://doi.org/10.1111/j.1365-2559.2010.03710.x

Kadarsah, D. R. a. K., Govindaraju, R., & Prihartono, B. (2023). The role of Knowledge-Oriented Leadership in Fostering Innovation Capabilities: The mediating role of data Analytics maturity. IEEE Access, 11, 129683–129702. https://doi.org/10.1109/access.2023.3333915

Khaligh, A., Haghighi, M. S., Nazari, M., & Hosseini, H. K. (2020). An exploratory model of competitive advantage through dynamic capabilities and differentiation approach for knowledge-based companies.. https://doi.org/10.21203/rs.3.rs-42614/v1

Kwon, O., Lim, S., & Lee, D. H. (2020). Innovation patterns of big data technology in large companies and start-ups: an empirical analysis. Technology Analysis & Strategic Management, 33(9), 1052–1067. https://doi.org/10.1080/09537325.2020.1864315

Labadie, C. and Legner, C. (2023). Building data management capabilities to address data protection regulations: learnings from eu-gdpr. Journal of Information Technology, 38(1), 16-44. https://doi.org/10.1177/02683962221141456

Lawson, B., & Samson, D. (2001). DEVELOPING INNOVATION CAPABILITY IN ORGANISATIONS: a DYNAMIC CAPABILITIES APPROACH. International Journal of Innovation Management, 05(03), 377–400. https://doi.org/10.1142/s1363919601000427

Lu, Z. and Cai, Z. (2023). Cueing roles of new energy vehicle manufacturers' technical capability and reputation in influencing purchase intention in china. Frontiers in Energy Research, 10. https://doi.org/10.3389/fenrg.2022.1032934

McAfee, A. and Brynjolfsson, E. (2012) Big Data: The Management Revolution. Harvard Business Review.

Moreno, T., Almeida, A., Ferreira, F., Caldas, N., Toscano, C., & Azevedo, A. (2021). Digital twin for manufacturing equipment in industry 4.0. Advances in Transdisciplinary Engineering. https://doi.org/10.3233/atde210062

Mortati, M., Magistretti, S., Cautela, C., & Dell'Era, C. (2023). Data in design: How big data and thick data inform design thinking projects. *Technovation*, *122*, 102688. https://doi.org/10.1016/j.technovation.2022.102688

Nurhayati, W. (2018). The effect of product innovation and innovation process on performance of manufacturing companies listed in indonesia stock exchange during 2014-2016. Russian Journal of Agricultural and Socio-Economic Sciences, 80(8), 42-49. https://doi.org/10.18551/rjoas.2018-08.06

OECD. (2005). Measurement of scientific and technological activities, Oslo manual. Paris: Organization for Economic Cooperation & Development. Retrieved from https://ebookcentral.proquest.com/lib/[SITE_ID]/detail.action?docID=514749.

Penrose, E. (1959). The theory of the growth of the firm (reprinted 1995 ed.). Oxford: Oxford University Press. https://doi.org/10.1093/0198289774.001.0001/acprof-9780198289777-chapter-1. Retrieved from.

Pérez, J. E. A. and Lozada, N. (2021). Fostering big data analytics capability through process innovation: is management innovation the missing link?. Business Information Review, 38(1), 28-39. https://doi.org/10.1177/0266382120984716

Pham, C. T. A., Magistretti, S., & Dell'Era, C. (2021). The role of design thinking in Big Data innovations. *Innovation: Management, Policy and Practice*, *24*(2), 290–314. https://doi.org/10.1080/14479338.2021.1894942

Pikkarainen, M., Huhtala, T., Kemppainen, L., & Häikiö, J. (2020). Success factors for data–driven service delivery networks. *Journal of Innovation Nanagement*, *7*(4), 14–46. https://doi.org/10.24840/2183-0606_007.004_0003

Rammer, C., & Es-Sadki, N. (2023). Using big data for generating firm-level innovation indicators - a literature review. *Technological Forecasting and Social Change*, *197*, 122874. https://doi.org/10.1016/j.techfore.2023.122874

Rao, S. (2021). Data-driven business model innovation for 6g. Journal of Ict Standardization. https://doi.org/10.13052/jicts2245-800x.935

samy shafik, n., Ragheb, M. A., Omar, F., & Sadek, H. H. (2024). Influence of innovation capabilities and customer experience on loyalty: empirical study in the egyptian private hospitals. المجلة العربية للإدارة, 0(0), 1-14. https://doi.org/10.21608/aja.2024.273726.1601

Schirone, D. and Torkan, G. (2012). Innovation: challenges & perspectives. International Journal of Management & Information Technology, 2(1), 63-66. https://doi.org/10.24297/ijmit.v2i1.1411

