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CRITICAL SUCCESS FACTORS FOR DATA WAREHOUSE  
IMPLEMENTATION IN AN INDUSTRIAL  
ASSOCIATIONS ORGANIZATION

Miss Phatnarin Khantayana



A Thesis Submitted in Partial Fulfillment of the Requirements  
for the Degree of Master of Engineering in Engineering Management  
(CU-Warwick)

FACULTY OF ENGINEERING

Chulalongkorn University

Academic Year 2022

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ขององค์กรสมาคมอุตสาหกรรม



น.ส.ภัทรนันท์ ชันธญาณะ

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิศวกรรมศาสตรมหาบัณฑิต  
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By	Miss Phatnarin Khantayana
Field of Study	Engineering Management
Thesis Advisor	Professor Dr. PARAMES CHUTIMA

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Accepted by the FACULTY OF ENGINEERING, Chulalongkorn University  
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จุฬาลงกรณ์มหาวิทยาลัย  
CHULALONGKORN UNIVERSITY

ภัทรันธน ชันธญาณะ : ปัจจัยหลักแห่งความสำเร็จสำหรับการดำเนินการระบบคลังข้อมูลขององค์กรสมาคม  
อุตสาหกรรม. ( CRITICAL SUCCESS FACTORS FOR DATA WAREHOUSE IMPLEMENTATION IN  
AN INDUSTRIAL ASSOCIATIONS ORGANIZATION) อ.ที่ปรึกษาหลัก : ศ. ดร.ปารเมศ ชูดิมา

งานวิจัยนี้มีวัตถุประสงค์เพื่อเจาะลึกถึงปัจจัยแห่งความสำเร็จที่สำคัญ (CSFs) ที่เกี่ยวข้องกับการนำคลังข้อมูล (DW) ไปใช้จากมุมมองของผู้มีส่วนได้ส่วนเสียต่างๆ ภายในองค์กร คลังข้อมูลเป็นที่เก็บส่วนกลางที่รวมข้อมูลจากแหล่งต่างๆ ทำให้มีมุมมองที่เป็นเอกภาพและมีโครงสร้างสำหรับข้อมูลขององค์กรเพื่อการวิเคราะห์และการรายงาน การนำระบบคลังข้อมูลไปใช้อย่างประสบความสำเร็จสามารถมีผลกระทบอย่างมีนัยสำคัญต่อประสิทธิภาพโดยรวมขององค์กร เนื่องจากช่วยให้สามารถจัดการข้อมูลได้ดีขึ้น อำนวยความสะดวกในการตัดสินใจได้ดีขึ้น และปรับปรุงการวางแผนเชิงกลยุทธ์

ขอบเขตของการวิจัยนี้ครอบคลุมการตรวจสอบเชิงลึกของ CSF หลักที่เป็นเครื่องมือในการบรรลุความสำเร็จในระหว่างการปรับใช้คลังข้อมูล มุ่งเน้นที่การทำความเข้าใจและวิเคราะห์ปัจจัยที่นำไปสู่ประสิทธิผลและประสิทธิภาพของโครงการระบบคลังข้อมูลจากมุมมองของผู้มีส่วนได้ส่วนเสียที่แตกต่างกัน ผู้มีส่วนได้ส่วนเสียเหล่านี้รวมถึงผู้ใช้ซึ่งเป็นผู้รับประโยชน์หลักของระบบระบบคลังข้อมูลตลอดจนแผนกไอทีที่รับผิดชอบในการดำเนินการทางเทคนิคและการบำรุงรักษา โครงสร้างพื้นฐานระบบคลังข้อมูลนอกจากนี้ พนักงานจากแผนกต่างๆ ที่มีส่วนร่วมอย่างแข็งขันในโครงการระบบคลังข้อมูลก็จะถูกพิจารณาว่าเป็นผู้มีส่วนได้ส่วนเสียที่สำคัญเช่นกัน

เพื่อรวบรวมข้อมูลเชิงลึกที่ครอบคลุม การวิจัยจะใช้วิธีการต่างๆ เช่น การสำรวจ การสัมภาษณ์ และการประชุมเชิงปฏิบัติการเพื่อมีส่วนร่วมกับผู้มีส่วนได้ส่วนเสียและเรียกข้อมูลและข้อเสนอแนะของพวกเขา การได้ตอบเหล่านี้จะช่วยให้ทีมวิจัยสามารถระบุและจัดลำดับความสำคัญของปัจจัยความสำเร็จที่สำคัญที่มีอิทธิพลต่อกระบวนการปรับใช้ DW ตัวอย่างของปัจจัยดังกล่าวอาจรวมถึงเป้าหมายและวัตถุประสงค์ของโครงการที่ชัดเจน ความเป็นผู้นำที่แข็งแกร่งและการสนับสนุนจากผู้บริหารระดับสูง การสื่อสารที่มีประสิทธิภาพและการทำงานร่วมกันระหว่างผู้มีส่วนได้ส่วนเสีย การฝึกอบรมและการพัฒนาทักษะที่เพียงพอสำหรับผู้ใช้ปลายทาง นโยบายการกำกับดูแลข้อมูลที่เข้มงวด และมาตรการประกันคุณภาพข้อมูลที่เหมาะสม

ผลลัพธ์ที่คาดหวังของการวิจัยนี้ ประการแรก มีจุดมุ่งหมายเพื่อให้เข้าใจอย่างครอบคลุมเกี่ยวกับปัจจัยแห่งความสำเร็จที่สำคัญซึ่งมีความสำคัญต่อการนำคลังข้อมูลไปใช้ภายในองค์กร ปัจจัยเหล่านี้จะทำหน้าที่เป็นแผนงานและแนวทางสำหรับผู้มีอำนาจตัดสินใจและทีมงาน โครงการที่เกี่ยวข้องกับความคล่องตัวที่คล้อยคลึงกัน ช่วยให้พวกเขาสามารถรับมือกับความท้าทายและเพิ่มโอกาสในการประสบความสำเร็จได้สูงสุด ประการที่สอง การวิจัยพยายามนำเสนอฐานข้อมูลที่มีโครงสร้างดีและเชื่อถือได้ พร้อมด้วยความสามารถในการประมวลผลข้อมูลและการแสดงข้อมูลที่มีประสิทธิภาพ ซึ่งองค์กรสามารถนำไปใช้เพื่อการตัดสินใจอย่างชาญฉลาด การวางแผนเชิงกลยุทธ์ และการปรับปรุงประสิทธิภาพโดยรวม

สาขาวิชา การจัดการทางวิศวกรรม

ลายมือชื่อนิสิต .....

ปีการศึกษา 2565

ลายมือชื่อ อ.ที่ปรึกษาหลัก .....

# # 6370805921 : MAJOR ENGINEERING MANAGEMENT

KEYWORD: Critical Success Factors, Data Warehouse implementation

Phatnarin Khantayana : CRITICAL SUCCESS FACTORS FOR DATA WAREHOUSE IMPLEMENTATION IN AN INDUSTRIAL ASSOCIATIONS ORGANIZATION.

Advisor: Prof. Dr. PARAMES CHUTIMA

The purpose of this research is to delve into the key success factors (CSFs) associated with data warehouse (DW) implementation from the perspectives of various stakeholders within an organization. A data warehouse provides a unified and structured view of an organization's data for analysis and reporting, and successfully implementing such a system can have a significant impact on overall organizational performance. It enables better data management, facilitates improved decision-making, and enhances strategic planning.

The scope of this research encompasses an in-depth examination of the core CSFs that are instrumental in achieving success during data warehouse deployments. It focuses on understanding and analyzing the factors that contribute to the effectiveness and efficiency of data warehouse projects from the perspectives of different stakeholders. These stakeholders include users who are the primary beneficiaries of the data warehousing system, as well as the IT department responsible for the technical operation and maintenance of the data warehouse infrastructure. Additionally, employees from various departments who are actively involved in the data warehousing project will also be considered as key stakeholders.

To gather comprehensive insights, the research utilizes methods such as surveys, interviews, and workshops to engage with stakeholders and solicit their views and suggestions. These interactions will help the research team identify and prioritize the key success factors that influence the DW deployment process. Examples of such factors could include clear project goals and objectives, strong leadership and support from senior management, effective communication and collaboration between stakeholders, sufficient training and skill development for end users, strict data governance policies, and appropriate data quality assurance measures.

The prospective outcomes of this research are twofold. Firstly, it aims to provide a comprehensive understanding of the key success factors that are critical to the implementation of data warehouses within an organization. These factors will serve as roadmaps and guidelines for decision-makers and project teams involved in similar initiatives, enabling them to tackle challenges and maximize their chances of success. Secondly, the research seeks to present a well-structured and reliable database with powerful data processing and display capabilities, which organizations can utilize for making informed decisions, strategic planning, and improving overall performance.

Field of Study: Engineering Management  
Academic Year: 2022

Student's Signature .....  
Advisor's Signature .....

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Phatnarin Khantayana

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## **Chapter 1**

### **Introduction**

#### **1.1 Introduction**

The significance of a business association organization to its members was introduced by Bennett (1997), the research clarified the article reviews of current British Government plans to collaborate more closely with business groups, namely trade organizations, using a representative sample survey of associations from all major industries. Since 1994, successive White Papers on competitiveness have emphasized the review of the DTI's "Guide to a Model Trade Association," which was published in January 1996, and the wide aims of Government sponsorship operations with industry groups. The article indicates that the primary reaction of organizations is to improve their internal management systems and member relations, as instead of supporting the government's focus on enhancing the competitiveness of their members.

The explanations in literature More information regarding business alliances and how they could help SMEs be more competitive can be found in Bennett (1998), suggesting that SMEs are one of the least well-represented business groupings, and that under association governance, either large enterprises or people with employee status are likely to have more influence over their interests than they do. Although there is significant variety among businesses by industry, region, and size, there are generally limitations to the development of services through business groups. The author draws the conclusion that associations' contributions to certain enterprises through particular services seem to be very minimal. The main way organizations appear to promote the competitiveness of its member companies is by raising industry standards generally, for example through codes of behavior, information, collaborative events, benchmarking, and management seminars.

According to Bennett and Ramsden (2007), who elaborated on the role of advice from associations, these benefits are primarily "soft," like improving one's capacity to deal with difficulties and enhancing one's management skills. Specifically, advice services primarily offer reassurance, boost one's self-assurance, or lessen

uncertainty for SME owner/managers. The research concludes that membership incentives cover a wide range of services, from individual support to group advocacy, in a complicated "bundle." These associations provide a basic set of services including information, counsel, lobbying/representation, and networking. A quarter of SMEs place importance on marketing and recognition, while a sixth-place importance on social activities and accreditation.

According to Costa, Soares and de Sousa (2020), by examining the new and special context of digital platforms handled by industrial business associations (IBAs), the internationalization of small and medium-sized businesses may be enhanced (SMEs). A special purpose is to elicit specified digital platform needs and characteristics for this unique organizational setting. The designs are generated for DPs that may enable many forms of social interaction generating processes, including information exchange, cooperation, and collective action. Relevant for practice, primarily for IBAs, SMEs, and digital platform designers to develop more effective collaborative digital platforms and sociotechnical systems, supporting collaborative networks and the internationalization needs of SMEs to improve communication, information management, coordination, and collaboration.

According to the empirical research of Hamdan et al. (2017), trade organizations are seen by the government as playing a big part in enhancing the performance of its members in terms of innovation, productivity, and exports. However, many trade organizations lack the necessary resources to offer these services, and members have different opinions on whether they need to be offered in an effort to boost members' efficiency. Trade groups have participated in extensive programs intended to increase the competitiveness of the whole industry in specific areas, notably manufacturing, sometimes with government assistance. These programs may include benchmarking, but they often cover much more ground, such as research, information sharing, training efforts, supply chain projects, marketing assistance, and export promotion.

To some extent, an association must participate in such plans, if only to maintain its standing. An organization must always be aware of the varying levels of interest in such programs among its members as well as the participation of its trade associations. To create best practices for the promotion and growth of export trade,

Trade Partners UK commissioned a sector partnership study. Eleven best practice criteria were established by the research, including leadership and resource allocation, government interaction, regional and national coordination, strategy and networking, opportunity identification, marketing and promotion, development, and information. To design and implement Internet-based strategies for sector export information management, information, statistics, and assessment are required.

The concept of Critical Success Factors (CSFs) in business problem-solving originated from Daniel's work in 1961. However, it was Rockart in 1979 who introduced a research method specifically designed to identify CSFs. According to Rockart (1979, p.85), CSFs are defined as the limited number of areas where achieving satisfactory results ensures successful competitive performance for an organization. Since then, there has been extensive research in the field of Information Systems (IS) aimed at understanding the key factors that enable organizational success, particularly in relation to IS (e.g., Delone & McLean, 1992). This ongoing research and practice continue to adapt the CSF method to suit various contexts (e.g., Peffers, Gengler & Tuunanen, 2003).

In recent years, several studies have focused on detecting the critical success factors (CSFs) of project management. These studies, conducted by Sumner (1999), Chua et al. (1999), Lin Moe & Pathranarakul (2006), and Yalegama et al. (2016), have employed different approaches to identify CSFs. Pinto and Slevin (1987) outlined a process to detect CSFs that predict successful project management. They further identified CSFs specific to research and development projects in a subsequent study (Pinto and Slevin, 1989). Belassi and Tukul (1996) attempted to categorize success factors, explore their interactions, and identify individual factors. Their findings included several critical factors associated with project managers' performance, team members, and environmental factors.

Expanding on the concept, CSFs are crucial elements or areas within an organization that, when effectively addressed and managed, significantly contribute to achieving successful competitive performance. They are specific to the organization and its goals, focusing on the few key factors that have the most substantial impact on overall success. CSFs play a vital role in strategic planning, as they help identify priorities and allocate resources accordingly. In the context of IS, understanding and

addressing the key factors that enable IS success is crucial for organizations seeking to leverage technology effectively and gain a competitive advantage.

The CSF method provides a systematic approach to identify and prioritize these critical factors. It involves a structured process of elicitation, analysis, and validation to determine the limited number of areas where achieving satisfactory results is paramount for organizational success. The method has been continuously adapted and refined to suit different research contexts, enabling researchers and practitioners to gain valuable insights into the factors that drive success in various domains, such as project management.

Overall, the concept of CSFs and their application has evolved over time, with an emphasis on understanding the key factors that contribute to organizational success and adapting the method to different research domains. By identifying and addressing these critical factors, organizations can enhance their competitive performance and improve their chances of achieving their goals.

Systems for data warehouses (DW) are one of the most crucial IT-based systems in businesses in order to assist management decision-making (Gartner, 2007). The character and performance of an organization may be significantly impacted by the choices made utilizing these technologies. Critical success variables served as the theoretical framework and analytical perspective for this study (CSF). This CSF collection was used to examine why a business DW project failed. The CSF were analyzed within the organizational context of the project to address prior criticism of the CSF technique. The research offers many takeaways for businesses starting corporate DW programs and demonstrates the value of the enhanced CSF technique in comprehending DW construction.

## **1.2 Organization background**

The organization is a non-profit organization that has been elevated from the Thai Industry Association which has been in operation since November 13, 1967, became the Federation of Thai Industries on December 29, 1987, under the supervision of the Minister of Industry according to the Federation of Thai Industries Act, B.E. 2530 which is the government's policy that wants to develop private business institutions of Thailand to be strong which will make the development

mechanism in the industrial sector is continuously can coordinate with the economic development of the country and protect national interests in the world economy vision

“It is the core of strengthening and Thai industrial productivity to be able to compete internationally to develop the economy, society and environment of Thailand to be sustainable.”

The organization consists of two types of members:

1. Ordinary type, which is an industrial operator who is a juristic person and operate the industry according to the law on factories, including trade associations to promote the industry

2. The type of contribution is any natural person or juristic person. That is not an industrial factory or a trade association

The members are categorized into industry groups such as petroleum and cosmetic group and provincial chapters such as Nonthaburi province industry spread across all regions, with the Organization head quarter as the core linking mechanisms of relationship between various industry groups, including consumers and other entrepreneurs. The Board of the organization will be in the position for a term of 2 years, elected by industry groups and various provincial industry councils. The committee will determine the policies and manage the organization and coordinate with the government in the country and abroad. The objective is to develop Thai industry.

The organization is a juristic person having the powers and duties to carry out the tasks according to the specified objectives as follows:

1. Representing private sector operators in coordinating policies and taking action with the state.
2. Promote and develop the industry.
3. Study and find solutions to problems related to industrial operations.
4. Issue a certificate of origin or a certificate of product quality.
5. Providing advice and recommendations to the government to develop the industrial economy.
6. Promote industrialists and provide a central place for industrialists to exchange ideas for the benefit of the industry.



7. Supervise the members to comply with the laws related to the industry.

8. Perform other activities according to the law.

The organization is located in Bangkok's Sathorn district. The organization was founded and has been serving customers for a total of 55 years, powered by more than 250 employees. The average annual revenue is 60 million baht per year, with the main income coming from membership fees. The secondary income comes from organizing activities from each department such as organizing trainings and seminars including organizing study trips and visits to factories both domestically and internationally including receiving support from government agencies in the preparation of various projects.

Customer profile: A customer is a group of customers or members who come to an organization to receive services such as attending seminars and other projects such as business matching to increase revenue and business expansion, helping companies access funding, and including assistance and resolution of complaints related to government agencies and laws.

Employee profile: A group of staff members who have competence in areas such as economics, international commerce, business administration, backgrounds in business administration and business economics research, and other related fields, as well as staff members who have experience in legal issues. Employee's organization provide services to their members and able to effectively drive and help enterprises belonging to members and consumers by coordinating their efforts with those of other departments and agencies.

Management profile: The team management, composed of representatives from major enterprise groups, will come to assist in laying the groundwork and driving industry sectors in order to develop improvement and growth, increase efficiency, collaborate effectively with government and industrial sectors, and standardize policy and framework.

### **Leveraging Information Technology for Advancing Thai Industries**

The Federation of Thai Industries (FTI) has identified four key strategies to drive the growth and development of Thai industries: industry collaboration, First2Next-Generation Industry, Smart SMEs, and Smart Service Platform. The FTI

recognizes the importance of leveraging information technology (IT) effectively to support and enable these strategies. Therefore, developing an aligned IT strategy is crucial for the successful implementation of these initiatives and the overall growth of the Thai industries.

The IT strategy should be developed in a manner that aligns with and supports each of the FTI's strategies. Here's how the IT strategy can link with and expand upon each of the FTI's strategies:

1. **Industry Collaboration:** The IT strategy can focus on creating a collaborative IT infrastructure and platforms that facilitate data sharing, knowledge exchange, and communication among industries. This could involve implementing collaborative software solutions, developing industry-specific online portals or platforms, and fostering a culture of collaboration and innovation through technology-driven initiatives.
2. **First2Next-Generation Industry:** The IT strategy can emphasize adopting emerging technologies, such as artificial intelligence (AI), Internet of Things (IoT), robotics, and advanced analytics, to drive the transformation of traditional industries into next-generation industries. This could involve investing in research and development, promoting technology adoption and upskilling, and leveraging data-driven insights to identify and seize opportunities for innovation and competitiveness.
3. **Smart SMEs:** The IT strategy can focus on empowering small and medium-sized enterprises (SMEs) through digitalization and technology enablement. This could include providing support for SMEs to adopt cloud computing, e-commerce platforms, digital marketing tools, and data analytics solutions. The strategy could also involve initiatives to enhance digital skills and awareness among SMEs, fostering an ecosystem that nurtures and supports their growth in the digital era.
4. **Smart Service Platform:** The IT strategy can concentrate on establishing a robust and integrated IT infrastructure that serves as the foundation for a smart service platform. This platform can provide advanced digital services, such as data analytics, cloud computing, and digital marketing, to support industries in improving their operations, customer engagement, and overall performance. The IT strategy should focus on developing secure and scalable platforms, fostering partnerships with technology providers, and promoting the adoption of smart services among industries.

In expanding the context, it is crucial to emphasize that the IT strategy should not be developed in isolation but rather in close alignment with the overall organizational strategy of the FTI. The IT strategy should address the specific needs, challenges, and goals of the FTI's strategies, enabling the effective implementation of technology solutions that drive collaboration, innovation, and growth in Thai industries.

To ensure the successful implementation of the IT strategy, several critical success factors (CSFs) should be considered. These may include strong executive sponsorship and leadership, stakeholder engagement, effective change management, data governance, skilled resources and expertise, robust cybersecurity measures, and continuous evaluation and improvement. By incorporating these CSFs into the IT strategy, the FTI can maximize the chances of success and create a solid foundation for the advancement of Thai industries through the effective utilization of technology.

