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THE IMPACT OF IMPLEMENTING BUSINESS INTELLIGENCE SYSTEM ON QUALITY OF DECISION MAKING

أثر تطبيق نظام ذكاء الأعمال على جودة اتخاذ القرار

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Dedication

To my Beloved family. I wouldn’t have been here completing my degree without their support and encouragement. They always provided me with motivation and were always a source of inspiration and strength. May Allah bless them all.

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List of Abbriviations

No	Abbreviation	Explanation
1	BI	Business Intelligence
2	MAS	Machine Automation Solution
3	EFA	Exploratory Factor Analysis
4	IT	Information Technology
5	DSS	Decision support systems
6	IV	Independent Variable
7	DV	Dependent Variable
8	QDM	Quality of decision-making
9	QSD	Quality of Strategic Decisions
10	QTD	Quality of Tactical Decisions
11	QOD	Quality of Operational Decisions
12	DQ	Decision Quality
13	CPM	Corporate Performance Management
14	BA	Business Analytics
15	SMEs	Small Medium-sized enterprises
16	HIS	Healthcare Information Systems
17	BI&A	Business Intelligence andAnalytics
18	ST	Standard Devia
19	TM	Top Management
20	MM	Middle Management
21	LM	Lower Management
22	FDA	Food and Drug Authority

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The Impact of Implementing Business Intelligence System on Quality of Decision Making

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Abstract

This study aims to explore the impact of Implementing Business Intelligence (BI) System on the Quality of Decision-Making in different Management levels at Emerson Machine Automation Solution (MAS), which is part of Emerson Electric Corporation. This study focused on the exploring the impact BI has on three main types of organizational decisions that shape the decision-making process in a firm at three different management levels: (1) Strategic Decisions for top-level management (2) tactical decisions for Middle-level management (3) Operational decisions for lower-Level Management. The totality of the quality of such decisions is what shapes the decision-making quality in any organization.

Three types of Questionnaires were distributed to all managers working in the three levels of management at MAS. Every one of these questionaries focused on a different type of decision-making. The Total study population was (64) members: (9 out of 12) responses from Top Management, (16 out of 17) responses from Middle management, and (29 out of 35) responses from Lower Management.

Data analysis was done using a group of statistical methods that includes Cronbach's alpha, EFA (Exploratory Factor Analysis), Descriptive analysis, and Simple Liner Regression analysis using (SPSS-V21) program.

Based on this study, a set of results were concluded where the most important ones highlighted that there is a significant positive and direct impact of BI System implementation on quality of decision making at level ($\alpha \leq 0.05$). The same is applicable to the impact of BI system implementation on Quality of Strategic, Tactical, and Operational Decisions at level ($\alpha \leq 0.05$).

Based on the results and conclusions of this study, the following main recommendations are proposed:

Organizations shall increase awareness on the use of BI systems in a way that maximize gains of such systems by proper utilization and use.

Prober integration of BI systems between different departments and business units in the organization will maximize capabilities in achieving competitive performance.

The benefits of utilizing BI Systems can be extended to trusted partners and suppliers by sharing BI reports and dashboards that support collaborative decisions making and provides insights that enhance special collaborative efforts like supply chain.

Keywords: Business Intelligence, Quality of Decision Making, Strategic Decisions, Tactical Decisions, Operational Decisions.

أثر تطبيق نظام ذكاء الأعمال على جودة اتخاذ القرار

الإعداد: عبد الحافظ سلامه

بإشراف: د. إبراهيم أبو السندس

الملخص

تهدف هذه الدراسة إلى استكشاف تأثير تطبيق نظام ذكاء الأعمال على جودة اتخاذ القرار في المستويات الإدارية المختلفة في قسم حلول اتمتة الآلات من شركة ايميرسون.