Sekareza, A., Sulistiyani, E., & Inayah, I. (2022). Situational leadership, knowledge sharing, work stress on employee performance and their impact on employee performance. International Journal of Economics Business and Accounting Research (Ijebar), 6(2), 696. https://doi.org/10.29040/ijebar.v6i2.4839

Shehzad, M. U., Davis, K., & Ahmad, M. S. (2020). KNOWLEDGE-ORIENTED LEADERSHIP AND OPEN INNOVATION: THE MEDIATING ROLE OF KNOWLEDGE PROCESS AND INFRASTRUCTURE CAPABILITY. International Journal of Innovation Management, 25(03), 2150028. https://doi.org/10.1142/s1363919621500286

Sorescu, A. (2017). Data-driven business model innovation. Journal of Product Innovation Management, 34(5), 691-696. https://doi.org/10.1111/jpim.12398

Sousa, M. J., Martins, J. M., & Sousa, M. (2018). Green energy as a driver for green economy and organizations' sustainability. Management and Economics Research Journal, 4(2), 242-260.

Stein, B., & Morrison, A. (2012). The enterprise data analytics value chain: From data to decisions. Journal of Business Analytics, 5(2), 123-135.

Subramaniam, M. and Youndt, M. A. (2005). The influence of intellectual capital on the types of innovative capabilities. Academy of Management Journal, 48(3), 450-463. https://doi.org/10.5465/amj.2005.17407911

Sultana, S., Akter, S., & Kyriazis, E. (2022). How data-driven innovation capability is shaping the future of market agility and competitive performance? *Technological Forecasting and Social Change*, *174*, 121260. https://doi.org/10.1016/j.techfore.2021.121260

The World Bank, International Finance Corporation. (2019, October). CREATING MARKETS IN INDONESIA UNLOCKING THE DYNAMISM OF THE INDONESIAN PRIVATE SECTOR. Retrieved from https://documents1.worldbank.org/curated/ar/774611582289016364/pdf/Creating-Markets-in-Indonesia-Unlocking-the-Dynamism-of-the-Indonesian-Private-Sector.pdf

Trabucchi, D., Buganza, T., Dell'Era, C., & Pellizzoni, E. (2017). Exploring the inbound and outbound strategies enabled by user generated big data: Evidence from leading smartphone applications. *Creativity and Innovation Management*, *27*(1), 42–55. https://doi.org/10.1111/caim.12241

Troisi, O., Maione, G., Grimaldi, M., & Loia, F. (2020). Growth hacking: Insights on data-driven decision-making from three firms. *Industrial Marketing Management*, *90*, 538–557. https://doi.org/10.1016/j.indmarman.2019.08.005

Troisi, O., Visvizi, A., & Grimaldi, M. (2023). Digitalizing business models in hospitality ecosystems: toward data-driven innovation. European Journal of Innovation Management, 26(7), 242-277. https://doi.org/10.1108/ejim-09-2022-0540

Turulja, L. and Bajgorić, N. (2016). Innovation and information technology capability as antecedents of firms' success. Interdisciplinary Description of Complex Systems, 14(2), 148-156. https://doi.org/10.7906/indecs.14.2.4

Utoyo, I., Fontana, A., & Satrya, A. (2019). THE ROLE OF ENTREPRENEURIAL LEADERSHIP AND CONFIGURING CORE INNOVATION CAPABILITIES TO ENHANCE INNOVATION PERFORMANCE IN a DISRUPTIVE ENVIRONMENT. International Journal of Innovation Management, 24(06), 2050060. https://doi.org/10.1142/s1363919620500607

Visvizi, A., Troisi, O., Grimaldi, M., & Loia, F. (2021). Think human, act digital: activating data-driven orientation in innovative start-ups. *European Journal of Innovation Management*, *25*(6), 452–478. https://doi.org/10.1108/ejim-04-2021-0206

Widodo, S., Marpaung, Z. S., Santoso, A. D., Al-Fadheeli, M. A., Sulaiman, N. B., Hizam, H. B., . . . Shehab, M. A. (2022). What Makes Public Sector Innovation Sustainable?: A Case Study from Indonesia. TEM Journal, 1376–1384. https://doi.org/10.18421/tem113-48

Winter, S. G. (2003). Understanding dynamic capabilities. Strategic Management Journal, 24(10), 991-995. https://doi.org/10.1002/smj.318

World Bank Open Data. (2018). Retrieved from https://data.worldbank.org/indicator/SP.POP.TOTL?most_recent_value_desc=true

World Intellectual Property Organization. (2023). Global Innovation Index 2023. Retrieved from https://www.wipo.int/edocs/pubdocs/en/wipo-pub-2000-2023/id.pdf

Wulff, K., & Finnestrand, H. (2023). Datengesteuerte Information zum Handeln. *Gruppe. Interaktion. Organisation. Zeitschrift Für Angewandte Organisationspsychologie (GIO)*, *54*(1), 65–77. https://doi.org/10.1007/s11612-023-00666-9

Xu, L., Zhang, J., Ding, Y., Sun, G., Zhang, W., Philbin, S. P., & Guo, B. H. W. (2022). Assessing the impact of digital education and the role of the big data analytics course to enhance the skills and employability of engineering students. Frontiers in Psychology, 13. https://doi.org/10.3389/fpsyg.2022.974574

Yin, R. K. (2009). Case Study Research: Design and Methods (4th ed.). Thousand Oaks, CA: Sage Publications.