### **1.3 Problem statement**

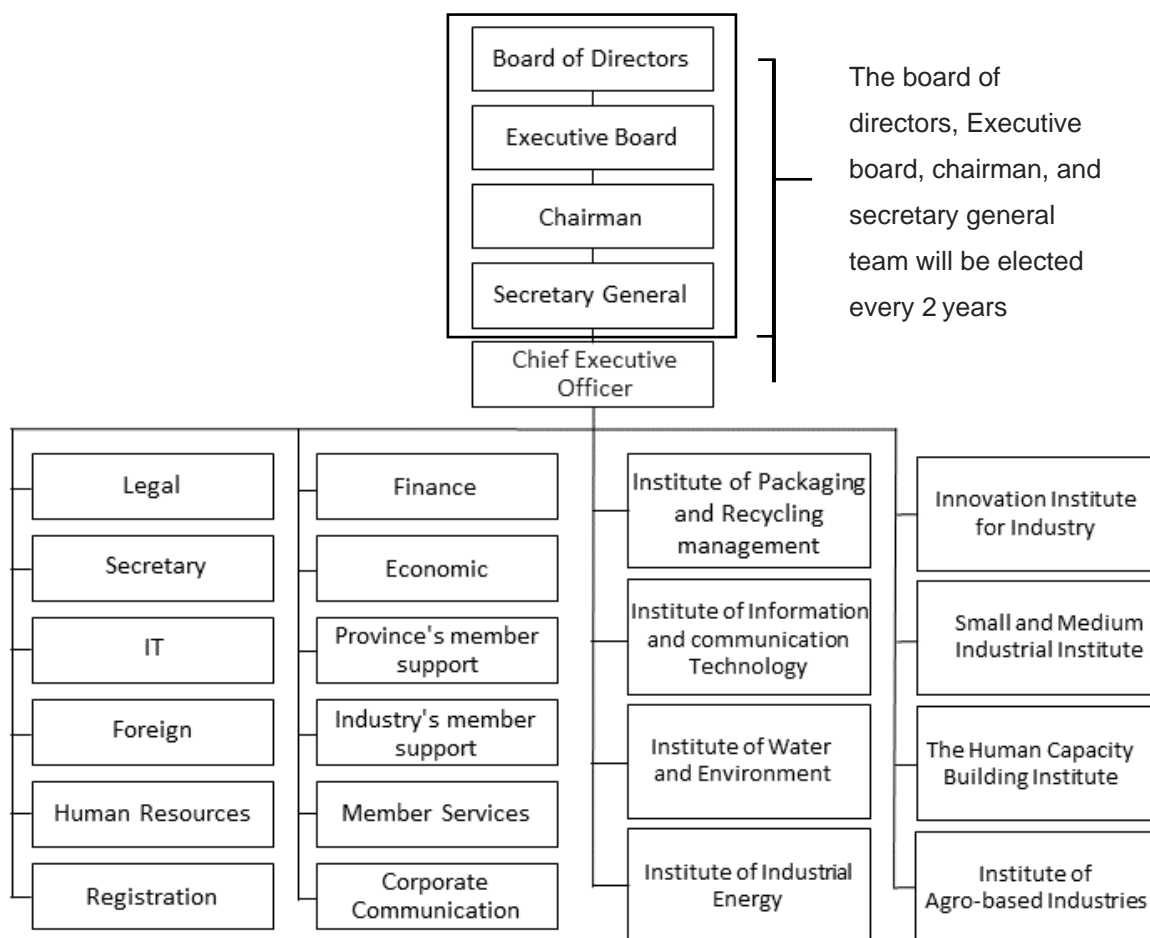
According to the organizational structure, the board of director team will be elected every 2 years and those top management team will be a new team, which is the owner or representative from various organizations. After the election, the new team will be adjusted, and they will change the organization's vision and mission including policy or restructure causing discontinuity and uncertainty of operations. The new management team does not work in this organization all the time because they have full-time jobs at their own company. Therefore, the discontinuity of this work leads to the introduction of an IT-based system to improve work processes and to help continuity of work. According to this, the IT team should play a role in developing the structure of IT development and pushing to enhance the continuity of data and strengthen the organization to be able to continue to use the data in the future.

The structure of the organization, there have been analyses performed on the general scenario that the company finds itself in with relation to the fact that the company divides its individuals into different functions according to the job titles, responsibilities, and capabilities that they represent. Therefore, each task is carried out by each department, these departments only concentrate on their own objectives,

responsibilities, and goals. Due to a lack of communication across departments, information, resources, and capabilities may get stuck in certain departments.

In addition, the information that located in the organization have been discovered that it is a beneficial data including the contact person from various industry sectors and the production and product information. It can be analyzed and processed for the benefit of the organization, leading to policy making to drive management and industrial development in the future. In fact, these are kept fragmented, and the data is not shared across the organization, including the lack of standardized retention forms. Therefore, this information is not used in the most practical way.

The organization is seen in this context aimed at building DW, which can be compared to a large-scale data infrastructure for decision support. In terms of systems, DW consists of enterprise data warehouses, BI analysis and presentation specifications, and applications that extract, transform, and load (ETL) data into the data warehouse. According to implement the high-level decide architecture into the organization can fail for a number of reasons, including a lack of long-term executive commitment and leadership, poor communication, internal resistance to change, an inability to effectively develop a new corporate culture and structure, and negative viewpoints on change. One method to comprehend DW implementation is to think about the relatively few variables that must be successfully handled for a project to be successful. These elements are referred to as CSFs, or critical success factors.



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**Figure 2** Examples of data collection of departments in an organization

## 1.4 Research Question

The implementation projects, as was previously discussed, have a very large model, and require numerous implement steps, resources, and key personnel to be involved. As a result, the project will face some challenges that will be examined through the critical success factors to achieve a successful implementation. The analysis of the critical success factors for a data warehouse implementation will be the focus of the research topics.

### **1.5 Research objective**

To investigate the Critical Success Factor (CSF) of a Data warehouse (DW) implementation from stakeholder's perspectives to improve the overall organizational performance and build the foundations of organizational systems.

### **1.6 Scope of the Research**

The study will examine key critical success factors for data warehouses implementation as part of its scope. When DW is being implemented, information is being discussed and gathered from the perspective of the stakeholder, which includes end users, IT department, employees from different department who are a part of the project in the organization, including giving feedback to senior manager to confirm the results in order to investigate the factors that contribute to the success of DW project implementation.

### **1.7 Expected outcomes**

1. The critical success factors in order to success data warehouse implementation to the organization.
2. Obtain a database and processing visualization data that the company may utilize in the future for decision making.

## **Chapter 2**

### **Literature Review**

One of the most crucial IT-based systems in enterprises is the business intelligence (BI) system and Data warehouse (DW). The character and performance of an organization may be significantly impacted by the choices made utilizing these technologies. When it comes to the use of information technology (IT) to assist management decision-making, data warehousing (DW) and business intelligence (BI) are at the core (Gartner, 2007). One way to think about DW serves as the large-scale data infrastructure that is used for decision support. Enterprise data warehouses, data marts, and applications that extract, transform, and load (ETL) data into the data warehouse or mart are all included under the cover term "data warehouse" (DW)

Business intelligence (BI) is the successor in many respects, and it can be considered as the data management and analytics layer that sits between both the data warehouse and the executive decision-makers. BI can also be viewed as the data analysis and presentation layer (Arnott and Pervan, 2005). In contrast to earlier generations of decision support systems, business intelligence (BI) and data warehousing are large-scale systems that may occasionally compete with the budgets of operational transaction processing systems. This expansion in the scope of decision assistance may provide substantial issues for boards and senior management teams. When trying to get a grasp on DW/BI development, it might be helpful to think about the relatively few aspects that, in order for a project to be successful, need to have appropriate consideration given to them. These elements are referred to as crucial success factors, or CSF for short (Rockart and DeLong, 1988).

#### **2.1 Concepts and Mechanisms of Data Warehouse**

Since the phrase "data warehousing" was introduced in 1990, businesses have investigated the methods they may acquire, store, and alter data for analysis and decision support, according to Smith (2002).

One of the key elements of the decision support systems used by many IS operations is the data warehouse. Millions of transactions are stored there in a manner that makes comparison and analysis possible. A data warehouse is "a collection of



interconnected, subject-oriented databases where each data unit is particular to some period of time," according to William H. Inmon, known as the "father of the data warehouse." Detailed data, data that has been minimally or heavily summarized, and data that has been structured for analysis and decision assistance may all be found in data warehouses.

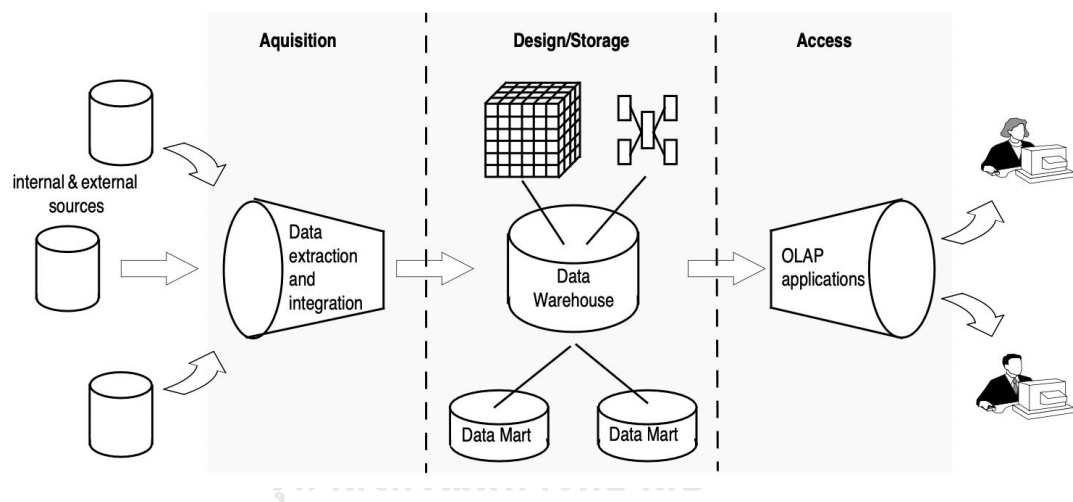
In the past, companies clearly distinguished between each of these functional domains, and IS development followed suit. As a result, systems could not exchange data or processes, and cross-functional information analysis was not feasible. The divides among the several information systems generated arbitrary obstacles that needed to be overcome because all functional areas are interconnected, making this separation an invalid depiction of a company's operations.

In conclusion, the growth of data warehouses as components of the information systems explosion requires the attention and problem-solving of knowledgeable information systems experts who have a comprehensive awareness of the difficulties that each environment presents. If the data is prepared for query and reporting, the information is coordinated with the organizational needs for decision support, and the data warehouse is integrated with all data, the result might be a superior source of data for analysis and decision-making.

Data warehousing technology includes a collection of novel ideas and technologies that provide decision-making information to the knowledge worker (executive, manager, analyst). The primary objective of constructing a data warehouse is to enhance the quality of the organization's data. The primary challenge is providing access to a company-wide view of data regardless of its location. Data from internal and external sources, ranging from conventional structured data to unstructured data such as text files or multimedia, is cleansed and consolidated into a single repository. A data warehouse is a centralized repository for corporate data that is accessible to end users in a format they can comprehend and utilize.

Watson, Goodhue and Wixom (2002) acknowledged the fact that a framework for data warehousing advantages enables a number of decision support applications that may be advantageous to businesses. Benefits range from qualitative to quantitative and include labor time savings to improved user morale and more effective and efficient judgments.

The primary features of a data warehouse are the integration of data from several sources, such as database systems, file formats, and external data sources such as statistics databases or websites. Prior to integration, both structural and semantic disparities must be addressed, or data must be homogenized based on a standardized data model. In addition, operational system data values must be cleansed before they can be included into the data warehouse. The need to access the data and historical data of warehouse data over an extended period of time is one of the key motivations for adopting the data warehouse methodology. Historical data are required for business trend analysis, which may be characterized as a comprehension of the contrasts between various perspectives of real-time data (Gatziu et al., 1999).



**Figure 3** An example of data warehouse architecture

## 2.2 Data Warehouse Components

### 2.2.1 ETL Tools

Several key data warehouse components and their system functions are apparent from the designs described before. In the data extraction and integration phase, ETL Tools will be used. ETL, which stands for Extract, Transform, and Load, is a process that extracts and transforms data before putting it into a data warehouse. The format of the data arriving from the multiple data layer might differ widely.

Before combining data from various sources into a centralized database, the system must filter and arrange the information (Dhaouadi et al., 2022).

### **2.2.2 The Database**

The database is the most important component and the core of any architecture. The warehouse is used to store and retrieve data. When constructing a data warehouse system, company must first choose the type of database you want to employ, such as third-party software and hardware for data storage and management or Cloud-based databases.

### **2.2.3 Data**

After cleaning and organizing the data, the system stores it in a data warehouse. The data warehouse is the primary repository that holds each source's information, metadata, summary data, and raw data. Metadata is the defining information for data. Its major function is to facilitate the management of data instances. It allows data analysts to categorize, find, and guide searches to the necessary data. The warehouse manager compiles summary information. It is updated when fresh data enters the warehouse. This section may provide lightly or thoroughly summarized data. Its primary function is to accelerate query performance. Unprocessed data is the actual data that is being loaded into the repository. The availability of raw data facilitates further processing and analysis.

### **2.2.4 Access Tools**

Users engage with the collected data using various tools and technologies. They may do data analysis, get insight, and generate reports. Reporting equipment. They are essential to knowing how your firm is performing and what should be accomplished subsequently. Reporting tools include visuals such as graphs and charts that illustrate the evolution of data over time.

### **2.3 The concept of Critical Success Factor Method**

John Rockart is credited with being the one who initially suggested the critical success factor (CSF) approach in 1979. Since then, the method has been used for a great deal of research in the field of information systems (IS). It is defined as the restricted number of areas in which effective competitive performance for the company may be ensured if the outcomes in those areas are good. A significant amount of study has been carried out in the field of information system (IS) with the goal of elucidating the essential components that contribute to the achievement of organizational and, more particularly, IS goals. This first phase of a three-phase IS planning project was used to generate the information needs for the senior managers of the organization, and these requirements were presented in the form of CSFs.

The CSF method was initially known as Rockart's CSF method, and it was employed as the first phase of the project. The second step consisted of conducting an analysis of the CSFs with the goals of establishing system priorities and convincing management that those system priorities would provide enough support for crucial choices. During the third phase, the real systems were put into place in addition to the creation of prototypes. The idea generation of the CSFs, which is the initial element of the approach developed by Rockart, is the primary emphasis of this work. Additional constraints have also been recognized, such as the need of conducting CSF reviews on a regular basis due to the ever-shifting organizational and environmental circumstances (Walters, 2006).

It has been suggested that the CSF technique has been responsible for a number of important contributions to IS research. Primarily, these revolve around the ease with which the method can be implemented as well as its capacity to concentrate and actively engage management attention on the most vital aspects of a company (Rockart 1979; Boynton & Zmud 1987; Henderson, Rockart & Sifonis 1987), such as product quality, customer satisfaction, and employee retention, directs the focus of management to the most important aspects of the firm, CSFs must be articulated by management; CSFs are directly generated from the aims of management, and as such, they are tied to the corporate strategy. It is easier for senior management to have an instinctive understanding of the method's goals, which helps to generate user approval at the senior level.

The limitations of the CSF approach were discovered. First summarized by Davis (1979) and based on the findings of other supported researchers, for instance, individuals have a restricted ability to process information and critical reasoning, a decision of significance may be impacted by biasing factors such as the data availability, and a concentrate on measurement can result in neglecting or underrating "soft" elements which are more difficult to quantify.

## 2.4 Critical success factors on Data Warehouse implementation

One method to comprehend DW development is to think about the very few elements that must be well handled for a project to be successful. These elements are referred to as CSFs, or critical success factors (Rockart and DeLong, 1988). These criteria have been validated by several articles of research that have been conducted on the topic of their frequent occurrence (Tarhini et al., 2015).

This ranking offers some insight into the CSFs that are considered to be the most significant in the IS implementation initiatives. On the basis of this information, the participants in this project who are concerned with achieving the best outcomes, getting the needed features, and meeting the expectations posed by the Data warehouse system should prioritize their focus on the relevant variables.

**Table 1** Critical Success Factors for Data warehouse implementation

References	Description	McBride (1997)	Poon and Wagner (2001)	Sammon and Finnegan (2000)	Watson et al. (2004)	Wixom and Watson (2001)	Salmeron and Herrero (2005)
<b>Factors</b>							
Committed and informed executive sponsor	Senior executive need to oversee the project's overall direction, resource allocation, and representation before the executive team and board.	✓	✓	✓	✓	✓	

**Table 1** (continued)

<b>References</b>	<b>Description</b>	McBride (1997)	Poon and Wagner (2001)	Sammon and Finnegan (2000)	Watson et al. (2004)	Wixom and Watson (2001)	Salmeron and Herrero (2005)
<b>Factors</b>							
Widespread management support	Data warehouses should be business-driven and have comprehensive managerial support. This facilitates change management and gets rid of opposition.			✓	✓	✓	
Appropriate team skills	The organization's staff should have the required information, abilities, and experience.		✓	✓		✓	✓
Appropriate technology	The DW hardware and software need to be very organizationally compatible.		✓	✓		✓	✓

Table 1 (continued)

References	Description	McBride (1997)	Poon and Wagner (2001)	Sammon and Finnegan (2000)	Watson et al. (2004)	Wixom and Watson (2001)	Salmeron and Herrero (2005)
<b>Factors</b>							
Adequate resources	Hardware, software, and human resources should all be adequately funded.			✓		✓	
Effective data management	There need to be operational data sources accessible. Applications for the system should provide correctness, consistency, and currency. The data model needs to be adaptable and scalable.		✓	✓	✓	✓	
Clear link with business objectives	The project should be economically justified in terms of its commercial value and have a clear connection to the company's strategy.		✓		✓		

**Table 1** (continued)

References	Description	McBride (1997)	Poon and Wagner (2001)	Sammon and Finnegan (2000)	Watson et al. (2004)	Wixom and Watson (2001)	Salmeron and Herrero (2005)
<b>Factors</b>							
Well-defined information and systems requirements	Although describing the needs of executives might be challenging, the project should have a consensus on what is expected of the system.		✓		✓		✓
Evolutionary development	An efficient DW system should be created iteratively with active user participation, progressing towards a useful application set.	✓	✓	✓		✓	✓
Management of project scope	A project's scope may drastically expand. Resource constraints may result from this.					✓	



## **2.5 The identification of critical successful factors by participants**

Participants were allowed to discuss on the allocation of CSFs as a group. This demonstrated to management the phases at which participants had failed to recognize the significance of certain aspects. This gave management the chance to take appropriate corrective action. It was discovered that a significant consequence of this phase was a four-step functioning model of cross knowledge transfer, which may give an important chance to enhance customer service. The first step, initiation, was followed by implementation, then ramp-up, and finally integration was the last stage.

However, there was only limited success in identifying the CSFs across all four stages. Participants were more likely to nominate factors for the earlier stages of the knowledge transfer model as opposed to the later stages. This could be because participants were exhausted by the time the latter stages were investigated or because each interviewee had a limited amount of time. It was also debated if the early phases were more crucial, and as a result, a greater number of components were discovered at these periods (Cooper, 2008).

An essential approach for the validation of the theory was offered by the use of the cross-organizational focus group in the research. the benefits of cross-organizational focus groups include the ability to include participants from a variety of different backgrounds and organizations and the ability to evoke discussion between participants, which may discover issues that otherwise may not be revealed in an individual interview. Other benefits include the ability to use cross-organizational focus groups involve respondents from a range of different backgrounds and organizations (Lichtenstein and Swatman, 2003).

However, focus groups are subject to a number of criticisms, there are a number of issues that might arise with the use of focus groups. These include their inability to provide clear results, the chance that the moderator may introduce bias into the results, the risk that certain personalities will dominate the group, and their inadequacies when used as the only source of data gathering. The results of this qualitative study suggest, on the other hand, that a focus group of this kind may offer an indication of the research's applicability to other contexts. It is interesting to note that the major restriction of the cross-organizational focus group was around the restricted amount of time that participants had available, both before and after the

focus group discussion. Before to the session and throughout the meeting itself, participants in the cross-organizational focus group were obliged to receive considerable documentation. This was a requirement of the focus group.