ركزت هذه الدراسة على استكشاف تأثير تطبيق نظام ذكاء الأعمال على جودة اتخاذ القرار على ثلاثة أنواع رئيسية من القرارات التنظيمية التي تشكل عملية صنع القرار في الشركة ضمن ثلاثة مستويات إدارية مختلفة: القرارات الإستراتيجية للإدارة العليا، والقرارات التكتيكية للإدارة الوسطى، والقرارات التشغيلية للإدارة ذات المستوى الأدن حيث ان مجموع جودة مثل هذه القرارات هو ما يشكل جودة اتخاذ القرار في أي منظمة.

تم توزيع ثلاثة أنواع من الاستبيانات على جميع المدراء العاملين في المستويات الإدارية الثلاثة في قسم حلول اتمتة الآلات من شركة ايميرسون. ركز كل واحد من هذه الاستبيانات على نوع مختلف من اتخاذ القرار. كان مجموع مجتمع الدراسة (64): (12) من الإدارة العليا، (17) من الإدارة الوسطى و(35) من الإدارة الدنيا. ما مجموعه (54) استجابوا للاستبيان: (9) من الإدارة العليا، (16) من الإدارة الوسطى و (29) من الإدارة الدنيا.

تم تحليل البيانات بالاعتماد على مجموعة من الأساليب الإحصائية التي تشمل معامل ألفا كرونباخ والتحليل الوصفي و تحليل عامل الاستكشافي وتحليل الانحدار الخطي البسيط باستخدام برنامج (SPSS-V21).

بناءً على هذه الدراسة، أبرزت أهم النتائج أن هناك تأثيرًا إيجابيًا مهمًا لتطبيق نظام ذكاء الأعمال على جودة اتخاذ عند المستوى ($\alpha \leq 0.05$). وينطبق الشيء نفسه على تأثير تطبيق نظام ذكاء الأعمال على جودة القرارات الاستراتيجية والتكتيكية والتشغيلية عند المستوى ($\alpha \leq 0.05$).

بناء على نتائج هذه الدراسة واستنتاجاتها، تم اقتراح التوصيات الرئيسية التالية :

يجب على المنظمات العمل على زيادة الوعي في ما يتعلق باستخدام أنظمة ذكاء الأعمال داخل منظماتهم بطريقة تزيد من مكاسب استخدام هذه الأنظمة.

سيؤدي التكامل المناسب لأنظمة ذكاء الاعمال بين الإدارات ووحدات الأعمال المختلفة في المنظمة إلى زيادة القدرة في تحقيق الأداء التنافسي.

يمكن توسيع فوائد استخدام أنظمة ذكاء الاعمال إلى الشركاء والموردين الموثوق بهم من خلال مشاركة تقارير ذكاء الاعمال ولوحات المعلومات التي تدعم اتخاذ القرارات التعاونية وتوفر رؤى تعزز الجهود التعاونية الخاصة مثل سلسلة التوريد .

الكلمات المفتاحية: ذكاء الأعمال، جودة اتخاذ القرار، القرارات الاستراتيجية، القرارات التكتيكية، القرارات التشغيلية.

Chapter One: Background

1.1 Introduction

Recent technological advances and Management information systems (MIS) developments led to the emergence of Business Intelligence (BI) system (Chen, Chiang, and Storey, 2012). BI works on collecting data and transforms it into trends and visualizations to enable users to take actions based on insights in real-time (Microsoft,2022). Therefore, BI is considered a special type of Information Technology (IT) capabilities that is related to the company ability to provide high-quality information to decision-makers (Kulkarni, Flores, and Popovic, 2017).

Organizations are urged to capture, understand, and saddle their data for supporting their decision-making and to improve their business operations as managers need to have the right information at the right time and in the right place (Sharda, Delen and Turban, 2022). At the same time, there is continuous pressure from management to justify the contribution of BI (Dedić and Stanier, 2017)

BI may contribute to the improvement of the quality of decision-making in any organization (Olszak and Ziemba, 2006) BI also, provides quality information to the organization which is crucial in the process of decision-making because it equips the knowledge workers with the opportunity of having real-time access to the information, analyzing it effectively and instinctively (Popovic, Hackney, Coelho and Jaklic, 2012).