Yin, R. K. (2011). Applications of case study research (3rd ed.). Thousand Oaks, CA: Sage Publications.

Ying, L., Soroka, A. J., Han, L., Jin, J., & Tang, M. (2020). Cloud-based big data analytics for customer insight-driven design innovation in SMEs. *International Journal of Information Management*, *51*, 102034. https://doi.org/10.1016/j.ijinfomgt.2019.11.002

Appendices

Appendix A

The literature review process began by searching for relevant material on the scientific journal website and narrowing it down to a sufficient number of articles to be evaluated. In this case, Scopus was used to scope the number using the string and filtering features.

Aiming for the expected articles, keywords used are "data analysis", "data driven", "organization", "company", "innovation", and "designing system". Additionally, the searching narrowed down by filtering into subjects "Business, Management and Accounting", "Engineering", "Decision Sciences", journal source type, and final publication stage. The result generated was sorted by relevancy to get the effective result, and the first 50 articles were chosen to be reviewed.

The first screening process used titles and abstracts to identify the related articles; this resulted in 22 articles chosen. The next process is second screening, which involves examining the content of the articles, including things like methodology, and delving into discussion sections. From the second screening, 4 articles couldn't be accessed, and 4 others were excluded since they were outside of the expected topic. At the end, there are 14 articles included in the literature review.
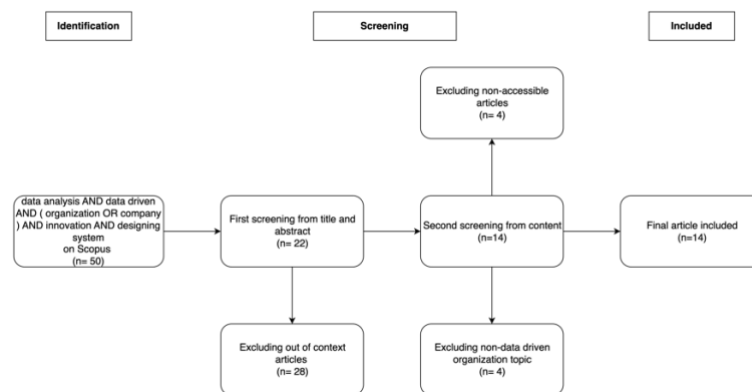

Figure 1 Articles Selection Process

These 14 articles were reviewed and categorized based on the discussions. The synthesis of this literature takes into account the topic of discussions and how the research approach relates to DDI and capabilities. Below is a summary of what is discussed in the articles, as well as their categorization.

Table 16 Summary of articles synthesis

Author and Year	Discussion	Category
Dremel et al. (2020)	Investigate the actualization of Big Data Analytics using Affordance Actualization Model	Specific product approach
Briard et al. (2023)	The challenge of data driven design research in early phases of physical product development process	Specific product phase discussion
Mortati et al. (2023)	Investigate characteristics of design thinking activity and the balance use of big data and thick data	Human related approach
Pham et al. (2022)	Investigate how design thinking can foster innovation based on big data technology	Human related approach
Förster et al. (2022)	Understanding employees perspective regarding value realization of data	Human related approach

Visvizi et al. (2021)	Investigate the drivers of innovation management in contemporary data driven organization	Human related approach
Colombari et al. (2023)	Explore data driven decision making system contribute to operational performance and new technology role on DDM	Business process focus
Troisi et al. (2020)	Investigate the role of cognitive computing and big data analytics in redefining business process	Business process focus
Pikkarainen et al. (2019)	Explore the success factor of data driven service networks	General Context
Isabelle et al. (2020)	Explore how multi-sided platforms can utilize data to develop data driven business model	General Context
Trabucchi et al. (2018)	Observe how user generated big data can contribute to user innovation	Secondary data approach
Sultana et al. (2021)	Scrutinized a systematic process for developing analytics based data driven innovation	Secondary data approach
Wulff & Finnestrand (2023)	Discuss how data may be gathered and used in organizations striving to become data-driven	Data related activities discussion
Eriksson & Heikkilä (2023)	Examine organizational and marketing capabilities of data driven innovation in B2B companies	Technology and Marketing Capability