The purpose of this study is to assess the Critical Success Factor (CSF) for a data warehouse implementation in an organization of Industrial Associations. Researchers believe that both practitioners and researchers can benefit from the findings of the case study that is being presented. CSFs have reportedly been used in research studies before, so we have chosen a number of CSFs to be used as a reference in the research to confirm with the organization which one agrees or disagrees by carrying out a survey such as Committed and informed executive sponsor, Widespread management support, Appropriate team skills, Appropriate technology, Adequate resources, Effective data management, Clear link with business objectives, Well-defined information and systems requirements, Evolutionary development, and Management of project scope followed by an interview and focus group discussion. The chosen considerations to be utilized are Committed and informed executive sponsor, Widespread management support, Appropriate team skills, Appropriate technology, Adequate resources, Effective data management, Clear link with business objectives, Well-defined information and systems requirements, Evolutionary development, Management of project scope.

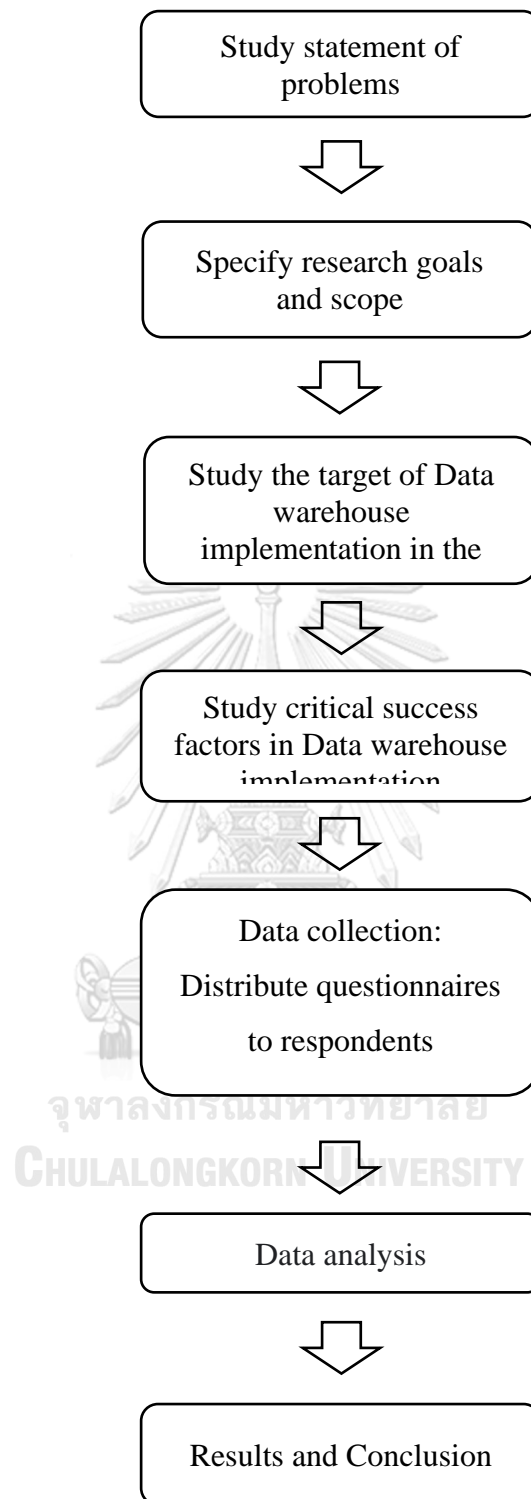
## **Chapter 3**

### **Research Methodology**

#### **3.1 Research design**

The research framework is an effort to examine key critical success factors for data warehouses implementation as part of its scope. When DW is being implemented, information is being discussed and gathered from the perspective of the project team management, which includes top management, managers, and employees who are a part of the project in the organization, in order to investigate the factors that contribute to the success of DW project implementation as well as suggestions for further research.





**Figure 4** Overview of research design

### **3.1.1 Study statement of problems**

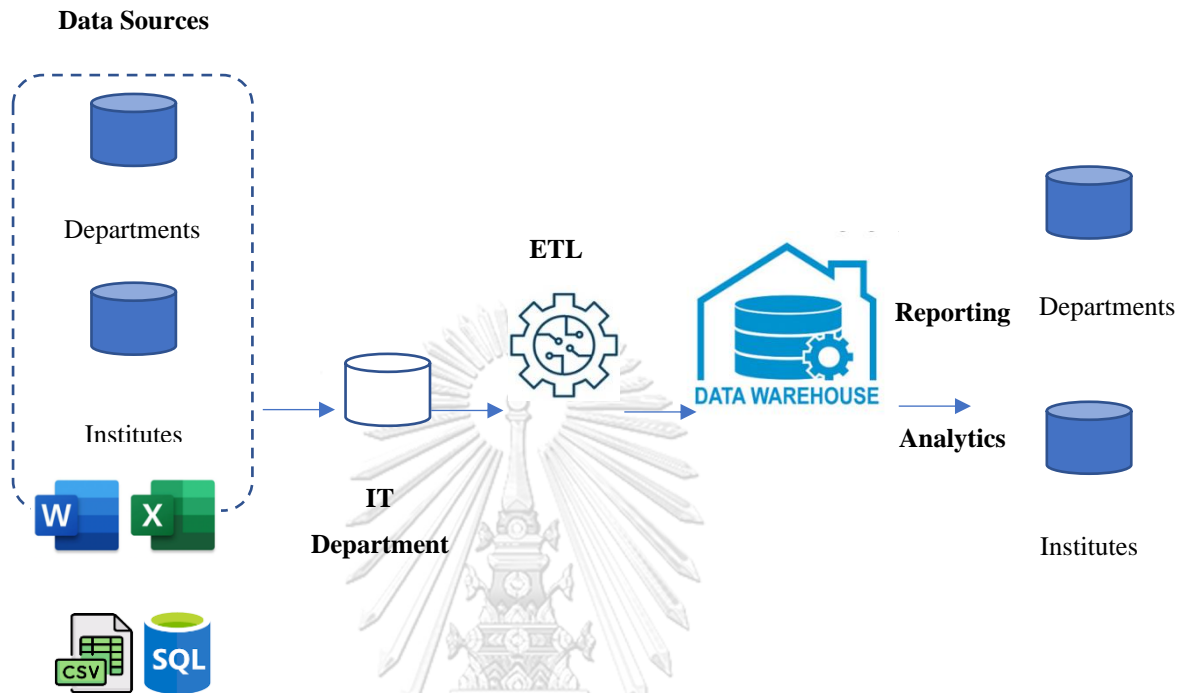
After having studied the problems that occur within the organization as discussed in Chapter 1, the organization has a policy to solve such problems by creating a data warehouse model for the use of data in the organization in the most beneficial way.

### **3.1.2 Specify research goals and scope**

The implementation projects, as was previously discussed, have a very large model, and require numerous implement steps, resources, and key personnel to be involved. As a result, the project will face some challenges that will be examined through the critical success factors to achieve a successful implementation. The analysis of the critical success factors for a data warehouse implementation will be the focus of the research topics.

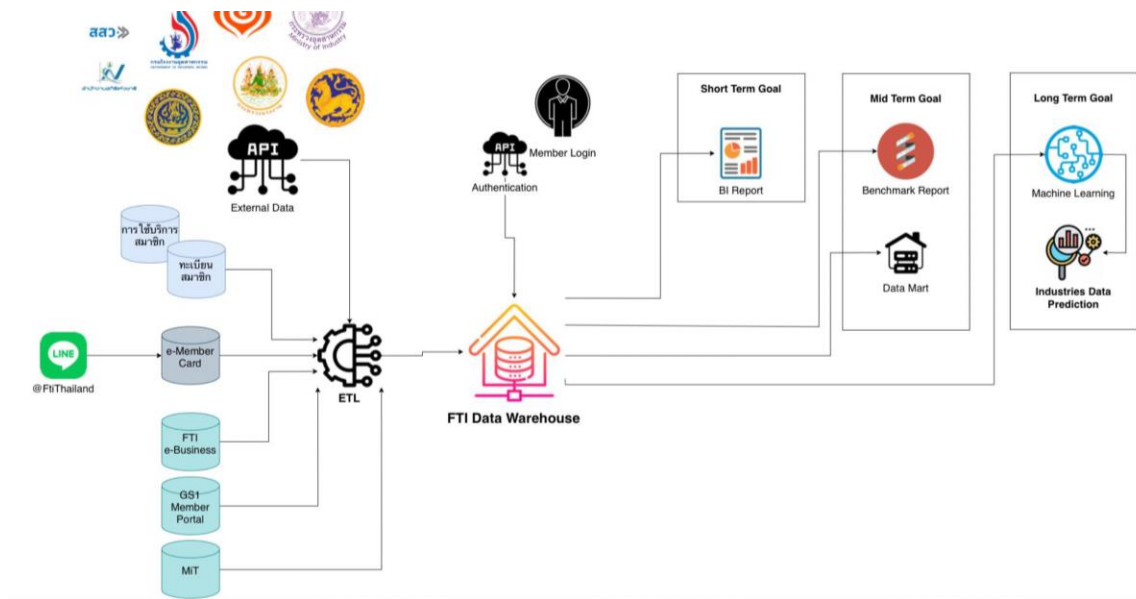
When DW is being implemented, information is being discussed and gathered from the perspective of the project team management, which includes top management, managers, and employees who are a part of project in the organization, in order to investigate the factors that contribute to the success of DW project implementation. The scope of this study is limited to investigating the critical success factors for DW deployment from the viewpoint of employees; thus, only the fundamentals of the data warehouse concept and architecture will be discussed.

### 3.1.3 Study the target of Data warehouse implementation in the organization



**Figure 5** The simple underlying data warehouse architecture model in the organization

There is various information that located in different departments and institutes under the organization which led to the intention to develop a unified data center for data sharing and utilization across the organization. There is a reason and necessity to extend and develop into the collection of information from external agencies such as the Ministry of Industry and Office of Small and Medium Enterprises Promotion and other resources that are useful for industry analysis, such as retrieving data reports to be able to bring information to use in various activities of the organization more conveniently and quickly or processing member information to be able to calculate from income or number of employees as defined as an S, M or L business.



**Figure 6** Flowchart of implementation guidelines Data warehouse in the organization

### 3.1.4 Study critical success factors in Data warehouse implementation

When trying to get a perspective on the DW implementation and development process, it might be helpful to think about the relatively few variables that need to be handled in an appropriate manner for a project to be successful. These aspects are collectively referred to as crucial success factors. In addition, the critical success factors are discussed in Chapter 2, section 2.13.

### 3.1.5 Data collection: Distribute questionnaires to respondents

The approach used determines how data is collected. The study will benefit from the frame of reference, which must be met to complete the interview guidelines and, ultimately, respond to the research questions. The questionnaire will examine the viewpoint emphasis gathered from the perspective of the stakeholder, which includes end users, IT department, employees from different department who are a part of the project in the organization and working close to customers, based on Reitsma and Hilletoft (2018) research. Including giving feedback to senior manager to confirm the results in order to investigate the factors that contribute to the success of DW project implementation.

Interviewees were chosen from participants at various levels of the organization, specifically five people from the end users, five people from the IT department, and five employees from different departments within the organization who are a part of the project in the organization and work closely with customers. In conclusion, fifteen participants will be interviewed, and those who are selected will be asked to participate making the quantitative questionnaire and invites to the CSF focus group interview within 90 minutes. The quantitative on qualitative analytic approach, this study used a questionnaire to gather primary data. These data are regarded data that are acquired particularly for the aim of this research. Before to answering the question, each respondent will get a short explanation of the study's objectives and limitations to prevent misunderstanding.

The first survey proposed the success elements to identify DW implementation for a project to be successful based on McBride (1997), Poon and Wagner (2001), Sammon and Finnegan (2000), Watson et al. (2004), Wixom and Watson (2001), and Salmeron and Herrero (2005). The questionnaires will consist of closed-ended questions with a grading scale. The questionnaire will first be sent to fifteen participants to identify the most significant factors before an invitation to participate in a focus group interview. The respondents responded by picking one of the five available alternatives, with five indicating strong agreement, four indicating agreement, three indicating neither agreement nor disagreement, two indicating disagreement, and one indicating significant disagreement. Through an interview, a qualitative methodological approach will be applied for the second section.



### 3.1.5.1 The quantitative analytic questionnaire: Rate the following factors

**Table 2** Questionnaire associated with Data warehouse implementation

Factors	Descriptions	Questions
Committed and informed executive sponsor	Senior executive need to oversee the project's overall direction, resource allocation, and representation before the executive team and board.	Q1: Does the implementation require the support of top management?
Widespread management support	Data warehouses should be business-driven and have comprehensive managerial support. This facilitates change management and gets rid of opposition.	Q2: Should data warehouses be driven because of business needs and having full management?
Appropriate team skills	The organization's staff should have the required information, abilities, and experience.	Q3: Does the organization's staff should have the necessary knowledge, skills, and experience, or was training and education important to the implementation?
Appropriate technology	The DW hardware and software need to be very organizationally compatible.	Q4: Is there various organizational technology that works with the DW hardware and software?
Adequate resources	Hardware, software, and human resources should all be adequately funded.	Q5: Do Hardware, software, and human resources need to be adequately funded?

Table 2 (continued)

Factors	Descriptions	Questions
Effective data management	There need to be operational data sources accessible. Applications should provide correctness, consistency, and currency. The data model needs to be adaptable and scalable.	Q6: There needs to be operational data sources accessible. Applications for ETL should provide correctness and consistency?
Clear link with business objectives	The project should be economically justified in terms of its commercial value and have a clear connection to the company's strategy.	Q7: Does the project needs to have clear goals?
Well-defined information and systems requirements	Although describing the needs of executives might be challenging, the project should have a consensus on what is expected of the system.	Q8: Even though it is hard to define what executives want, should the project have a reasonable basis for what the system needs to do?
Evolutionary development	An efficient DW system should be created iteratively with active user participation, progressing towards a useful application set.	Q9: Was it important that users were involved in the implementation?
Management of project scope	A project's scope may drastically expand. Resource constraints may result from this.	Q10: If the size and scope of a project change a lot, can this make a project's funds go further?

### 3.1.5.2 The qualitative analytic questionnaire

Based on Reitsma and Hilletoft (2018) research, which identified 13 CSFs with an emphasis on user perception in the adoption of the systems. The framework gives an overview of the CSFs and looks at their significance from the viewpoint of the users. As the user's perspective is the emphasis of this study, this offers the essential framework. The study will benefit from the frame of reference, which must be met to complete the interview guidelines and, ultimately, respond to the research questions. First, a broad explanation of the 13 CSFs will be given, followed by descriptions from the viewpoints of users, senior managers, and project managers.

Additionally, the case study's capacity to help in the generation of answers to questions that begin "why," "how," and "what," particularly the "why" question (Saunders et al., 2009). The ability to respond to the question "why" is advantageous for this study since it allows for a deeper knowledge of the context of the research as well as the reasons why specific CSFs are significant to system users.

**Table 3** 13 CSFs of Data warehouse implementation

Factors	Descriptions	Questions
Project team	The project team must be made up of the best individuals and must include a project advocate, workers from all levels and departments, and outside consultants when internal experience is lacking.	<ul style="list-style-type: none"> <li>- What do you think about the project team's significance for an DW implementation?</li> <li>- What do you consider to be crucial in terms of the project team?</li> </ul>
Top management involvement	Top management should increase everyone's dedication to the company and establish guidelines that define and authorize any changes to organizational structure, positions, and duties.	<ul style="list-style-type: none"> <li>- What do you think about the significance of senior management participation for a deployment of DW?</li> <li>- How, in your opinion, should top management be involved?</li> </ul>

Table 3 (continued)

Factors	Descriptions	Questions
Strategic decision-making	A clear business strategy and vision must detail the planned strategic and practical advantages, resources, expenses, risks, and timetable as well as how the organization functions behind the implementation effort.	<ul style="list-style-type: none"> <li>- How was the execution plan for the implementation created?</li> <li>- What do you think a plan should have to help you, the user, understand how it will be put into action?</li> </ul>
Communication	Every organizational level should develop effective communication, which must involve official project and team promotion and progress advertising.	<ul style="list-style-type: none"> <li>- What do you think about how important communication is for implementing a DW?</li> </ul>
Project management	Clear objectives should be defined as part of project management, and the development of a work plan and resource plan must center on identifying the machinery needed to run the system.	<ul style="list-style-type: none"> <li>- How was the management of the implementation project?</li> <li>- How should a project be handled, in your opinion?</li> </ul>
Project support	Technical support, maintenance, and updates for the project should be developed, and they must be handled by a dedicated partner that manages the full implementation's life cycle.	<ul style="list-style-type: none"> <li>- How do you view the significance of project assistance for implementation?</li> <li>- How should project assistance be structured in your opinion?</li> </ul>

Table 3 (continued)

Factors	Descriptions	Questions
Organizational change management	The organization has to use methods and procedures for change management that have been designed and assessed according to industry best practices.	<ul style="list-style-type: none"> <li>- How was the management of the change process during the full implementation phase?</li> <li>- What do you think about the significance of organizational change managing the adoption of a DW?</li> </ul>
Business process alignment	To stay on course and prevent conflicts with the stringent procedural To keep on track and prevent conflicts with the stringent procedural requirements of an system, one should choose and follow to an archive of best business practices.	<ul style="list-style-type: none"> <li>- How was the system integrated with the business processes?</li> <li>- What do you see the significance of business process alignment to be a deployment of DW?</li> </ul>
Software testing	To make the adoption of the system simpler, the business should set up thorough and sophisticated testing of the software.	<ul style="list-style-type: none"> <li>- How was the system tested when it was being put into place?</li> <li>- How should the testing be carried out, in your opinion?</li> </ul>
Performance measurement	To manage expectations, keep track of all events, and compare accomplishments to milestones and objectives, performance metrics should be identified.	<ul style="list-style-type: none"> <li>- How was performance assessed during the implementation process?</li> <li>- How should performance be measured, in your opinion?</li> </ul>

**Table 3** (continued)

<b>Factors</b>	<b>Descriptions</b>	<b>Questions</b>
Education and training	Users should get enough education and training from the start of the project to ensure an efficient and proper usage of the system. This demands expenditure.	<ul style="list-style-type: none"> <li>- How was training and education handled throughout implementation?</li> <li>- How do you think training and education should be delivered?</li> </ul>
Technical possibilities	Based on its strategy, size, business area, business processes, and internal and external relationship structure, systems of all sorts should be compared and contrasted in the market.	<ul style="list-style-type: none"> <li>- How were the system's technological capabilities aligned with the company?</li> <li>- How do you think the technological capabilities of an system should be balanced with the organization?</li> </ul>

### 3.1.6 Data analysis

Due to the combination of qualitative and quantitative research methods in this study, quantitative survey, the analytical data will be supplied through questionnaires. For the purpose of analysis, questionnaire responses will be transformed to numeric codes using descriptive statistics. The word descriptive statistics refers to the act of gathering, summarizing, and explaining data so that it may be understood more simply (Burns and Burns, 2008). This technique allows for the collection and visualization of key data warehouse implementation aspects from the perspectives of end users, IT department, employees from different department who are a part of the project in the organization and working close to customers. Utilizing statistics to characterize a variable with an emphasis on the central tendency and dispersion.

For the second parts, interviews will be used to get the data after adopting a qualitative research approach, all of the data was examined using qualitative analysis

and this was done with the help of a cross-organizational focus group (Mayring, 2000). It may provide a defined aim and allow for a broad comprehension.

After the interviews have been obtained and analyzed, the findings will be verified with a management group, where the findings may point in the same direction or where new suggestions are made. In the future, a summary of the additional information will be provided.

### **3.1.7 Results and Conclusion**

Before the establishment of a data warehouse, this research used CSF theory for analysis. CSF may also be used as a hypothesis for predicting the results of DW projects. The business and IT professionals participating in a project may be able to discover issues before they become severe if they do CSF analysis at crucial phases. The CSF analyses may be discussed by the fifteen people at different levels. They might then take appropriate actions based on their knowledge of the status and direction of the CSF for their project. This rather investigation may have benefited the DW contribution. For further study, the summary, discussion, and recommendations will be presented.

## **Chapter 4**

### **Results and Analysis**

Chapter four of the study focuses on presenting the practical findings obtained from conducting interviews within the organization. This chapter begins by providing general information about the interviewees who took part in the study. This background information helps set the context for understanding the viewpoints and insights shared by the interviewees.

The main goal of this chapter is to provide a clear and comprehensive understanding of how the interviewees perceive each critical success factor (CSF) identified in the study. Through analyzing the interview responses, the chapter aims to shed light on the interviewees' opinions and attitudes toward these CSFs.

To ensure a thorough analysis, the chapter compares the findings from the literature review with the insights gathered from the interviews. This comparison allows for the identification of similarities and differences between the existing knowledge in the field and the perspectives expressed by the interviewees within the organization.

By comparing the literature review findings with the interviewee responses, the analysis offers a valuable opportunity to examine how well the interviewees' perceptions align with or differ from the existing literature. This comparison enables a deeper exploration of the nuances and variations in understanding and implementing the CSFs within the specific organizational context.

The analysis in this chapter is presented systematically, providing a structured and coherent overview of the cases examined. This approach ensures that the data is organized effectively, facilitating a comprehensive understanding of the interviewees' viewpoints and experiences. Overall, chapter four is an essential part of the study, providing detailed and meaningful insights derived from the interviews conducted within the organization. It offers a comprehensive exploration of the interviewees' perceptions towards the CSFs, while also highlighting the similarities and differences between their perspectives and the existing literature in the field. By doing so, the chapter enhances understanding of the research topic and contributes to the overall findings of the study.



## **4.1 Research Context**

Within chapter four, the empirical findings from the interviews are presented. General information of Interviewees was chosen from participants at various levels of the organization, specifically five people from the end users, five people from the IT department, and five employees within the organization who are a part of the project in the organization and work closely with customers. The results within the chapter provide clarification and show the stakeholders' perception of each CSF. The next step in this chapter is the cross-organizational focus group where the findings of the cases are presented and compared with each other, where both similarities and dissimilarities could be identified.

### **4.1.1 End users**

Data warehouses are powerful tools that enable companies to store, manage, and analyze vast amounts of data in a centralized location. End users play a critical role in the ongoing success of a data warehouse, as they are responsible for collecting and upgrading new data for everyone within the company. End users are typically employees who have been trained on the data warehouse platform and are responsible for using it to extract valuable insights from the data. These individuals may work in various departments, such as marketing, finance, or operations, and they use the data warehouse to inform their decision-making processes.

One of the key responsibilities of end users is to ensure that the data within the warehouse is accurate and up to date. This involves regularly collecting new data from various sources, such as customer databases, sales reports, and social media platforms, and integrating it into the warehouse. End users may also need to perform data cleaning and transformation tasks to ensure that the data is consistent and easy to use. Another important role of the end user is to help optimize the data warehouse for the needs of the entire company. This may involve creating new reports or visualizations to better represent the data or developing new data models to enable more sophisticated analysis. End users may also work closely with IT teams to identify and resolve any issues with the data warehouse, such as performance bottlenecks or data quality problems.

Ultimately, the success of a data warehouse depends on the efforts of end users to collect and upgrade new data for everyone within the company. By taking ownership of this important task, end users can help ensure that the data warehouse remains a valuable resource for decision-making and strategic planning.

#### **4.1.2 IT department**

The IT department plays a crucial role in the development and maintenance of a company's data warehouse. They are responsible for designing the framework of the warehouse, creating the platform according to the requirements of the company, and resolving any issues that may arise. The first step in designing a data warehouse framework is to identify the specific data needs of the company. This involves working with stakeholders from various departments to understand what types of data will be collected and how it will be used.

The IT department then designs a database schema that reflects these requirements and optimizes the warehouse for efficient data processing. Once the framework has been designed, the IT department is responsible for creating the platform that will be used to collect, store, and manage the data. This involves selecting the appropriate hardware and software components, configuring the database server, and developing custom applications as needed. The IT department also ensures that the platform is scalable, secure, and reliable, so that it can handle the growing volume of data as the company expands. In addition to creating the platform, the IT department is also responsible for resolving any issues that may arise with the data warehouse. This may involve troubleshooting technical problems, such as performance bottlenecks or data quality issues, and working with end users to identify and resolve any usability issues.

The IT department may also collect feedback from employees on their experience using the data warehouse and use this information to make improvements and optimizations to the platform. Overall, the IT department plays a critical role in ensuring that the data warehouse is designed and maintained to meet the specific needs of the company. By creating a scalable, secure, and reliable platform, and resolving any issues that arise, the IT department helps to ensure that the data warehouse remains a valuable resource for decision-making and strategic planning.

#### **4.1.3 Employees within the organization work closely with customer.**

Employees within an organization who work closely with customers play an important role in utilizing data from the data warehouse to collect and analyze valuable information. By collecting data from various sources, such as customer databases, sales reports, and social media platforms, these employees can gain insights into customer behavior and preferences. For example, these employees can collect data on the number of times each customer attends a seminar or training. This information can help them identify the most engaged and loyal customers, as well as those who may need more support or encouragement to attend future events.

By analyzing this data, employees can develop targeted marketing campaigns to promote specific events to specific groups of customers, based on their interests and attendance history. In addition, employees can use data from the warehouse to classify customers into target groups. By segmenting customers based on their demographics, interests, and buying behaviors, employees can tailor their communication and marketing efforts to better meet the needs and preferences of each group. For example, they can create targeted email campaigns or social media ads that are more likely to resonate with specific customer segments, increasing the likelihood of engagement and conversion.

Overall, employees within an organization who work closely with customers can benefit greatly from utilizing data from the data warehouse. By collecting and analyzing valuable information, they can better understand customer behavior and preferences, and develop targeted marketing campaigns that drive engagement and revenue. This can ultimately lead to improved customer satisfaction, loyalty, and retention, as well as increased sales and revenue for the organization.

#### **4.2 Data Analysis Results**

There are several sequential steps to follow. The first step involves the researcher dividing the survey into two distinct formats.

#### **4.2.1 Questionnaires are distributed to the respondents.**

These questionnaires contain a list of factors that are relevant to the implementation of a data warehouse. The respondents are then asked to rate each factor on a scale of 5 to 1, indicating the level of importance they assign to each factor. This rating scale allows the respondents to express their opinions by assigning higher scores to factors they consider more important and lower scores to factors they deem less important. Once the questionnaires have been collected, the scores assigned by the respondents are carefully analyzed.

The purpose of this analysis is to determine the relative importance of each factor in the successful implementation of a data warehouse. By examining the scores, it becomes possible to identify the factors that receive higher ratings, indicating their significance in contributing to the organization's goals and objectives. The analysis of the scores reveals valuable insights regarding which factors should be prioritized by the organization. By focusing on these factors, the organization can align its efforts with the most critical elements necessary for a successful implementation of a data warehouse.

This approach ensures that the organization's resources and efforts are directed towards the factors that have the greatest impact on achieving its goals and objectives. It is important to note that the survey encompasses a total of 10 factors, which means there are 10 distinct elements being evaluated for their importance in the context of implementing a data warehouse. By considering these factors and their respective ratings, the organization can make informed decisions and develop strategies that will optimize the implementation process and increase the likelihood of achieving success in their data warehouse initiative.

#### **4.2.2 Focus Group Interview**

A focus group interview is a qualitative research method that involves a small group of individuals selected to participate in a guided discussion about a specific topic or research objective. This method aims to gather in-depth insights, perspectives, and opinions by encouraging participants to share their thoughts and engage in interactive group discussions. The participants in a focus group interview

are carefully selected to represent a specific target population or share common characteristics relevant to the research topic.

The group dynamics and diversity of perspectives within the group can enrich the discussion and provide a comprehensive understanding of the topic under investigation. During the session, participants are encouraged to express their thoughts openly and engage in active discussion with other group members. This interactive format allows for the exchange of ideas, the emergence of diverse viewpoints, and the exploration of shared experiences or differing perspectives on the topic. The findings from focus group interviews can be used to inform decision-making or gain a deeper understanding of a particular phenomenon. They can complement quantitative research methods by providing a more nuanced understanding of participants' thoughts, motivations, and experiences.

To conduct a successful focus group interview, careful planning is required. This includes defining the research objectives, selecting appropriate participants, designing effective discussion prompts, and creating a comfortable and conducive environment for open dialogue.

The moderator plays a crucial role in facilitating the discussion, maintaining group dynamics, and ensuring that all participants could share their perspectives. Overall, focus group interviews offer a valuable qualitative research method to explore and understand the complexities of human attitudes, behaviors, and experiences. By harnessing the power of group interaction, these interviews provide researchers with in-depth insights and a deeper understanding of the research topic. Additional interviews will be conducted to gain further insights and a deeper understanding of the subject matter. These interviews will specifically focus on 13 factors that are crucial to the successful implementation of the system.

A group of 15 participants will be selected to take part in these interviews, and a focus group interview approach will be utilized. During the focus group interviews, the participants will engage in dynamic discussions facilitated by a moderator. This interactive setting allows for the exploration of various perspectives, experiences, and ideas related to the factors under investigation. By bringing together diverse viewpoints, the aim is to gather a rich pool of insights that can inform and enhance the implementation process. Ultimately, the combination of the interview data and the

findings from the literature review will contribute to a more comprehensive and informed understanding of the factors that are critical for successfully implementing the system. This integrated knowledge will guide decision -making and help align the organization's efforts with the key considerations necessary for achieving the desired outcomes.

### **4.3 Group of interviewees**

According to the Table 3 is a focus group interview consisting of three different groups of employees. Each group represents a specific category of participants: end users, the IT department, and employees who closely collaborate with customers.

Group 1, the end users, consists of five participants. The first participant is the Head of Department with 15 years of experience. The second participant is a Manager with 10 years of experience. The third participant is a Deputy Manager with 8 years of experience. The fourth and fifth participants are a Senior Officer and an Officer, both with 5 years of experience.

Group 2, the IT department, includes five participants as well. The sixth participant is the Head of Department with 10 years of experience. The seventh participant is a Manager with 8 years of experience. The eighth participant is a Deputy Manager with 8 years of experience. The ninth participant is a Specialist with 5 years of experience, and the tenth participant is a Senior Officer with 5 years of experience.

Group 3 represents employees in the organization who closely collaborate with customers. This group also consists of five participants. The eleventh participant is the Head of Department with 8 years of experience. The twelfth participant is a Manager with 7 years of experience. The thirteenth, fourteenth, and fifteenth participants are Officers with 5, 5, and 4 years of experience, respectively.

The purpose of the focus group interview is to gather insights and perspectives from these different groups within the organization. By including representatives from the end users, the IT department, and employees who interact with customers, the interview aims to capture a comprehensive understanding of various perspectives and experiences related to the organization's operations.

**Table 4** Group of interviewees

Group 1: End users			Group 2: IT department			Group 3: Employees in the organization closely collaborate with customers		
Participants	Position	Year's experience	Participants	Position	Year's experience	Participants	Position	Year's experience
Participation 1	Head of Department	15	Participation 6	Head of Department	10	Participation 11	Head of Department	8
Participation 2	Manager	10	Participation 7	Manager	8	Participation 12	Manager	7
Participation 3	Deputy manager	8	Participation 8	Deputy manager	8	Participation 13	Officer	5
Participation 4	Senior officer	5	Participation 9	Specialist	5	Participation 14	Officer	5
Participation 5	Officer	5	Participation 10	Senior officer	5	Participation 15	Officer	4

#### 4.4 Results

##### **In Part 1 of the survey, Questionnaires are distributed to the respondents.**

The researchers have taken all the returned questionnaires and conducted a thorough examination of their accuracy and completeness. They have also encoded the data and performed statistical analysis using a pre-built software. The statistical methods used for data analysis are as follows:

1. Personal factors of the respondents in the questionnaire were analyzed to determine the frequency and percentage.
2. Evaluate the critical success factors identified in the questionnaire to analyze the mean and standard deviation.

Symbols used in presenting data analysis results:

$n$  - Represents the population (sample size)

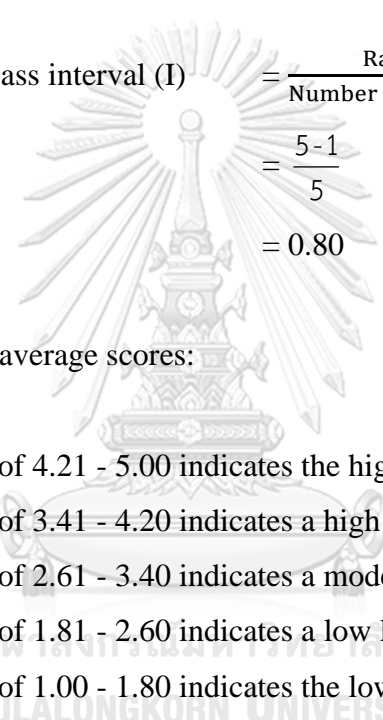
$\bar{x}$  - Represents the mean (average)

S.D. - Represents the standard deviation.

The 5 - level rating score, along with its corresponding scoring criteria, is as follows:

- Score 5: Represents the highest level.
- Score 4: Represents a high level.
- Score 3: Represents a moderate level.
- Score 2: Represents a low level.
- Score 1: Represents the lowest level.

Calculating the range of a class interval.



$$\begin{aligned}
 \text{The width of a class interval (I)} &= \frac{\text{Range (R)}}{\text{Number of intervals (k)}} \\
 &= \frac{5-1}{5} \\
 &= 0.80
 \end{aligned}$$

Interpretation of average scores:

- Average score of 4.21 - 5.00 indicates the highest level.
- Average score of 3.41 - 4.20 indicates a high level.
- Average score of 2.61 - 3.40 indicates a moderate level.
- Average score of 1.81 - 2.60 indicates a low level.
- Average score of 1.00 - 1.80 indicates the lowest level.



**Table 5** The table of critical success factors questionnaire

No.	Factors	$\bar{X}$	S.D.	Interpret
1	Committed and informed executive sponsor	4.60	0.51	Highest level
2	Widespread management support	4.87	0.35	Highest level
3	Appropriate team skills	3.07	0.70	Moderate level
4	Appropriate technology	3.53	0.52	High level
5	Adequate resources	3.67	0.49	High level
6	Effective data management	4.80	0.41	Highest level
7	Clear link with business objectives	4.87	0.35	Highest level
8	Well-defined information and systems requirements	4.73	0.46	Highest level
9	Evolutionary development	4.67	0.49	Highest level
10	Management of project scope	4.40	0.51	Highest level

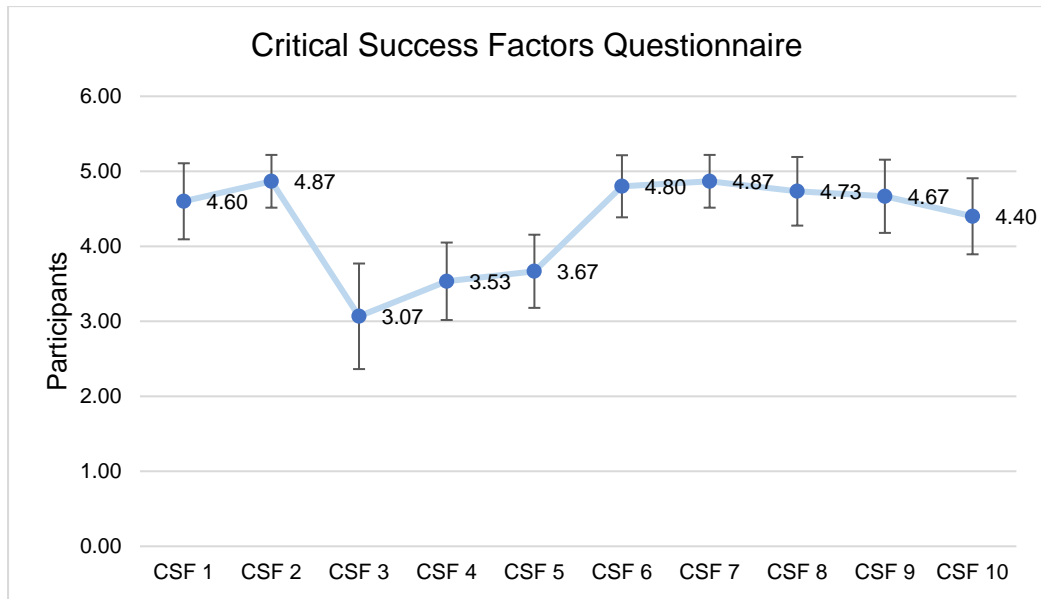


Figure 7 Plotting between Average and Standard deviation of each factor

According to the table of critical success factors questionnaire, when considering individual aspects, it is found that there are two aspects with the highest average scores, which are "Widespread management support" and "Clear link with business objectives" ( $\bar{X}=4.87$ ). Following those, the aspects with high average scores are "Effective data management" ( $\bar{X}=4.80$ ), "Well-defined information and systems requirements" ( $\bar{X}=4.73$ ), "Evolutionary development" ( $\bar{X}=4.67$ ), and "Committed and informed executive sponsor" ( $\bar{X}=4.60$ ). The aspects with relatively lower average scores are "Management of project scope" ( $\bar{X}=4.40$ ), "Adequate resources" ( $\bar{X}=3.67$ ), "Appropriate technology" ( $\bar{X}=3.53$ ), and "Appropriate team skills" ( $\bar{X}=3.07$ ) respectively.

Based on the analysis of the critical success factors for data warehouse implementation in the Industrial Associations Organization, the following conclusions can be drawn.

**Top Factors:** The two factors that have received the highest average scores are "Widespread management support" and "Clear link with business objectives." These factors, with average scores of 4.87, indicate the significance of having strong support from management and establishing a clear connection between the data warehouse

initiative and the organization's strategic goals. These factors play a crucial role in driving the success of the implementation.

**High-Scoring Factors:** The analysis also reveals several other factors that have received high average scores. These factors include "Effective data management" ( $\bar{X}=4.80$ ), "Well-defined information and systems requirements" ( $\bar{X}=4.73$ ), "Evolutionary development" ( $\bar{X}=4.60$ ), and "Committed and informed executive sponsor" ( $\bar{X}=4.60$ ). These factors highlight the importance of managing data effectively, clearly defining the requirements of the data warehouse and its systems, adopting an evolutionary development approach, and having an executive sponsor who is dedicated and well-informed throughout the implementation process. These factors significantly contribute to the success of the implementation.

**Lower-Scoring Factors:** On the other hand, the analysis indicates that there are areas with relatively lower average scores. These factors include "Management of project scope" ( $\bar{X}=4.40$ ), "Adequate resources" ( $\bar{X}=3.67$ ), "Appropriate technology" ( $\bar{X}=3.53$ ), and "Appropriate team skills" ( $\bar{X}=3.07$ ). These areas require attention and improvement to ensure the successful implementation of the data warehouse. Effective management of project scope, allocation of adequate resources, selection of appropriate technology, and development of the necessary team skills are crucial in addressing these lower-scoring factors.

Based on the revised list of factors and scores, let's consider the three factors with lower scores and provide explanations for why they may not be a significant concern, which are, adequate resources (3.67). Although this factor has a lower score compared to the top factors, it may not be a major concern due to a few reasons. Firstly, the lower score might be influenced by specific circumstances during the survey period, such as temporary resource constraints or perception issues. It is important to assess whether the perceived lack of resources is a recurring or systemic problem, or if it was a result of a specific situation during the survey. Additionally, the organization might have implemented resource optimization strategies, such as prioritization or efficient resource allocation methods, which mitigate concerns about inadequate resources.

Secondly, Appropriate technology (3.53), the lower score for this factor may not be a significant concern for the project due to a few possible reasons. Firstly, it could be that the organization has already invested in appropriate technology for the data warehouse implementation. The lower score might reflect minor challenges or specific instances where the technology might not have fully met expectations. However, this does not necessarily indicate a fundamental issue with the suitability of the technology for the project. Additionally, the lower score might be influenced by factors such as employee familiarity or training gaps, which can be addressed through targeted training programs or knowledge transfer initiatives.

Finally, appropriate team skills (3.07), while this factor has the lowest score among the listed factors, it may still not be a significant concern for the project. The lower score could be due to temporary skill gaps or specific challenges faced during the survey period. The organization might have ongoing initiatives to address skill gaps through training, recruitment, or team restructuring. By proactively addressing skill deficiencies and ensuring the availability of appropriate expertise, the organization can mitigate concerns related to team skills and enhance the success of the data warehouse implementation project. It is important to note that while these three factors may not be the highest scoring, they should still be monitored and improved upon to ensure they do not become significant barriers to project success. Regular evaluation, training, resource management, and technology assessments are crucial to addressing any potential concerns and driving the success of the data warehouse implementation project.

Although these three factors may not be a primary concern based on their lower scores, it is still essential to monitor and address any potential issues that may arise. Regular evaluation and improvement efforts should be undertaken to ensure that these factors do not become significant barriers to the success of the data warehouse implementation project.