Appendix B

Interview Guide (Semi-structured interview)

The initial question has purpose to identify basic thing, since the respondents are from diverse background of job position and company industry. This will be nice to bring the conversation lightly while getting to know more about their professional background. In this digitalization context, data and information are the fundamental aspects of innovative technologies and the driver for new opportunities and collaborations between industrial companies and services suppliers (Moreno et al., 2021). To explore how essential the data used and treated in the company, we are going to ask this as the initial question. Then, the need to understand further in what context of company industry and environment is actually the data circulate. Companies can achieve continuous improvement by generating innovative ideas and adopting new methodologies that align with the social and economic context in which they operate (Schirone & Torkan, 2012). Hence, in the beginning the questions asked:

- Respondent's job position and the company industry they worked in. Asking about their job describing in general, types of products sell by the company and glance of customers or partners.
- Respondent's experience working with data in general. Regarding how often they look at the data, types of data, the activities they did with the data

Then we are going to examining further about the purpose of innovation. The purpose of innovation for the company includes the importance of keeping company on track to achieve better business result (Jimenez-Jimenez & Raquel, 2011) and obtain economic benefits (Von Hippel, 1998). Though the end purpose is related with profitability, there are different ways of achieve that which we would like to identify further to understand the context. In addition, the questions also aim to explore other reason behind innovation and what type of data specifically use for develop innovation. The questions asked:

- The way data utilized in develop something new in the company. Following up to the previous questions about activities they did with the data, then whether they do something after looking at the data
- The purpose of building innovation from that data, what factor triggered them in doing that and how that factor influenced the innovation development

The next questions are starting to identify the DDI projects and all the activities throughout the process. Started with understanding types of DDI, whether it is business process or product, and digging into steps of activity they did in the project. Some of the process identified, benchmarking from the existing articles such as seven steps process (Sultana and Kyriazis, 2021), how the data should be treated (Wulff and Finnestrand, 2022), analytics value chain (Stein, 2012; Foster, 2016). The questions asking specifically what are the actually happen during the process of DDI:

- The detail process of DDI, started with type of project which can be identified by DDI business process or product. Ensure the outcome of DDI is clear and confirm to the respondent if needed
- Data facts used for the process and how the data conveyed, who are the parties they are actively interact in this process, the tools they use to obtain the data
- The way they use the data after being collected, the purpose of treatment towards data. Tools and software they use, what specific activity they did with the data until they can generate the idea and determine on what innovation should be build. The parties involved in this process
- Follow up what they did after the idea was decided until the innovation implemented in the company
- What happened after the innovation launch, any follow up action, how and who did that

Along with the explanation of DDI, respondents might indicate the necessary capabilities by the actors involved. To get more insights, the questions of capabilities also explicitly asked to them. the concept of technical capability in the context of data driven innovation encompasses the organization's ability to develop and utilize advanced technological tools and platforms for data collection, analysis, and interpretation, enabling the extraction of valuable insights and the identification of opportunities for innovation (Dorr et al., 2018; Pérez & Lozada, 2021). Non-technical capability can include managerial and organizational dimensions that extend beyond technical advancements, emphasizing the importance of skills related to effective management, leadership, and organizational processes (shafik, 2024). The capabilities asked narrowed down into two types, technical and non-technical. The question mainly asking:

- Technical Capabilities involved in the process. Explain the respondents the example of technical aspects such as the use of software, programming language, machinery, and so on. Confirm to respondents in where parts of action the capabilities employed and how was it
- Non-technical Capabilities involved in the process, explain them that this includes the capabilities apart from technical such as communication skills. Confirm to them where in particular action the capabilities taking part
- The way they ensure the personnel in the project are occupied with these capabilities

The last part is asking the component revolve around the action to DDI process. With the steps and many actors involved in the process, there should be something that can be generate aside from just the actions. This is beneficial to get more findings about the detail of process, which include challenge they faced. Eriksson & Heikkila¨ (2023) mentioned one of the major challenges in building DDIs is figuring out what can be done with all the data that are available, and defining what kind of data are needed to create value added. Product innovation involves a complex process of technological advancement, responding to changing customer needs, adapting to shorter product life cycles, and facing increased global competition (Nurhayati, 2018). In addition, the question also would like to explore the DDI project position in their daily work and their suggestion towards the finished projects. The purpose of this is for respondents to reflect on their answer, where this also can triggered them to remember any detailed missed in the DDI process. The questions are asking about:

- The issues arise during the process, in what specific actions and who are the related parties
- The way they overcome the issues
- DDI position in their daily task, is it part of daily work or not, and how they managed it. Confirming whether there is specific time dedicated to develop ideas
- Their suggestion on the future DDI project