There are seven factors stand out as the most critical and selective areas to focus on to drive the success of the data warehouse implementation project. The challenges presented by frequent changes in the board of directors and management, which cause discontinuity and uncertainty in operations, are at the center of the

company's problem statement. The following is the relationship between the company's problem statement and the critical success factors:

Table 6 The top 7 critical success factors

No.	Factors	Descriptions	Employee's Perspective
1	Widespread management support	Data warehouses should be business-driven, meaning that their design, implementation, and operation should be aligned with the organization's business goals and objectives. To achieve this, comprehensive managerial support is essential. Such support not only ensures the successful implementation and adoption of the data warehouse but also facilitates change management and mitigates opposition that may arise during the process.	With the organization undergoing changes in vision, mission, and policies due to new management teams, it becomes essential to improve work processes and ensure continuity. Effective data management practices within the data warehouse play a vital role in achieving this objective. By properly managing and organizing data, ensuring data quality, integration, governance, and security, the organization can rely on accurate and reliable information for decision-making and day-to-day operations, fostering continuity and reducing uncertainty.

Table 6 The top 7 critical success factors (continued)


No.	Factors	Descriptions	Employee's Perspective
2	Clear link with business objectives	<p>To ensure the success and viability of a data warehouse project, it is crucial for the project to be economically justified and have a clear connection to the company's strategy.</p>  <p>จุฬาลงกรณ์มหาวิทยาลัย CHULALONGKORN UNIVERSITY</p>	<p>To overcome the challenges posed by changing management and to ensure the data warehouse project's relevance and value, it is important to align it with the organization's overall goals and strategic direction. By establishing a clear link between the project and the business objectives, the data warehouse becomes a valuable tool in supporting the organization's success. This alignment helps to drive decision-making, streamline operations, and maintain a consistent focus on achieving the organization's goals.</p>

Table 6 The top 7 critical success factors (continued)

No.	Factors	Descriptions	Employee's Perspective
3	Effective data management	<p>There need to be operational data sources accessible. Applications should provide correctness, consistency, and currency. The data model needs to be adaptable and scalable.</p>	<p>Employees would value a system that ensures continuity of work despite the frequent changes in the top management team. An IT-based system can help streamline work processes, provide access to operational data sources, and ensure that information is readily available to employees regardless of changes in the management team. Effective data management would involve implementing systems and tools that facilitate seamless communication and information sharing across departments.</p>

Table 6 The top 7 critical success factors (continued)

No.	Factors	Descriptions	Employee's Perspective
4	Well-defined information and systems requirements	To ensure the success of a data warehouse project, it is crucial to establish a consensus among stakeholders regarding the expectations and requirements of the system.	<p>The organization faces discontinuity and restructuring, which underscores the importance of understanding the specific needs and requirements for data and systems.</p> <p>Thoroughly defining these requirements ensures that the data warehouse is tailored to meet the organization's evolving needs. By capturing and addressing the unique information and system requirements, the data warehouse becomes a reliable source of insights and supports decision-making, despite the changes occurring within the organization.</p>



Table 6 The top 7 critical success factors (continued)

No.	Factors	Descriptions	Employee's Perspective
5	Evolutionary development	<p>It is beneficial to adopt an iterative approach with active user participation. This iterative development process involves continuously refining and enhancing the system based on user feedback and evolving requirements.</p>	<p>Given the frequent changes and uncertainties faced by the organization, an iterative and incremental approach to data warehouse implementation is essential. This approach allows for flexibility and adaptability as the project progresses. By embracing evolutionary development, the data warehouse can accommodate new requirements and adjust to changing circumstances, ensuring its continued relevance and value amidst organizational changes.</p>

Table 6 The top 7 critical success factors (continued)

No.	Factors	Descriptions	Employee's Perspective
6	Committed and informed executive sponsor	<p>A committed and informed executive sponsor is a senior executive within an organization who takes on the responsibility of overseeing the project's overall direction, resource allocation, and representation before the executive team and board. This executive sponsor plays a crucial role in ensuring the success of the project by providing strategic guidance, securing necessary resources, and advocating for the project's objectives and outcomes.</p>	<p>The organization faces a challenge with frequent changes in the board of directors and management, leading to discontinuity and uncertainty in operations. To address this, it is crucial to have consistent support from top-level management. Strong endorsement and involvement from management provide the necessary resources, guidance, and decision-making authority to ensure the successful implementation of the data warehouse. This support helps stabilize operations and maintain continuity, even with changing leadership.</p>

Table 6 The top 7 critical success factors (continued)

No.	Factors	Descriptions	Employee's Perspective
7	Management of project scope	It is not uncommon for the project scope to expand over time. This expansion can be driven by various factors such as evolving business needs, emerging data sources, or changing requirements. However, the expansion of the project scope can introduce resource constraints that need to be effectively managed.	With the organization undergoing discontinuity and restructuring, managing, and controlling the project scope becomes critical. Effective scope management ensures that the data warehouse implementation stays within defined boundaries and objectives. This helps prevent scope creep and maintain project focus, enabling successful implementation despite the changes in vision, mission, and policies.

By considering and implementing these critical success factors, the organization can navigate the challenges posed by frequent changes in the board of directors and management. The data warehouse implementation project becomes a catalyst for improving work processes, ensuring continuity, and leveraging data effectively, ultimately contributing to the organization's success.

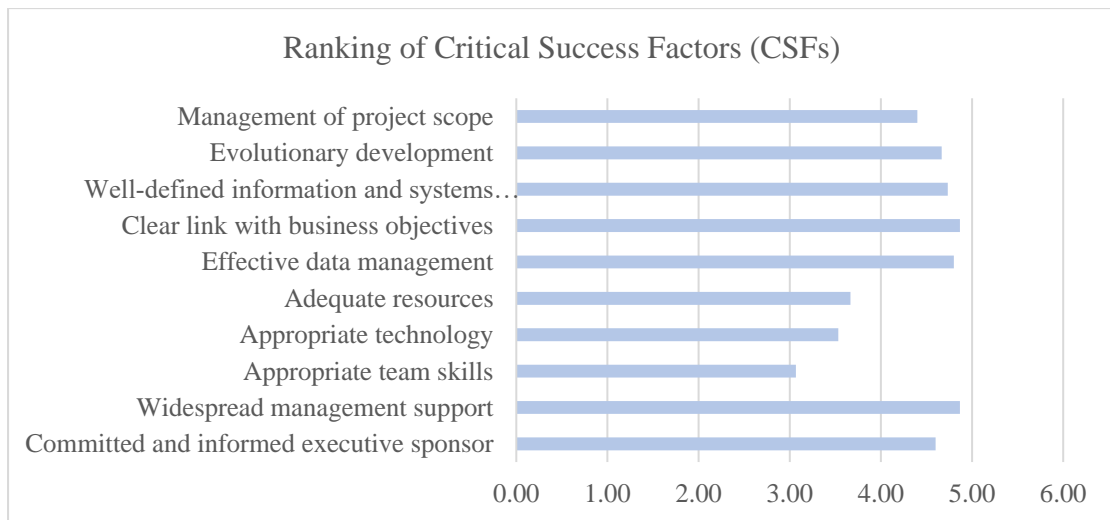


Figure 8 Ranking of Critical Success Factors (CSFs) of Data warehouse implementation.

Based on the average scores provided by employees within the organization for critical success factors of data warehouse implementation, the top seven factors with the highest average ratings are:

1. Widespread management support (4.87)
2. Clear link with business objectives (4.87)
3. Effective data management (4.80)
4. Well-defined information and systems requirements (4.73)
5. Evolutionary development (4.67)
6. Committed and informed executive sponsor (4.60)
7. Management of project scope (4.40)

### **In Part 2 of the survey, Focus Group Interview**

The following description shows the interviewee's perceptions of each CSF. Based on the findings, the interviews of fifteen participants were first coded. These codes were then analyzed where the importance of the CSF was first considered and then the best quotes from the interviews that were fitting the individual CSF were determined. Finally, the quotes were used as a base for creating the descriptions that

serve as a summarized perception of the participants' reasoning of the importance of the CSFs.

### **Project team**

The project team is significant for a successful implementation of a data warehouse within an organization. The team is responsible for planning, designing, and implementing the data warehouse, and will be working closely together throughout the project to ensure its success.

Having the right mix of individuals on the project team is crucial. This includes a project advocate,

who is responsible for championing the project and ensuring that it receives the necessary support from management and other stakeholders. It also includes workers from all levels and departments, as they bring a diversity of perspectives and knowledge that is critical for ensuring that the data warehouse meets the needs of the organization.

In addition, the project team may require outside consultants when internal experience is lacking. This can help to bring in specialized expertise and knowledge that is necessary for the project's success. Overall, having a strong project team is crucial for the successful implementation of a data warehouse within an organization. By ensuring that the team has the necessary skills, knowledge, and diversity of perspectives, the organization can improve its chances of building a data warehouse that meets its needs and objectives. Some crucial factors for the project team in terms of skills and knowledge. Members of the project team should have a strong understanding of data, including data modeling, data integration, and data analysis. Members of the project team should have technical skills such as programming, database administration, and data quality management. Members of the project team should have a deep understanding of the organization's business processes and objectives, so they can ensure that the data warehouse is aligned with those goals. Members of the project team should be able to communicate effectively and collaborate closely with other team members and stakeholders, both within and outside the organization.

This aligns with the findings of Somers and Nelson (2001) in their literature, which suggest that the success or failure of an implementation project is influenced by various factors. These factors include the project manager's knowledge, skills, abilities, and experience, as well as the careful selection of team members. It is crucial for team members not only to possess technological competence but also to have a deep understanding of the company and its business requirements. Additionally, the expertise of consultants can be utilized to bridge any knowledge gaps within the team. Ultimately, the competence and knowledge of the project team, along with the strategic use of consultants, play a significant role in determining the outcome of an implementation project.

### **Top management involvement**

The involvement of top management is also a critical success factor for the implementation of a data warehouse within an organization. Top management support is necessary to ensure that the project is adequately resourced, and that the project team has the necessary authority to make decisions and execute the project plan. Top management must communicate the importance of the data warehouse project to the entire organization, so that all stakeholders are aware of its goals, objectives, and benefits. They should participate in key project meetings and reviews, to ensure that the project is aligned with the organization's overall strategy and objectives. As well as Top management should be available to make timely decisions on key project issues, to avoid delays and keep the project on track.

The significance of having support from top management proved crucial in the effective execution of a substantial customized system (Ginzberg,1981) and seemed to be the primary impetus behind its successful implementation (Clemons, 1998). Moreover, in the literature review, additional perspectives have been included regarding this factor, alongside the viewpoints of the staff that were previously discussed. Research on project failures indicates that project cancellations arise when senior management delegates the responsibility of monitoring progress and making decisions during crucial project milestones to technical experts (Ewusi-Mensah, and Z. H. Przanyski,1991)

### **Strategic decision-making**

Implementing a data warehouse successfully relies on making strategic decisions that align with the organization's overall business strategy. The project team must have the ability to make these strategic decisions to support the organization's objectives. It's crucial to design the data warehouse according to the organization's specific business requirements, ensuring it provides valuable insights for strategic decision-making. Research by (Laughlin, 1999; Plant & Willcocks, 2007) supports the idea that establishing clear goals at the start of the project helps understand its purpose and facilitates strategic decision-making. Similarly, Holland et al. (1999), Nah et al. (2003), and Rosario (2000) emphasize the importance of clear goals and a well-defined business plan for project success.

To summarize, aligning the data warehouse project with the organization's business strategy, making strategic decisions, and having clear goals and a well-defined business plan are all interconnected factors that contribute to a successful data warehouse implementation.

### **Communication**

Effective communication ensures that all stakeholders are aware of the project's goals, objectives, and progress, and that they have the information they need to participate in the project successfully. The project team must clearly communicate the goals and objectives of the data warehouse project to all stakeholders, so that they understand the project's purpose and how it will benefit the organization. As well as progress reporting, it is important to keep all stakeholders informed of the project's status and any issues that need to be addressed. Progress reports should be clear, concise, and easy to understand.

In conclusion, effective communication is a crucial success factor for the implementation of a data warehouse within an organization. By communicating clearly with all stakeholders, reporting progress regularly, promoting collaboration and teamwork, providing user training and support, and encouraging feedback and continuous improvement, the project team can ensure that the data warehouse project delivers the desired benefits to the organization emphasized the significance of communication as a vital element encompassing all ten factors of their Project

Implementation Profile. They highlighted that effective communication is crucial not only within the project team but also between the team and the rest of the organization (Slevin and Pinto, 1986).

### **Project management**

Project management is important for the implementation. It ensures that the project is implemented on time, within budget, and to the required quality standards. According to the literature reviews, project management activities occur throughout the entire lifespan of a project, starting from its initiation to its closure (J. A. Hoffer, J. F. George, and J. S., 1998). The contingency approach to project management suggests that planning and controlling a project depend on its specific characteristics, such as size, technology familiarity, and project structure. The diverse combination of hardware, software, and various organizational, human, and political factors make many projects large and inherently complex, requiring new project management skills (H. W. Ryan, 1999).

Properly managing the scope of a project is crucial to prevent schedule delays and cost overruns. This involves creating a plan and adhering to it. If a project's scope is too broad or ambitious, it can lead to significant problems. Implementing customization increases the project's scope, resulting in additional time and cost. To manage the project's scope effectively, it is important to adopt a minimal customization strategy, which limits user-requested changes and customizations. This approach helps in controlling the project's scope. Due to the high implementation risks associated with projects, it is essential to utilize various management tools. These tools include external and internal integration devices as well as formal planning and results controls.

### **Project support**

The significance of project support ensures that the data warehouse is implemented successfully, and that it meets the organization's requirements. It also ensures that technical issues are addressed promptly, preventing delays and cost overruns. There are some of the keys that need to be considered regarding project support, such as, dedicated partner, A dedicated partner should be responsible for the



technical support, maintenance, and updates for the project. This partner should have a deep understanding of the data warehouse's technical requirements and be able to provide support to the project team and end-users. As well as Project assistance, it should be structured to provide the necessary technical support, maintenance, and updates throughout the project's life cycle. This includes regular maintenance and updates along with, provided in a timely and effective manner. Maguire et al. (2010) and Snider et al. (2009) conducted research indicating that users highly value the assistance provided by consultants during an ERP implementation. They emphasized that consultants could offer substantial benefits and contribute to the overall success of the implementation process.

### **Organizational change management**

A data warehouse implementation represents a significant change for an organization, as it requires new processes, technologies, and ways of working. The change process should be managed using a structured approach that includes stakeholder analysis, communication planning, training, and support. The project team should have the necessary skills and experience to manage the change process effectively. A part of Stakeholders should be analyzed to identify their needs, expectations, and concerns. This includes identifying stakeholders who will be affected by the change and understanding their perspectives.

The project team should develop a communication plan that includes the purpose of the data warehouse, its benefits, and how it will be used. Communication should be ongoing and two-way. Another key concern that relates to organizational change management is training and supporting, the project team should develop a training plan that provides stakeholders with the knowledge and skills they need to use the data warehouse effectively. Training should be tailored to the needs of different stakeholders and should be ongoing. Support should be provided to stakeholders throughout the change process. This includes providing help and guidance on how to use the data warehouse and addressing any issues or concerns that arise.

In conclusion, managing organizational change is crucial for the successful adoption of a data warehouse. By managing the change process effectively, the project team can ensure that stakeholders understand the benefits of the data warehouse and how it will be used. This will increase the likelihood of successful adoption and lead to improved decision-making within the organization. Laughlin (1999), Loh and Koh (2004), and Shanks et al. (2000) conducted research that supports the significance of change management in dealing with user resistance and addressing employee motivation challenges. These studies underline the necessity of implementing appropriate change management strategies to effectively handle the human dimension involved in the implementation of new systems or processes.

### **Business process alignment**

Aligning the data warehouse system with the organization's business processes is a critical success factor for its deployment and requires a thorough analysis and redesign of the organization's processes. A data warehouse implementation represents a significant change in the way an organization collects, manages, and uses data, and it must be aligned with the organization's business processes to ensure its success. Understanding business processes, the project team should have a clear understanding of the organization's business processes and how they relate to data collection, management, and usage. The project team should conduct a thorough analysis of the organization's business processes to identify areas where the data warehouse can be integrated and where changes may be needed.

In conclusion, business process alignment is crucial for the successful deployment of a data warehouse. By aligning the data warehouse with the organization's business processes, the project team can ensure that the system is integrated smoothly and that it is used effectively to support decision-making within the organization. This will lead to improved operational efficiency, better decision-making, and increased competitiveness for the organization. As per the literature review, implementing a system necessitates the re-engineering of the organization's business processes. When executed effectively, this aids in reducing user resistance to change (Huang et al., 2004). It is crucial for the business processes to align with the

functionality of the system since an organization cannot enhance its performance without modifying its existing processes.

Both the organizational perspective and the literature review stress the significance of aligning the data warehouse with the organization's business processes to achieve a successful implementation. They emphasize the need for a comprehensive analysis and redesign of existing processes to facilitate a seamless integration of the system. Furthermore, they highlight the importance of understanding the organization's business processes and conducting a thorough analysis to identify areas that require integration and potential adjustments. Ultimately, the objective is to enhance operational efficiency, improve decision-making capabilities, and bolster overall competitiveness. Both perspectives underscore the critical role of aligning the system with the organization's business processes to attain these desired outcomes.

### **Software testing**

The testing of a data warehouse system during its implementation phase is crucial to ensure that the system meets the organization's requirements and functions as intended. The testing process during the data warehouse implementation typically involves various stages, such as unit testing, integration testing, system testing, and user acceptance testing. The testing process should have a well-structured plan that includes testing scripts, test cases, and testing environments to ensure comprehensive testing. Unit testing involves testing each module or component of the system to ensure that it performs as expected. Integration testing involves testing the integration of different modules or components to ensure that they work together correctly. System testing involves testing the entire system to ensure that it meets the organization's requirements. User acceptance testing involves testing the system with real-world data and scenarios to ensure that it meets the end-user's requirements and expectations. This testing phase typically involves end-users and stakeholders who provide feedback and report any issues or bugs. Based on the interviewee's comments on how to conduct the system testing, the interviewees expressed their opinions.

For example, the project team should develop comprehensive testing scripts and test cases that cover all the functional and non-functional requirements of the

system and conduct user acceptance testing involving end-users and stakeholders to ensure that the system meets their requirements and expectations. Lastly, it is crucial to ensure that any modifications or improvements made to the system do not adversely impact its existing functionality.

It is important to verify that changes or enhancements do not disrupt the system's current operations or capabilities. Chang et al. (2014), Nah et al. (2003), and Singla & Goyal (2006) support the general viewpoint on software testing and emphasize the significance of conducting thorough testing of software prior to its implementation. They stress the importance of ensuring that adequate testing is performed to identify and resolve any potential issues before the system is launched.

### **Performance measurement**

During the implementation process of a data warehouse, performance can be assessed using various metrics such as data load time, query response time, data accuracy, system availability, and user satisfaction. These metrics can help identify bottlenecks and areas for improvement and ensure that the data warehouse meets the performance requirements of the organization. From the interviewee's opinion, performance should be measured based on the specific goals and objectives of the organization, and the metrics chosen should be relevant and meaningful to those goals. It is also important to regularly review and adjust the metrics as needed to ensure that they remain aligned with the organization's objectives. According to Loh and Koh (2004), performance measurement is crucial for gaining a comprehensive understanding of progress. It is necessary to measure performance against project goals and continuously monitor it in relation to milestones and targets.

### **Education and training**

During the implementation of a data warehouse, training and education are critical factors to ensure that end-users understand the system and can use it effectively. The training and education should be provided from the start of the project and be ongoing throughout the implementation process. This can help ensure a smooth transition to the new system and increase user adoption. In terms of how training and education should be delivered, there are various methods available such

as classroom training, online courses, video tutorials, on-the-job training, and user manuals. The delivery method should be chosen based on the needs of the users and the complexity of the system. It is also important to ensure that the training is tailored to the specific roles and responsibilities of the users, and that it covers not only how to use the system but also the underlying concepts and principles.

Additionally, it is beneficial to provide ongoing support and access to training resources even after the implementation is complete to help users adapt to any changes and continuously improve their skills. During the implementation project, the critical success factor of education and training was identified as having the most significant impact, particularly during the shakedown phase. This phase involves training employees on how to use the new system and transitioning away from previous work practices (Loh & Koh, 2003). However, Somers and Nelson (2004) argue that education and training remain critical throughout the entire implementation process. Their research also emphasizes the importance of continuous knowledge development for users to maximize the utilization of the system during the post-implementation phase.

### **Technical possibilities**

Technical possibilities are an essential critical success factor for data warehouse implementation. The system's technological capabilities must align with the organization's strategy, size, business area, business processes, and internal and external relationship structure. Organizations should compare different systems available in the market and select the one that best fits their needs. The system should be scalable to accommodate growth, flexible to meet changing business requirements, and able to integrate with other systems in use. The data warehouse should have the capability to handle large volumes of data, provide fast access to the data, and offer tools to analyze and report on the data effectively. Furthermore, technical support, maintenance, and updates must be available to ensure the system's long-term success. Therefore, having the right technological capabilities is crucial for the successful implementation and operation of a data warehouse. According to Somers and Nelson (2001), a successful ERP implementation project requires early preparation and careful selection of the ERP system.

## **Chapter 5**

### **Research Summary**

The main objective of this study was to address two gaps in the existing literature related to data warehouse implementation. Firstly, the study aimed to examine how operational users perceive the critical success factors (CSFs) for data warehouse implementation. Secondly, it aimed to explore the significance of these CSFs during the implementation phase.

The findings of the study shed light on the perspectives of users regarding 10 CSFs in quantitative analysis and 12 CSFs in qualitative analysis. Through analyzing different cases, the study identified both gaps and similarities between the interviewees and various stakeholders such as end users, the IT department, and employees from different departments involved in the project. These stakeholders have direct involvement in the organization and work closely with customers, which provides valuable insights.

The study aimed to fill gaps in the literature regarding the perception of CSFs for data warehouse implementation by operational users and the importance of these factors during implementation. The findings not only contributed to understanding the perspectives of users but also highlighted variations and similarities among different stakeholders involved in the project. This information can be valuable for organizations looking to implement data warehouses effectively and efficiently. Following the completion of a survey using a questionnaire, employees within the organization were asked to rank 10 critical success factors based on their perceived importance. The scoring system ranged from 5 (highest importance) to 1 (lowest importance). The purpose of the survey was to gather insights into the factors that significantly contribute to the success of the organization's initiatives.

After examining the survey findings, it became clear that employees assigned great significance to the following seven factors:

1. Widespread management support (4.87)
2. Clear link with business objectives (4.87)
3. Effective data management (4.80)
4. Well-defined information and systems requirements (4.73)

5. Evolutionary development (4.67)
6. Committed and informed executive sponsor (4.60)
7. Management of project scope (4.40)

These 7 factors were consistently recognized as highly important by employees and were perceived to have a direct correlation with the organization's problem statement and success in implementing data warehouse initiatives. By prioritizing these factors and aligning organizational efforts accordingly, the organization can increase the likelihood of achieving its desired outcomes and maximizing the benefits derived from the implementation of data warehouse projects.

Following the completion of the survey questionnaire, a focus group interview was conducted in Part 2, involving 15 experts as mentioned in this thesis. The purpose of the focus group interview was to delve deeper into the discussion of all 12 critical success factors that were identified and summarized in Chapter 4. During this process, the 7 factors obtained from the questionnaire were correlated and connected to the 12 factors identified by the experts.

By combining the insights gathered from the questionnaire responses and the expert opinions shared during the focus group interview, a comprehensive understanding of the critical success factors emerged. This integration of perspectives allowed for a more nuanced and holistic view of the factors that are most influential and relevant to the success of the project.

The findings from this synthesis provided valuable insights into the key elements that should be prioritized and addressed to ensure the successful implementation of the project. By considering both the perspectives of employees within the organization and the expertise, a more well-rounded and informed understanding of the critical success factors was achieved.

Table 7 The 7 questionnaire factors were linked to the 12 expert-identified factors.

No.	Critical Success Factors	The most relevant factors from the top 7 critical success factors from the questionnaire	Summarize
1	Project team	<p>Based on the interviewee's perspective, the most relevant factors from the top 7 critical success factors from the questionnaire that relate to the project team are:</p> <p>1. Clear link with business objectives: This factor emphasizes the importance of aligning the data warehouse project with the organization's overall goals and strategic direction. It is crucial for the project team to have a deep understanding of the organization's business objectives so that they can ensure the data warehouse is designed and implemented to support those objectives effectively.</p> <p>2. Effective data management: This factor highlights the need for the project team to have a strong understanding of data management practices. The team should be skilled in areas such as data</p>	<p>The project team plays a vital role in the successful implementation of a data warehouse. They are responsible for planning, designing, and implementing the data warehouse, working closely together to ensure its success. Having the right mix of individuals on the team is crucial, including a project advocate and workers from various levels and departments to bring diverse perspectives and knowledge. The team should possess strong data understanding, technical skills, and a deep understanding of the organization's</p>



Table 7 The 7 questionnaire factors were linked to the 12 expert-identified factors.  
(continued)

No.	Critical Success Factors	The most relevant factors from the top 7 critical success factors from the questionnaire	Summarize
		<p>integration, data quality management, and data governance. Effective data management is essential for ensuring that the data warehouse provides accurate and reliable information for decision-making and day-to-day operations.</p> <p>3. Committed and informed executive sponsor: This factor emphasizes the importance of having consistent support from top-level management. The project team relies on the executive sponsor to provide necessary resources, guidance, and decision-making authority. A committed and informed executive sponsor helps to stabilize operations and maintain continuity, even in the face of changing leadership.</p> <p>These three factors highlight the significance of the project team's understanding of business objectives, data management expertise, and the support they receive from management.</p>	<p>business processes. Effective communication and collaboration with stakeholders are essential. Clear alignment with business objectives, effective data management practices, and committed executive sponsorship are critical factors for success.</p> <p>By ensuring these factors are in place, the organization can improve its chances of building a data warehouse that meets its needs and objectives.</p>

Table 7 The 7 questionnaire factors were linked to the 12 expert-identified factors.  
(continued)

No.	Critical Success Factors	The most relevant factors from the top 7 critical success factors from the questionnaire	Summarize
2	Top management involvement	<p>Based on the interviewee's perspective, the most relevant factors from the top 7 critical success factors from the questionnaire that relate to top management involvement and its impact on the project team are:</p> <ol style="list-style-type: none"> <li>1. Widespread management support: This factor highlights the importance of having support from top management to ensure the project is adequately resourced and that the project team has the necessary authority to execute the project plan. Widespread management support fosters continuity and reduces uncertainty within the organization, enabling effective data management practices and decision-making.</li> <li>2. Clear link with business objectives: Top management's involvement is crucial in establishing a clear link between</li> </ol>	<p>Top management involvement is a critical success factor in the implementation of a data warehouse. Their support is essential to provide adequate resources and empower the project team with decision-making authority. Top management must communicate the project's importance to the entire organization, participate in key project meetings, and ensure alignment with business objectives. Their timely decision-making and commitment to the</p>

Table 7 The 7 questionnaire factors were linked to the 12 expert-identified factors.  
(continued)

No.	Critical Success Factors	The most relevant factors from the top 7 critical success factors from the questionnaire	Summarize
		<p>the data warehouse project and the organization's overall goals and strategic direction. Their participation in key project meetings and reviews ensures alignment with the organization's strategy and objectives, which helps drive decision-making and maintain a consistent focus on achieving the goals.</p> <p>3. Committed and informed executive sponsor: The interviewee emphasizes the importance of having a committed and informed executive sponsor from top management. This executive sponsor provides necessary resources, guidance, and decision-making authority, which stabilizes operations and maintains continuity even amidst changing leadership. Their involvement supports the project team in executing the project effectively.</p>	<p>project help maintain continuity and keep it on track. Studies have shown that having top management support is crucial for the successful execution of complex systems and prevents project cancellations caused by delegating decision-making to technical experts. Overall, widespread management support, a clear link with business objectives, and a committed executive sponsor play a significant role in the data warehouse implementation, enabling effective data management practices and</p>

Table 7 The 7 questionnaire factors were linked to the 12 expert-identified factors.  
(continued)

No.	Critical Success Factors	The most relevant factors from the top 7 critical success factors from the questionnaire	Summarize
		These three factors highlight the significance of top management involvement in supporting the project team and ensuring the successful implementation of the data warehouse. Widespread management support, clear alignment with business objectives, and a committed executive sponsor contribute to the team's ability to execute the project plan, make timely decisions, and align the data warehouse with the organization's needs and goals.	ensuring project success.
3	Strategic decision-making	Based on the interviewee's perspective, the most relevant factors from the top 7 critical success factors from the questionnaire that relate to strategic decision-making and its impact on the project team are:  1. Clear link with business objectives: This factor emphasizes the importance of aligning the data warehouse project with the	Strategic decision-making is a critical factor in the successful implementation of a data warehouse. It requires the project team to align the data warehouse project with the organization's business strategy and

Table 7 The 7 questionnaire factors were linked to the 12 expert-identified factors.  
(continued)

No.	Critical Success Factors	The most relevant factors from the top 7 critical success factors from the questionnaire	Summarize
		<p>organization's overall goals and strategic direction. It is crucial for the project team to understand the organization's business strategy and ensure that the data warehouse design and implementation support strategic decision-making effectively.</p> <p>2. Effective data management: This factor highlights the significance of managing and organizing data efficiently within the data warehouse. Effective data management practices enable accurate and reliable information, which is essential for strategic decision-making. The project team needs to ensure data quality, integration, governance, and security to support the organization's objectives.</p> <p>3. Well-defined information and systems requirements: This factor stresses the importance of</p>	<p>make informed decisions that support the organization's objectives. By designing the data warehouse according to specific business requirements and implementing effective data management practices, the project team ensures that the data warehouse provides valuable insights for strategic decision-making. Clear goals and a well-defined business plan further contribute to project success. Overall, the interconnection between aligning the data warehouse with business objectives,</p>

Table 7 The 7 questionnaire factors were linked to the 12 expert-identified factors.  
(continued)

No.	Critical Success Factors	The most relevant factors from the top 7 critical success factors from the questionnaire	Summarize
		<p>thoroughly defining the information and systems requirements for the data warehouse. By understanding the organization's specific needs and capturing them effectively, the project team can design a data warehouse that provides reliable insights for strategic decision-making, even in the face of changes within the organization.</p> <p>These three factors highlight the significance of strategic decision-making in the context of the project team. Aligning the data warehouse with business objectives, effective data management practices, and well-defined requirements enable the project team to make informed decisions and design a data warehouse that supports strategic decision-making.</p>	<p>making strategic decisions, and having clear goals and a well-defined plan is crucial for a successful data warehouse implementation.</p>

Table 7 The 7 questionnaire factors were linked to the 12 expert-identified factors.  
(continued)

No.	Critical Success Factors	The most relevant factors from the top 7 critical success factors from the questionnaire	Summarize
4	Communication	<p>Based on the interviewee's perspective, the most relevant factors from the top 7 critical success factors from the questionnaire that relate to communication and its impact on the project team are:</p> <p>1. Widespread management support: This factor emphasizes the importance of effective communication between the project team and top management. Clear communication ensures that the project team receives the necessary support, resources, and guidance from management, enabling successful implementation of the data warehouse.</p> <p>2. Clear link with business objectives: Effective communication is essential in establishing a clear link between the data warehouse project and the organization's overall goals and</p>	<p>Effective communication is a crucial success factor for implementing a data warehouse. It ensures that stakeholders are informed about the project's goals, progress, and benefits, enabling their active participation. Clear communication within the project team and with top management fosters support, guidance, and necessary resources for successful implementation. Establishing a clear link between the project and business objectives enhances</p>

Table 7 The 7 questionnaire factors were linked to the 12 expert-identified factors.  
(continued)

No.	Critical Success Factors	The most relevant factors from the top 7 critical success factors from the questionnaire	Summarize
		<p>strategic direction. Clear communication ensures that all stakeholders understand the project's purpose and how it aligns with the organization's objectives, promoting collaboration and effective decision-making.</p> <p>3. Effective data management: Communication plays a crucial role in effective data management practices. Clear communication channels facilitate seamless information sharing across departments, ensuring that operational data sources are accessible to employees and supporting continuity of work.</p> <p>These three factors highlight the significance of communication within the project team and between the team and other stakeholders. Effective communication, supported by widespread management support, a clear link with business objectives,</p>	<p>alignment and promotes effective decision-making. Additionally, effective communication enables seamless information sharing and data management across departments, ensuring access to relevant data sources and promoting continuity of work. By prioritizing effective communication, the project team can foster collaboration, understanding, and the successful delivery of the data warehouse's desired benefits to the organization.</p>



Table 7 The 7 questionnaire factors were linked to the 12 expert-identified factors.  
(continued)

No.	Critical Success Factors	The most relevant factors from the top 7 critical success factors from the questionnaire	Summarize
		and effective data management, promotes collaboration, understanding, and successful implementation of the data warehouse project.	
5	Project management	<p>Based on the interviewee's perspective, the most relevant factors from the top 7 critical success factors from the questionnaire that relate to project management and its impact on the project team are:</p> <p>1. Management of project scope: Properly managing the scope of the project is crucial to prevent schedule delays and cost overruns. The project team needs to create a well-defined plan and adhere to it. Effective scope management helps maintain project focus and prevents scope creep.</p>	<p>Project management is crucial for successful implementation, ensuring projects are delivered on time, within budget, and to the required quality standards. Properly managing the project scope is essential to prevent delays and cost overruns, requiring a well-defined plan and adherence to it. Embracing an iterative and</p>

Table 7 The 7 questionnaire factors were linked to the 12 expert-identified factors.  
(continued)

No.	Critical Success Factors	The most relevant factors from the top 7 critical success factors from the questionnaire	Summarize
		<p>2. Evolutionary development: Given the frequent changes and uncertainties faced by the organization, an iterative and incremental approach to data warehouse implementation is essential. Embracing evolutionary development allows the project team to adapt to changing circumstances, accommodate new requirements, and ensure the continued relevance and value of the data warehouse.</p> <p>3. Committed and informed executive sponsor: The involvement of a committed and informed executive sponsor from top-level management is crucial. Their support provides the necessary resources, guidance, and decision-making authority to ensure the successful implementation of the data warehouse. Their consistent involvement helps stabilize operations and maintain continuity, even with changing leadership.</p>	<p>incremental approach allows the project team to adapt to changes and accommodate new requirements, ensuring the continued relevance of the data warehouse. Having a committed and informed executive sponsor provides the necessary resources and guidance, maintaining stability and continuity. These factors highlight the importance of effective project management in executing the project plan and ensuring the successful implementation of the data warehouse.</p>

Table 7 The 7 questionnaire factors were linked to the 12 expert-identified factors.  
(continued)

No.	Critical Success Factors	The most relevant factors from the top 7 critical success factors from the questionnaire	Summarize
		<p>These three factors highlight the significance of effective project management in the context of the project team. Managing the project scope, embracing evolutionary development, and having a committed and informed executive sponsor contribute to the team's ability to execute the project plan, adapt to changes, and receive necessary support, ultimately leading to successful implementation of the data warehouse project.</p>	
6	Project support	<p>Based on the interviewee's perspective, the most relevant factors from the top 7 critical success factors from the questionnaire that relate to project support and its impact on the project team are:</p> <p>1. Widespread management support: This factor emphasizes the importance of having support from management teams throughout the organization. Their endorsement</p>	<p>Project support is crucial for the successful implementation of a data warehouse, ensuring that it meets the organization's requirements and addresses technical issues promptly. Widespread management support provides the</p>

Table 7 The 7 questionnaire factors were linked to the 12 expert-identified factors.  
(continued)

No.	Critical Success Factors	The most relevant factors from the top 7 critical success factors from the questionnaire	Summarize
		<p>and involvement provide the necessary resources, guidance, and decision-making authority to ensure the successful implementation of the data warehouse. Management support helps stabilize operations and maintain continuity, even with changing leadership.</p> <p>2. Clear link with business objectives: Effective project support requires aligning the data warehouse project with the organization's overall goals and strategic direction. By establishing a clear link between the project and the business objectives, the data warehouse becomes a valuable tool in supporting the organization's success. This alignment helps drive decision-making, streamline operations, and maintain a consistent focus on achieving the organization's goals.</p>	<p>necessary resources, guidance, and decision-making authority, stabilizing operations and maintaining continuity.</p> <p>Establishing a clear link between the project and the organization's business objectives aligns the data warehouse with strategic direction, driving decision-making and streamlining operations. Effective data management practices ensure that data is properly managed and accessible, supporting continuity</p>

Table 7 The 7 questionnaire factors were linked to the 12 expert-identified factors.  
(continued)

No.	Critical Success Factors	The most relevant factors from the top 7 critical success factors from the questionnaire	Summarize
		<p>3. Effective data management: Project support involves implementing systems and tools that facilitate effective data management practices. This ensures that data is properly managed, organized, and accessible to employees regardless of changes in the management team. Effective data management practices support continuity of work and provide accurate and reliable information for decision-making and day-to-day operations.</p> <p>These three factors highlight the significance of project support within the project team.</p> <p>Widespread management support, a clear link with business objectives, and effective data management practices contribute to the successful implementation of the data warehouse project, addressing technical issues promptly, preventing delays, and ensuring the project meets the organization's requirements."</p>	<p>of work and providing accurate information for decision-making. By focusing on these factors, the project team can ensure a successful implementation, prevent delays, and meet the organization's goals.</p>

Table 7 The 7 questionnaire factors were linked to the 12 expert-identified factors.  
(continued)

No.	Critical Success Factors	The most relevant factors from the top 7 critical success factors from the questionnaire	Summarize
7	Organizational change management	<p>Based on the interviewee's perspective, the most relevant factors from the top 7 critical success factors from the questionnaire that relate to organizational change management and its impact on the project team are:</p> <ol style="list-style-type: none"> <li>1. Widespread management support: With the organization undergoing changes in vision, mission, and policies due to new management teams, having widespread management support is crucial. This support provides the necessary resources, guidance, and decision-making authority to manage organizational change effectively and ensure the successful adoption of the data warehouse.</li> <li>2. Clear link with business objectives: Aligning the data warehouse project with the organization's overall goals and</li> </ol>	<p>Organizational change management is crucial for the successful adoption of a data warehouse. Implementing a data warehouse involves significant changes in processes, technologies, and ways of working, which require a structured approach. The project team should conduct stakeholder analysis, develop a communication plan, and provide ongoing training and support tailored to the needs of different stakeholders. Widespread management support ensures the necessary resources and</p>

Table 7 The 7 questionnaire factors were linked to the 12 expert-identified factors.  
(continued)

No.	Critical Success Factors	The most relevant factors from the top 7 critical success factors from the questionnaire	Summarize
		<p>strategic direction is essential. A clear link between the project and the business objectives helps stakeholders understand the benefits of the data warehouse and its relevance to the organization's success. This alignment promotes buy-in, engagement, and effective decision-making.</p> <p>3. Effective data management: Implementing effective data management practices is important for managing organizational change during the data warehouse implementation. Properly managing and organizing data, ensuring data quality, integration, governance, and security, allows employees to rely on accurate and reliable information for decision-making and day-to-day operations, fostering continuity and reducing uncertainty.</p>	<p>guidance for managing change effectively.</p> <p>Establishing a clear link between the data warehouse project and the organization's business objectives promotes buy-in and effective decision-making. Effective data management practices ensure reliable information for decision-making and foster continuity. By managing organizational change, the project team can increase the likelihood of successful adoption, address user resistance, and improve decision-</p>

Table 7 The 7 questionnaire factors were linked to the 12 expert-identified factors.  
(continued)

No.	Critical Success Factors	The most relevant factors from the top 7 critical success factors from the questionnaire	Summarize
		These three factors highlight the significance of organizational change management within the project team. Widespread management support, a clear link with business objectives, and effective data management practices contribute to the successful adoption of the data warehouse, addressing user resistance, and ensuring the project's alignment with the organization's goals.	making within the organization.
8	Business process alignment	Based on the interviewee's perspective, the most relevant factors from the top 7 critical success factors from the questionnaire that relate to business process alignment and its impact on the project team are:  1. Clear link with business objectives: Aligning the data warehouse project with the organization's overall goals and strategic direction is crucial.	Business process alignment is crucial for the successful deployment of a data warehouse. It requires a thorough analysis and redesign of the organization's processes to ensure that the data warehouse system integrates smoothly with the existing



Table 7 The 7 questionnaire factors were linked to the 12 expert-identified factors.  
(continued)

No.	Critical Success Factors	The most relevant factors from the top 7 critical success factors from the questionnaire	Summarize
		<p>Establishing a clear link between the project and the business objectives ensures that the data warehouse system is designed and implemented to support the organization's specific needs and desired outcomes. This alignment helps drive decision-making, streamline operations, and maintain a consistent focus on achieving the organization's goals.</p> <p>2. Effective data management: Implementing effective data management practices is essential for business process alignment. Properly managing and organizing data, ensuring data quality, integration, governance, and security, supports the seamless integration of the data warehouse into the organization's business processes. It enables accurate and reliable information for decision-making and day-to-day operations, fostering operational efficiency and reducing uncertainty.</p>	<p>business processes. The project team needs to understand the organization's business processes and conduct a comprehensive analysis to identify areas for integration and potential adjustments. By aligning the data warehouse with the organization's business objectives, implementing effective data management practices, and defining clear information and systems requirements, the project team can enable seamless integration, support decision-making,</p>

Table 7 The 7 questionnaire factors were linked to the 12 expert-identified factors.  
(continued)

No.	Critical Success Factors	The most relevant factors from the top 7 critical success factors from the questionnaire	Summarize
		<p>3. Well-defined information and systems requirements: Thoroughly defining the information and systems requirements ensures that the data warehouse is tailored to meet the organization's specific needs and business processes. Understanding the organization's business processes and conducting a thorough analysis allows for the identification of areas where the data warehouse can be integrated and potential adjustments that may be required. By aligning the system with the organization's business processes, the project team can ensure a seamless integration and effective utilization of the data warehouse system.</p> <p>These three factors highlight the significance of business process alignment within the project team. Clear link with business objectives, effective data management practices, and well-defined information and systems requirements contribute to the successful deployment of the data</p>	<p>improve operational efficiency, and enhance the organization's competitiveness. This alignment ensures that the data warehouse system is utilized effectively and contributes to the overall success of the organization.</p>

Table 7 The 7 questionnaire factors were linked to the 12 expert-identified factors.  
(continued)

No.	Critical Success Factors	The most relevant factors from the top 7 critical success factors from the questionnaire	Summarize
		warehouse, enabling improved decision-making, operational efficiency, and competitiveness for the organization.	
9	Software testing	<p>Based on the interviewee's perspective, the most relevant factors from the top 7 critical success factors from the questionnaire that relate to software testing and its impact on the project team are:</p> <p>1. Clear link with business objectives: Ensuring a clear link between the data warehouse project and the organization's overall goals and strategic direction is crucial. By aligning the testing process with the business objectives, the project team can verify that the system functions as intended and supports the organization's specific requirements, contributing to the achievement of desired outcomes.</p>	<p>Software testing is a critical aspect of implementing a data warehouse system, ensuring that it meets the organization's requirements and functions as intended. The testing process involves stages such as unit testing, integration testing, system testing, and user acceptance testing, with a well-structured plan including testing scripts, test cases, and environments. Unit testing verifies the performance of</p>

Table 7 The 7 questionnaire factors were linked to the 12 expert-identified factors.  
(continued)

No.	Critical Success Factors	The most relevant factors from the top 7 critical success factors from the questionnaire	Summarize
		<p>2. Effective data management: Implementing effective data management practices is essential for successful software testing. Properly managing and organizing data ensures that accurate and reliable information is used during testing to assess the system's performance and functionality. Effective data management supports comprehensive and reliable testing processes, enabling the identification and resolution of potential issues before system implementation.</p> <p>3. Well-defined information and systems requirements: Thoroughly defining the information and systems requirements is crucial for software testing. It ensures that the testing process covers all functional and non-functional requirements of the system. By having well-defined requirements, the project team can develop comprehensive testing</p>	<p>each module, integration testing ensures proper interaction between components, system testing validates the entire system, and user acceptance testing ensures it meets end-user expectations. The interviewee emphasizes the importance of comprehensive testing, encompassing functional and non-functional requirements, as well as involving end-users and stakeholders for feedback. Aligning testing with business objectives,</p>

Table 7 The 7 questionnaire factors were linked to the 12 expert-identified factors.  
(continued)

No.	Critical Success Factors	The most relevant factors from the top 7 critical success factors from the questionnaire	Summarize
		<p>scripts and test cases that align with the organization's needs, enabling thorough testing and validation of the system.</p> <p>These three factors highlight the significance of software testing within the project team.</p> <p>Establishing a clear link with business objectives, implementing effective data management practices, and defining well-defined information and systems requirements contribute to the successful implementation of the data warehouse system, ensuring its alignment with organizational goals, reliability, and functionality.</p>	<p>implementing effective data management practices, and defining clear information and systems requirements are key factors that contribute to successful software testing and the overall implementation of the data warehouse system.</p>
10	Performance measurement	<p>Based on the interviewee's perspective, the most relevant factors from the top 7 critical success factors from the questionnaire that relate to performance measurement and its impact on the project team are:</p>	<p>Performance measurement is a critical aspect of data warehouse implementation, as it allows for the assessment of various</p>

Table 7 The 7 questionnaire factors were linked to the 12 expert-identified factors.  
(continued)

No.	Critical Success Factors	The most relevant factors from the top 7 critical success factors from the questionnaire	Summarize
		<p>1. Clear link with business objectives: Ensuring a clear link between the data warehouse project and the organization's overall goals and strategic direction is crucial. This factor aligns performance measurement with the organization's objectives, ensuring that the metrics chosen are relevant and meaningful to those goals. By measuring performance in alignment with business objectives, the project team can assess the effectiveness of the data warehouse in supporting the organization's success.</p> <p>2. Effective data management: Implementing effective data management practices plays a vital role in performance measurement. Properly managing and organizing data ensures data accuracy, which is an important metric in assessing the performance of the data warehouse system. By having accurate and reliable data, the</p>	<p>metrics such as data load time, query response time, data accuracy, system availability, and user satisfaction. The interviewee emphasizes the importance of aligning performance measurement with the organization's specific goals and objectives, ensuring that the chosen metrics are relevant and meaningful.</p> <p>Additionally, effective data management practices are essential for accurate performance measurement, as they ensure data accuracy and reliability. Thoroughly defining</p>

Table 7 The 7 questionnaire factors were linked to the 12 expert-identified factors.  
(continued)

No.	Critical Success Factors	The most relevant factors from the top 7 critical success factors from the questionnaire	Summarize
		<p>project team can measure the system's performance accurately and identify areas for improvement.</p> <p>3. Well-defined information and systems requirements: Thoroughly defining the information and systems requirements is essential for performance measurement. Clear requirements enable the identification of relevant metrics and performance indicators that align with the organization's goals. Well-defined requirements also help in evaluating whether the data warehouse system meets the performance requirements set by the organization.</p> <p>These three factors highlight the significance of performance measurement within the project team. Establishing a clear link with business objectives, implementing effective data management practices, and defining well-defined information and systems</p>	<p>information and systems requirements also plays a crucial role in performance measurement, as it enables the identification of appropriate metrics and performance indicators that align with the organization's goals. Overall, aligning performance measurement with business objectives, implementing effective data management practices, and defining well-defined requirements contribute to the successful assessment of the data warehouse system's performance</p>

Table 7 The 7 questionnaire factors were linked to the 12 expert-identified factors.  
(continued)

No.	Critical Success Factors	The most relevant factors from the top 7 critical success factors from the questionnaire	Summarize
		requirements contribute to the successful assessment of the data warehouse system's performance, allowing for improvement and alignment with the organization's goals.	and its alignment with the organization's objectives.
11	Education and training	<p>Based on the interviewee's perspective, the most relevant factors from the top 7 critical success factors from the questionnaire that relate to education and training and its impact on the project team are:</p> <p>1. Widespread management support: Having widespread management support is crucial for the success of education and training initiatives. Management support provides the necessary resources, guidance, and decision-making authority to ensure effective training programs are implemented. It ensures that training efforts receive the attention and investment they require and underscores the importance of</p>	<p>Education and training are crucial factors during the implementation of a data warehouse, ensuring that end-users understand and effectively utilize the system. The interviewee highlights the need for training programs to be provided from the project's inception and continued throughout the implementation process to facilitate a smooth transition and increase user adoption. Various</p>



Table 7 The 7 questionnaire factors were linked to the 12 expert-identified factors.  
(continued)

No.	Critical Success Factors	The most relevant factors from the top 7 critical success factors from the questionnaire	Summarize
		<p>continuous learning and skill development within the project team.</p> <p>2. Clear link with business objectives: Aligning education and training programs with the organization's overall goals and strategic direction is essential. A clear link between training efforts and business objectives ensures that the skills and knowledge acquired by the project team align with the needs of the organization. It helps in fostering a sense of purpose and relevance among the team members and enables them to contribute effectively to the success of the data warehouse implementation.</p> <p>3. Effective data management: Implementing effective data management practices supports education and training efforts. Properly managing and organizing data ensures that training resources and materials are readily available</p>	<p>delivery methods, such as classroom training and online courses, should be tailored to the users' needs and system complexity. Ongoing support and access to training resources are essential even after implementation to aid users in adapting to changes and enhancing their skills. Widespread management support, a clear link with business objectives, and effective data management are identified as critical success factors. Management support ensures sufficient resources and attention for training, while aligning</p>

		<p>to the project team. It also facilitates seamless communication and information sharing across departments, enabling efficient knowledge transfer during training sessions. Effective data management enhances the overall training experience and supports continuous learning within the project team.</p> <p>These three factors highlight the significance of education and training within the project team. Widespread management support, clear link with business objectives, and effective data management contribute to the successful implementation of training initiatives, ensuring that the project team is equipped with the necessary skills and knowledge to support the data warehouse implementation effectively.</p>	<p>training with business objectives promotes relevance and purpose. Effective data management facilitates knowledge transfer and supports continuous learning. Overall, these factors contribute to the successful implementation of education and training, equipping the project team with the necessary skills and knowledge for a successful data warehouse implementation.</p>
12	Technical possibilities	<p>Based on the interviewee's perspective, the most relevant factors from the top 7 critical success factors from the questionnaire that relate to technical possibilities and their impact on the project team are:</p>	<p>Technical possibilities play a critical role in the implementation of a data warehouse system. The interviewee</p>

Table 7 The 7 questionnaire factors were linked to the 12 expert-identified factors.  
(continued)

No.	Critical Success Factors	The most relevant factors from the top 7 critical success factors from the questionnaire	Summarize
		<p>1. Clear link with business objectives: Establishing a clear link between the data warehouse project and the organization's overall goals and strategic direction is crucial. This alignment ensures that the technical possibilities of the system are aligned with the business requirements and objectives. It enables the project team to select a system that best fits the organization's needs and supports its long-term success.</p> <p>2. Effective data management: Implementing effective data management practices is essential for utilizing the technical possibilities of the data warehouse system. Properly managing and organizing data ensures that the system can handle large volumes of data, provides fast access to the data, and offers effective analysis and reporting tools. Effective data management supports the</p>	<p>emphasizes the importance of aligning the system's technological capabilities with the organization's strategy, size, business area, processes, and relationship structure. Selecting a system that is scalable, flexible, and capable of handling large volumes of data with fast access and effective analysis tools is crucial. Furthermore, technical support, maintenance, and updates are essential for long-term success. Clear alignment with business objectives,</p>

Table 7 The 7 questionnaire factors were linked to the 12 expert-identified factors.  
(continued)

No.	Critical Success Factors	The most relevant factors from the top 7 critical success factors from the questionnaire	Summarize
		<p>utilization of the system's technical capabilities and contributes to its overall success.</p> <p>3. Well-defined information and systems requirements: Thoroughly defining the information and systems requirements is crucial for selecting a data warehouse system with the right technical possibilities. Understanding the organization's specific needs and requirements ensures that the chosen system is scalable, flexible, and capable of integrating with other systems in use. Well-defined requirements enable the project team to evaluate and select a system that aligns with the organization's technological requirements.</p> <p>These three factors highlight the significance of considering technical possibilities within the project team. Establishing a clear link with business objectives,</p>	<p>effective data management practices, and well-defined information and systems requirements are identified as key factors. These factors ensure that the chosen system meets the organization's needs, supports its objectives, and maximizes the utilization of technical possibilities. Overall, considering these factors contributes to the successful implementation and operation of a data warehouse system with the right technological capabilities.</p>

Table 7 The 7 questionnaire factors were linked to the 12 expert-identified factors.  
(continued)

No.	Critical Success Factors	The most relevant factors from the top 7 critical success factors from the questionnaire	Summarize
		implementing effective data management practices, and defining well-defined information and systems requirements contribute to the successful implementation and operation of a data warehouse system with the right technical capabilities.	

### **Distinguishing Critical Success Factors (CSFs) for Corporations and Industry Associations in Data Warehouse Implementation**

Data warehouse implementation is a complex undertaking that requires careful consideration of various critical success factors (CSFs). While there are common CSFs applicable to both normal companies and industrial associations organizations, each context also presents unique challenges and considerations. By addressing these specific factors, organizations can increase the chances of successful data warehouse implementation and leverage the benefits of data-driven decision-making and growth.

For a normal company, securing executive sponsorship is crucial. It involves obtaining buy-in from top-level management, ensuring their support and commitment throughout the implementation process. Executive sponsorship provides the necessary authority, resources, and visibility to drive the data warehouse initiative and overcome organizational barriers.

Establishing data quality and governance practices is another critical factor. Organizations need to define and implement processes to ensure the accuracy, consistency, and reliability of the data stored in the warehouse. Data governance frameworks, data stewardship roles, and data quality monitoring mechanisms help maintain data integrity and enhance trust in the warehouse's outputs.

Integrating the data warehouse with existing systems is essential for seamless data flow and consolidation. Compatibility with operational systems, such as customer relationship management (CRM) or enterprise resource planning (ERP) systems, allows for efficient data extraction, transformation, and loading (ETL) processes. Integration ensures that data from various sources is aggregated and transformed into a consistent and usable format within the warehouse.

Scalability and performance are critical considerations to accommodate the growing data volume and user demands. The data warehouse architecture should be designed to handle increasing data loads and queries without compromising system performance. Scaling options, such as data partitioning or distributed processing, can be implemented to ensure efficient data storage and retrieval (Imhoff, C. et al., 2009).

Providing user training and adoption support is necessary to ensure widespread acceptance and utilization of the data warehouse. Users should receive proper training on data access tools, query languages, and analytical techniques to maximize the warehouse's value. Ongoing support, including documentation, user forums, and help desks, can address user concerns and promote adoption across the organization (Kimball, R. et al., 2013).

Managing change effectively is crucial during data warehouse implementation. Organizations must anticipate and address resistance to change, communicating the benefits and impact of the data warehouse to stakeholders. Change management strategies, including communication plans, stakeholder engagement, and training programs, facilitate a smooth transition to the new data-driven environment (Watson, H. J. & Wixom, B. H., 2007).

Aligning the data warehouse with strategic business objectives ensures that it delivers value and supports organizational goals. Clear alignment helps prioritize data integration efforts, define key performance indicators (KPIs), and develop analytics and reporting capabilities that address critical business needs. Regular evaluation of the warehouse's effectiveness ensures ongoing alignment and continuous improvement.

In the context of an industrial associations organization, additional factors come into play. Widespread management support is essential, considering the involvement of multiple member organizations. Strong support from management at

both the association level and individual member organizations promotes collaboration and data sharing across the network (Inmon, W. H. & Hackathorn, R. D., 2001).

Clear alignment with business objectives is crucial to ensure that the data warehouse serves the specific needs of the industrial associations organization. This includes understanding the information requirements of member organizations and aligning data collection, integration, and reporting processes accordingly. The warehouse should support the organization's objectives, such as benchmarking, industry-wide analysis, or policy advocacy.

Effective data management practices are critical for an industrial associations organization. This involves defining data standards, data sharing agreements, and data ownership policies. With multiple organizations contributing data, a well-defined data management framework ensures consistency, privacy, and security while enabling information exchange and collaboration.

Well-defined information and systems requirements are essential to accommodate the diverse needs of member organizations. The warehouse should be designed to capture and consolidate data relevant to the association's mission and goals. Collaborative requirements gathering and ongoing feedback mechanisms facilitate the evolution of the warehouse to meet changing information needs.

Evolutionary development is important for accommodating changing requirements and member organizations' evolving needs. The warehouse should be designed with flexibility in mind, allowing for iterative development and enhancements over time. This approach ensures that the warehouse remains relevant and adaptable as the association and its member organizations grow and evolve.

A committed and informed executive sponsor is crucial for the success of the data warehouse implementation in an industrial associations organization. The executive sponsor acts as an advocate, driving the initiative, and securing support from member organizations. Their understanding of the association's goals and their ability to communicate the warehouse's benefits are instrumental in gaining member organizations' cooperation.

Proper management of project scope is essential to prevent scope creep and maintain focus on key objectives. Given the complex nature of an industrial associations organization, it is important to strike a balance between accommodating the diverse needs of member organizations and ensuring the project remains manageable and achievable within the allocated resources and timeline.

By tailoring the CSFs to the specific requirements and characteristics of each context, both normal companies and industrial associations organizations can enhance their chances of successful data warehouse implementation. The proper implementation of a data warehouse empowers organizations to leverage their data assets effectively, leading to informed decision-making, operational efficiency, and strategic growth.

### **Feedback from the General manager**

As an expert, I can provide an opinion on the points mentioned in the article. The article highlights the importance of effective data management practices within a data warehouse to ensure continuity and support organizational changes, particularly in the context of new management teams.

I agree with the perspective that proper data management, including data quality, integration, governance, and security, is crucial for organizations to rely on accurate and reliable information for decision-making and day-to-day operations. Aligning the data warehouse project with the organization's overall goals and strategic direction is indeed essential. By establishing this clear link, the data warehouse becomes a valuable tool in supporting the organization's success. It enables data-driven decision-making, streamlines operations, and helps maintain focus on achieving the organization's objectives.

The suggestion of implementing IT-based systems to streamline work processes, facilitate communication, and ensure continuity despite changes in the management team is valid. Such systems can provide employees with access to operational data sources and foster seamless information sharing across departments, ensuring that work can progress smoothly despite organizational changes.

Thoroughly defining the specific needs and requirements for data and systems is crucial in ensuring that the data warehouse is tailored to meet the organization's



evolving needs. This understanding helps capture and address unique information and system requirements, making the data warehouse a reliable source of insights and supporting decision-making during periods of change.

The recommendation for an iterative and incremental approach to data warehouse implementation aligns with best practices. This approach allows for flexibility and adaptability, enabling adjustments to be made as the project progresses and accommodating new requirements and changing circumstances. It helps ensure the data warehouse's continued relevance and value amidst organizational changes.

The significance of consistent support from top-level management in addressing the challenge of frequent changes in the board of directors and management is well-stated. Strong endorsement and involvement from management provide the necessary resources, guidance, and decision-making authority to ensure the successful implementation of the data warehouse, stabilizing operations and maintaining continuity.

Finally, effective scope management is indeed critical in ensuring that the data warehouse implementation stays within defined boundaries and objectives. It helps prevent scope creep and maintain project focus, enabling successful implementation even in the face of changes in vision, mission, and policies.

Overall, the article provides valuable insights into the role of effective data management and aligning the data warehouse with organizational objectives to ensure continuity amidst organizational changes. The suggestions and recommendations mentioned align with best practices and can contribute to the successful implementation and utilization of a data warehouse in a changing organizational landscape. There are some issues which deserve be concerned and consideration.

#### Strategic Alignment:

The article mentioned the importance of aligning the data warehouse project with the organization's overall goals and strategic direction. To address the feedback from the general manager, it is crucial to emphasize the need for clear communication and collaboration between the data warehouse team and top-level management. Regular meetings or workshops can be conducted to ensure that the data warehouse objectives align with the strategic priorities of the organization. This alignment will

help the general manager see the direct impact of the data warehouse on achieving the organization's goals.

#### Change Management:

The general manager's feedback highlights the challenge of frequent changes in the board of directors and management. In response, it is important to emphasize the role of change management in the data warehouse project. This includes establishing a change management plan that addresses the communication, training, and stakeholder engagement aspects. By involving key stakeholders, including the general manager, in the change management process, the project can better adapt to organizational changes and ensure continuous support.

#### Key Stakeholder Involvement:

To address the general manager's feedback, it is important to highlight the role of the general manager as a key stakeholder in the data warehouse project. By involving the general manager in decision-making processes, progress updates, and regular reporting, they can have a better understanding of the project's value and success. This involvement can also foster a sense of ownership and support from the general manager, increasing their commitment to the project's success.

#### Risk Management:

The general manager's feedback indirectly emphasizes the need for effective risk management in the data warehouse project. Addressing the concerns regarding changes in the management team, it is crucial to identify potential risks and develop mitigation strategies. This can involve conducting risk assessments, establishing contingency plans, and regularly reviewing and addressing potential risks and issues. By proactively managing risks, the data warehouse project can ensure continuity and stability even in the face of organizational changes.

#### Ongoing Monitoring and Optimization:

To address the general manager's feedback, it is important to emphasize the need for continuous monitoring and optimization of the data warehouse. This includes establishing regular reporting mechanisms, performance tracking, and user feedback loops. There are certain factors that may be more relevant or have different priorities based on the specific context. Here are some CSFs to consider for each scenario:

**Data Integration:** Ensuring seamless integration of data from diverse sources within the industry, including member companies, external databases, and industry-specific data providers.

**Industry-specific Data Models:** Designing and implementing data models that align with the unique requirements and terminology of the industry, allowing for effective data analysis and reporting.

**Industry Standards Adoption:** Promoting the adoption of industry-specific data standards to facilitate data sharing and interoperability among member organizations.

**Collaborative Governance:** Establishing a governance framework that involves representatives from member organizations to define data standards, data quality guidelines, and data ownership rules within the association.

**Member Engagement and Buy-In:** Gaining active participation and support from member organizations in terms of data contribution, data quality management, and utilization of the data warehouse for industry benchmarking and analysis.

**Security and Privacy:** Implementing robust security measures to protect sensitive industry data and ensuring compliance with relevant privacy regulations.

**Analytical Capabilities:** Building analytical capabilities and tools that enable deep industry insights, trend analysis, and performance benchmarking for member organizations. By regularly reviewing key performance indicators (KPIs) and analyzing the data warehouse's impact on the organization, adjustments and improvements can be made to ensure its ongoing success and relevance. In order to measure the success of a data warehouse project within an Industrial Associations Organization, several key performance indicators (KPIs) can be considered. These KPIs should align with the organization's goals and objectives and reflect the desired outcomes of the data warehouse implementation. Here are some potential KPIs:

**Data Quality:** Measure the accuracy, completeness, and consistency of data within the data warehouse. This can include metrics such as data accuracy rate, data completeness rate, and data consistency rate.

**Data Integration:** Assess the effectiveness of integrating data from various sources into the data warehouse. KPIs in this area can include the number of data sources integrated, data integration time, and the success rate of data integration processes.

**Data Governance:** Evaluate the implementation of data governance practices and adherence to data governance policies and standards. KPIs can include the establishment of data governance frameworks, compliance with data privacy regulations, and the number of data governance incidents or issues.

**Data Accessibility:** Measure the ease of access and availability of data within the data warehouse. KPIs can include metrics such as average query response time, user satisfaction with data accessibility, and the percentage of authorized users accessing the data warehouse.

**User Adoption:** Assess the level of user adoption and utilization of the data warehouse. This can be measured through user surveys, user training participation rates, and the number of active users accessing the data warehouse.

**Decision-Making Impact:** Measure the impact of the data warehouse on decision-making processes within the organization. This can include metrics such as the percentage of decisions influenced by data warehouse insights, cost savings resulting from data-driven decisions, and the perceived value of the data warehouse in decision-making.

**Business Performance:** Evaluate the impact of the data warehouse on key business performance indicators. This can include metrics such as revenue growth, cost reduction, operational efficiency improvements, and customer satisfaction ratings.

It is important to note that the specific KPIs chosen should align with the organization's unique goals and objectives. The selection of relevant KPIs will depend on the specific focus and expected outcomes of the data warehouse project within the Industrial Associations Organization. Regular monitoring and tracking of these KPIs will provide insights into the success and impact of the data warehouse implementation and enable continuous improvement and optimization of the system.

### **Limitation**

In this study, the selection of companies for participation was not based on specific criteria such as company size, industry sector, or level of IT knowledge. It is important to note that in other research studies, companies may be selected based on these specific criteria to ensure a more targeted and representative sample. However, it is essential to highlight that the findings of this study may still hold relevance and applicability to industries that share similar characteristics in terms of size and experience. By acknowledging the limitations of the study's sample size and case selection process it becomes evident that the findings should be interpreted and applied within the context of these specific companies and their characteristics.

The absence of specific selection criteria in this study implies that the results are not necessarily generalizable to all companies across different industries or sizes. Instead, the findings provide valuable insights and perspectives based on the participants' experiences within the selected sample of companies. To gain a broader understanding of how these critical success factors (CSFs) may manifest in different contexts, future studies could consider incorporating diverse samples that encompass a range of company sizes, industries, and levels of IT knowledge. This would help to establish a more comprehensive understanding of how these CSFs operate in various organizational settings.

Therefore, when interpreting and applying the findings of this study, it is crucial to consider the specific context and limitations inherent in the research design. This awareness ensures that the findings are appropriately contextualized and can be utilized in a manner that aligns with the characteristics of other organizations and industries.

## **Future Research**

Based on the limitations identified in the organizational structure and data fragmentation, further research could be conducted to investigate how IT-based systems can be utilized to improve communication and enhance the continuity of work in such scenarios. Specifically, the role of the IT team in developing and implementing such systems should be examined, along with the potential benefits of using these systems for data analysis and policy making. This research could be combined with the investigation of the perception of users within organizations, in terms of their ranking of critical success factors (CSFs) and the reasoning behind these rankings. By selecting companies based on industry, size, and IT knowledge, and including participants with similar job positions and tasks, this research could provide generalizable results that identify similarities and differences compared to the findings of previous studies. Ultimately, this research could contribute to a more rigorous and comprehensive understanding of how IT-based systems can be leveraged to enhance organizational communication and decision-making processes.

There are several areas for potential future research. Firstly, further studies could be conducted to explore the effectiveness of the IT-based system introduced to improve work processes and ensure continuity of work in the organization. This could include examining the impact of the system on communication and collaboration across departments, as well as its ability to store and share information effectively. Secondly, given the importance of data within the organization, future research could focus on strategies for improving data management and utilization. This could involve exploring methods for standardizing data retention forms and developing protocols for sharing and analyzing information across departments. Thirdly, to build on the limitations identified in the current research, further investigation could be conducted into how users rank critical success factors (CSFs) within the implementation phases of IT projects. This could involve combining qualitative and quantitative research methods to gain a deeper understanding of the reasoning behind user perceptions of CSFs and their importance at different stages of implementation.

Finally, it would be interesting to expand on the current research by studying users' perceptions within different types of organizations. By selecting companies based on industry, size, and IT knowledge, and including participants with similar job

positions and tasks, it may be possible to identify similarities and differences compared to the findings of the current research and gain a more generalizable perspective on user perceptions of CSFs in IT implementation projects.



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## Appendix

จุฬาลงกรณ์มหาวิทยาลัย  
CHULALONGKORN UNIVERSITY

### **Introductory letter**

Dear interviewee,

I hope this letter finds you well. My name is Phatnarin Khantayana, and I am a student at Chula System Engineering, Faculty of Engineering, Chulalongkorn University. Currently, I am conducting research for my master's thesis in Engineering Management.

Firstly, I would like to express my sincere appreciation for your agreement to participate in this survey. The purpose of this study is to measure the critical success factors for data warehouse implementation in industrial association organizations.

Considering that your organization is planning to implement a data warehouse system, we believe that understanding the perceptions of system users is crucial in determining the factors that contribute to a successful implementation. Hence, this research aims to explore this area.

Your participation in this survey will enable us to examine the application of each identified critical success factor in the context of your organization. Your personal perception of what constitutes a successful data warehouse implementation is valuable and aligns with the objectives of this survey. During the rating process and interviews, we kindly request that you provide honest responses. Please rest assured that your answers will remain anonymous. Furthermore, if you are interested in receiving the research findings once the thesis is completed, we would be delighted to share them with you.

Thank you for your cooperation and support in this research endeavor.

Sincerely,

Phatnarin Khantayana

The quantitative analytic questionnaire: Rate the following factors: the respondents responded by picking one of the five available alternatives, with five indicating strong agreement, four indicating agreement, three indicating neither agreement nor disagreement, two indicating disagreement, and one indicating significant disagreement. Through an interview, a qualitative methodological approach will be applied for the second section.

<b>Factors</b>	<b>Descriptions</b>	<b>Questions</b>
Committed and informed executive sponsor	Senior executive need to oversee the project's overall direction, resource allocation, and representation before the executive team and board.	Q1: Does the implementation require the support of top management?
Widespread management support	Data warehouses should be business-driven and have comprehensive managerial support. This facilitates change management and gets rid of opposition.	Q2: Should data warehouses be driven because of business needs and having full management?
Appropriate team skills	The organization's staff should have the required information, abilities, and experience.	Q3: Does the organization's staff should have the necessary knowledge, skills, and experience, or was training and education important to the implementation?

<b>Factors</b>	<b>Descriptions</b>	<b>Questions</b>
Appropriate technology	The DW hardware and software need to be very organizationally compatible.	Q4: Is there various organizational technology that works with the DW hardware and software?
Adequate resources	Hardware, software, and human resources should all be adequately funded.	Q5: Do Hardware, software, and human resources need to be adequately funded?
Effective data management	There need to be operational data sources accessible. Applications should provide correctness, consistency, and currency. The data model needs to be adaptable and scalable.	Q6: There needs to be operational data sources accessible. Applications for ETL should provide correctness and consistency?
Clear link with business objectives	The project should be economically justified in terms of its commercial value and have a clear connection to the company's strategy.	Q7: Does the project needs to have clear goals?
Well-defined information and systems requirements	Although describing the needs of executives might be challenging, the project should have a consensus on what is expected of the system.	Q8: Even though it is hard to define what executives want, should the project have a reasonable basis for what the system needs to do?



Factors	Descriptions	Questions
Evolutionary development	An efficient DW system should be created iteratively with active user participation, progressing towards a useful application set.	Q9: Was it important that users were involved in the implementation?
Management of project scope	A project's scope may drastically expand. Resource constraints may result from this.	Q10: If the size and scope of a project change a lot, can this make a project's funds go further?



## Focus group discussion: The qualitative analytic questionnaire

<b>Factors</b>	<b>Descriptions</b>	<b>Questions</b>
Project team	The project team must be made up of the best individuals and must include a project advocate, workers from all levels and departments, and outside consultants when internal experience is lacking.	<ul style="list-style-type: none"> <li>- What do you think about the project team's significance for an DW implementation?</li> <li>- What do you consider to be crucial in terms of the project team?</li> </ul>
Top management involvement	Top management should increase everyone's dedication to the company and establish guidelines that define and authorize any changes to organizational structure, positions, and duties.	<ul style="list-style-type: none"> <li>- What do you think about the significance of senior management participation for a deployment of DW?</li> <li>- How, in your opinion, should top management be involved?</li> </ul>
Strategic decision- making	A clear business strategy and vision must detail the planned strategic and practical advantages, resources, expenses, risks, and timetable as well as how the organization functions behind the implementation effort.	<ul style="list-style-type: none"> <li>- How was the execution plan for the implementation created?</li> <li>- What do you think a plan should have to help you, the user, understand how it will be put into action?</li> </ul>
Communication	Every organizational level should develop effective communication, which must involve official project and team promotion and progress advertising.	<ul style="list-style-type: none"> <li>- What do you think about how important communication is for implementing a DW?</li> </ul>

<b>Factors</b>	<b>Descriptions</b>	<b>Questions</b>
Project management	Clear objectives should be defined as part of project management, and the development of a work plan and resource plan must center on identifying the machinery needed to run the system.	<ul style="list-style-type: none"> <li>- How was the management of the implementation project?</li> <li>- How should a project be handled, in your opinion?</li> </ul>
Project support	Technical support, maintenance, and updates for the project should be developed, and they must be handled by a dedicated partner that manages the full implementation's life cycle.	<ul style="list-style-type: none"> <li>- How do you view the significance of project assistance for implementation?</li> <li>- How should project assistance be structured in your opinion?</li> </ul>
Organizational change management	The organization has to use methods and procedures for change management that have been designed and assessed according to industry best practices.	<ul style="list-style-type: none"> <li>- How was the management of the change process during the full implementation phase?</li> <li>- What do you think about the significance of organizational change managing the adoption of a DW?</li> </ul>
Business process alignment	To stay on course and prevent conflicts with the stringent procedural To keep on track and prevent conflicts with the stringent procedural requirements of an system, one should choose and follow to an archive of best business practices.	<ul style="list-style-type: none"> <li>- How was the system integrated with the business processes?</li> <li>- What do you see the significance of business process alignment to be a deployment of DW?</li> </ul>

<b>Factors</b>	<b>Descriptions</b>	<b>Questions</b>
Software testing	To make the adoption of the system simpler, the business should set up thorough and sophisticated testing of the software.	<ul style="list-style-type: none"> <li>- How was the system tested when it was being put into place?</li> <li>- How should the testing be carried out, in your opinion?</li> </ul>
Performance measurement	To manage expectations, keep track of all events, and compare accomplishments to milestones and objectives, performance metrics should be identified.	<ul style="list-style-type: none"> <li>- How was performance assessed during the implementation process?</li> <li>- How should performance be measured, in your opinion?</li> </ul>
Education and training	Users should get enough education and training from the start of the project to ensure an efficient and proper usage of the system. This demands expenditure.	<ul style="list-style-type: none"> <li>- How was training and education handled throughout implementation?</li> <li>- How do you think training and education should be delivered?</li> </ul>
Technical possibilities	Based on its strategy, size, business area, business processes, and internal and external relationship structure, systems of all sorts should be compared and contrasted in the market.	<ul style="list-style-type: none"> <li>- How were the system's technological capabilities aligned with the company?</li> <li>- How do you think the technological capabilities of an system should be balanced with the organization?</li> </ul>

### Group of employees

Group 1: End users			Group 2: IT department			Group 3: Employees in the organization closely collaborate with customers		
Participants	Position	Year's experience	Participants	Position	Year's experience	Participants	Position	Year's experience
Participant 1	Head of Department	15	Participant 6	Head of Department	10	Participant 11	Head of Department	8
Participant 2	Manager	10	Participant 7	Manager	8	Participant 12	Manager	7
Participant 3	Deputy manager	8	Participant 8	Deputy manager	8	Participant 13	Officer	5
Participant 4	Senior officer	5	Participant 9	Specialist	5	Participant 14	Officer	5
Participant 5	Officer	5	Participant 10	Senior officer	5	Participant 15	Officer	4

### Focus group interview

Factors	Descriptions	Quotes
Project team	The project team must be made up of the best individuals and must include a project advocate, workers from all levels and departments, and outside consultants when internal experience is lacking.	<p>"The right mix of individuals on the project team is crucial for ensuring that the data warehouse meets the needs of the organization."</p> <p>"The project team should have data expertise, technical expertise, business expertise, and communication and collaboration skills."</p>

<b>Factors</b>	<b>Descriptions</b>	<b>Quotes</b>
Top management involvement	Top management should increase everyone's dedication to the company and establish guidelines that define and authorize any changes to organizational structure, positions, and duties.	"Top management involvement is critical for successful data warehouse implementation. They must ensure adequate resources, communicate project goals, and participate in key meetings and decisions."
Strategic decision - making	A clear business strategy and vision must detail the planned strategic and practical advantages, resources, expenses, risks, and timetable as well as how the organization functions behind the implementation effort.	"Strategic decision-making must be supported by the insights provided by the data warehouse, so the project team must be able to make informed decisions that will help the organization achieve its objectives."
Communication	Every organizational level should develop effective communication, which must involve official project and team promotion and progress advertising.	"Effective communication is crucial for the success of the data warehouse project. We need to ensure that all stakeholders understand the project's goals and objectives, and how it will benefit the organization. Regular progress reports should be clear, concise, and easy to understand, so that everyone is informed of the project's status and any issues that need to be addressed."

Factors	Descriptions	Quotes
		<p>“Collaboration and teamwork are also essential, as well as providing user training and support. By encouraging feedback and continuous improvement, we can ensure that the data warehouse project delivers the desired benefits to the organization.”</p>
Project management	<p>Clear objectives should be defined as part of project management, and the development of a work plan and resource plan must center on identifying the machinery needed to run the system.</p>	<p>"The team should have the necessary skills and experience to manage the project effectively and use a structured approach that includes project planning, risk management, issue tracking, and stakeholder management."</p> <p>"It's important to define clear objectives and scope for the project, identify the deliverables, and set a timeline."</p> <p>“The team should develop a work plan and resource plan that identifies the required hardware, software, and human resources, as well as any training or support that may be needed."</p> <p>"Monitoring progress is key to ensure that the project stays on track and within budget. The team should use</p>

Factors	Descriptions	Quotes
		appropriate project management tools and techniques to track milestones, budget, and resource usage, and identify and manage risks and issues."
Project support	Technical support, maintenance, and updates for the project should be developed, and they must be handled by a dedicated partner that manages the full implementation's life cycle.	<p>"We need a dedicated partner with a deep understanding of the technical requirements to provide us with technical support, maintenance, and updates.</p> <p>"The assistance provided should be structured to meet our needs throughout the project's life cycle, with regular maintenance and updates provided in a timely and effective manner."</p>
Organizational change management	The organization has to use methods and procedures for change management that have been designed and assessed according to industry best practices.	<p>"The project team should have the necessary skills and experience to manage the change process effectively, and stakeholders should be provided with ongoing training and support."</p> <p>"By effectively managing the change process and providing stakeholders with the knowledge and skills they need, the data warehouse can lead to improved decision-making within the organization."</p>



Factors	Descriptions	Quotes
Business process alignment	To stay on course and prevent conflicts with the stringent procedural to keep on track and prevent conflicts with the stringent procedural requirements of a system, one should choose and follow an archive of best business practices.	<p>We need to stay on course and avoid conflicts with procedural requirements, so it's important to have a set of best business practices to follow."</p> <p>"Following a set of best business practices can help us align our processes and prevent conflicts with the system's requirements."</p> <p>"To ensure we're staying on track and avoiding conflicts, we should choose and adhere to a proven archive of best business practices."</p>
Software testing	To make the adoption of the system simpler, the business should set up thorough and sophisticated testing of the software.	"It's important for the business to set up comprehensive testing of the software to make the adoption of the system simpler."
Performance measurement	To manage expectations, keep track of all events, and compare accomplishments to milestones and objectives, performance metrics should be identified.	<p>"As part of managing expectations, it's important to track all events and measure our performance against milestones and objectives."</p> <p>"Identifying performance metrics is essential to keep track of progress and ensure that we are meeting our goals."</p>

Factors	Descriptions	Quotes
		<p>"We need to establish through performance measurement systems to help us stay on track and compare our accomplishments against our objectives."</p>
Education and training	<p>Users should get enough education and training from the start of the project to ensure an efficient and proper usage of the system. This demands expenditure.</p>	<p>"The training should start from the beginning and continue throughout the implementation process, using various methods such as online courses, classroom training, and user manuals."</p> <p>"Ongoing support and access to training resources should also be provided even after the implementation is complete."</p>
Technical possibilities	<p>Based on its strategy, size, business area, business processes, and internal and external relationship structure, systems of all sorts should be compared in the market.</p>	<p>"The system should be scalable, flexible, and able to integrate with other systems in use. It should also have the capability to handle large volumes of data."</p> <p>"It should provide fast access to the data and offer tools to analyze and report on the data effectively."</p> <p>"Technical support, maintenance, and updates must also be available to ensure the system's long-term success."</p>

## The rating score on the questionnaire

Factors	Descriptions	Participants														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Committed and informed executive sponsor	Senior executives need to oversee the project's overall direction, resource allocation, and representation before the executive team and board.	4	5	5	4	5	5	5	5	5	5	5	4	4	4	4
Widespread management support	Data warehouses should be business-driven and have comprehensive managerial support. This facilitates change management and gets rid of opposition.	4	5	5	4	5	5	5	5	5	5	5	4	4	4	4
Appropriate team skills	The organization's staff should have the required information, abilities, and experience.	5	4	4	5	5	5	5	5	5	5	5	5	5	5	5
Appropriate technology	The DW hardware and software need to be very organizationally compatible.	3	4	4	4	4	3	3	3	3	3	3	3	2	2	2
Adequate resources	Hardware, software, and human resources should all be adequately funded.	3	4	4	4	4	3	3	3	3	3	3	4	4	4	4



Evolutionary development	An efficient DW system should be created iteratively with active user participation, progressing towards a useful application set.	5	5	5	5	5	4	4	4	4	5	5	5	5	5	5
Management of project scope	A project's scope may drastically expand. Resource constraints may result from this.	5	5	5	5	5	4	4	4	4	4	5	5	5	5	5

## VITA

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