As highlighted in the study of (Arnott, Lizama, and Song, 2017), there are patterns for BI systems use in the organization that needs to be explored, as the inputs of these systems support senior management in strategic and tactical decisions while at lower management levels, it supports people to do their day-to-day job.

Considering the importance of BI system as a modern technological tool in supporting the Decision-Makin process and based on what was discussed earlier, this study came to realize the impact of BI system on the quality of decision-making. After deep analysis and several interviews with experts working on maintaining BI systems, this study chose to focus on the impact of such system on the quality of strategic, tactical, and operational decisions as key pillars for the decision-making process in any organization while considering the differences in utilizing BI system for support each one of these decisions.

1.2 Study Problem

Even though BI is considered one of the booming trends adopted by large organizations in supporting management operations, there is a lack of research on how BI and analytics affect decision-making (Wren, Daly, and Burstein, 2021). BI systems have been a top priority for chief information officers, but still, there is a lack of knowledge on the successful management of these systems beyond the implementation (Wieder and Ossimitz, 2015). Thus, Organizations have a need for the evaluation and assessment of their BI systems.

Being a user of BI systems for several years and considering several discussions with colleagues who are experts on maintaining BI systems along with a joint review that includes seiner managers within Emerson MAS, the researcher concluded that there is a specific gap in BI practices that needs special attention. This gap is related to BI system impact on the

quality of decision-making considering the effect on different management levels' decisions whether strategic, tactical, or operational since the totally of the quality of these decisions is what can be considered a key competitive advantage and any gap in one of them will impact the whole organization

1.1 Study Objectives

Study objectives can be summarized in the flowing:

To study the impact of the implementation of BI system on the quality of decision-making in different management levels at Emerson MAS organization considering the impact of BI system on the quality of strategic, tactical, and Operational Decisions.

1.4 Importance of the Study

Despite the ongoing investments in BI systems and their increasing importance, not all companies are similarly successful in developing BI capabilities (Kulkarni, et al., 2017). Therefore, the importance of this study raised from the practical significance of the successful implementation of BI system and the critical impact of such system on the quality of decision-making in the firm.

The importance of this study also extended to the researcher’s workplace, by providing an assessment and evaluation of BI practices within Emerson MAS considering the three different levels of management and the quality of decision-making associated with each one of them.

On the other hand, the scientifical importance of this study arises from the researcher’s effort in Contributing to increasing the theoretical knowledge on BI, by increasing the number of

studies on BI system impact on the quality of decision-making in specific and BI systems in general as there is lack of studies on these topics, as far as the researcher knows.

1.5 Study Questions and Hypotheses

Derived from the study problem, this study will examine the following questions and hypotheses:

- **Study Questions**

The key question derived from the study problem:

Q1. Is there an impact of BI system implementation on quality of decision-making?

Q2. Is there an impact of BI system implementation on quality of strategic decisions making?

Q3. Is there an impact of BI system implementation on quality of tactical decisions making?

Q4. Is there an impact of BI system implementation on quality of operational decisions making?

- **Study Hypotheses:**

Ho_1: BI System implementation has no impact on quality of decision-making at ($\alpha \leq 0.05$).

Ho_2: BI System implementation has no impact on quality of strategic decisions making at ($\alpha \leq 0.05$).

Ho_3: BI System implementation has no impact on quality of tactical decisions Making ($\alpha \leq 0.05$).

Ho_4: BI System implementation has no impact on quality of operational decisions making ($\alpha \leq 0.05$)

1.6 Study Model

The researcher relied on the previous studies of (Wieder and Ossimitz, 2015) and (Urumsah and Ramadhansyah, 2019) for building the main structure of the model and selecting independent and dependent variables, but in contrast to these studies, the researcher didn't select mediating variables.

For the dependent variable and after a deep review of current BI practice at Emerson MAS and a series of interviews with BI experts within the company, the researcher decided to consider: Quality of Strategic decisions Making, Quality of Tactical decisions Making, and Quality of operational decisions Making considering their crucial impact on decision-making in the organization.

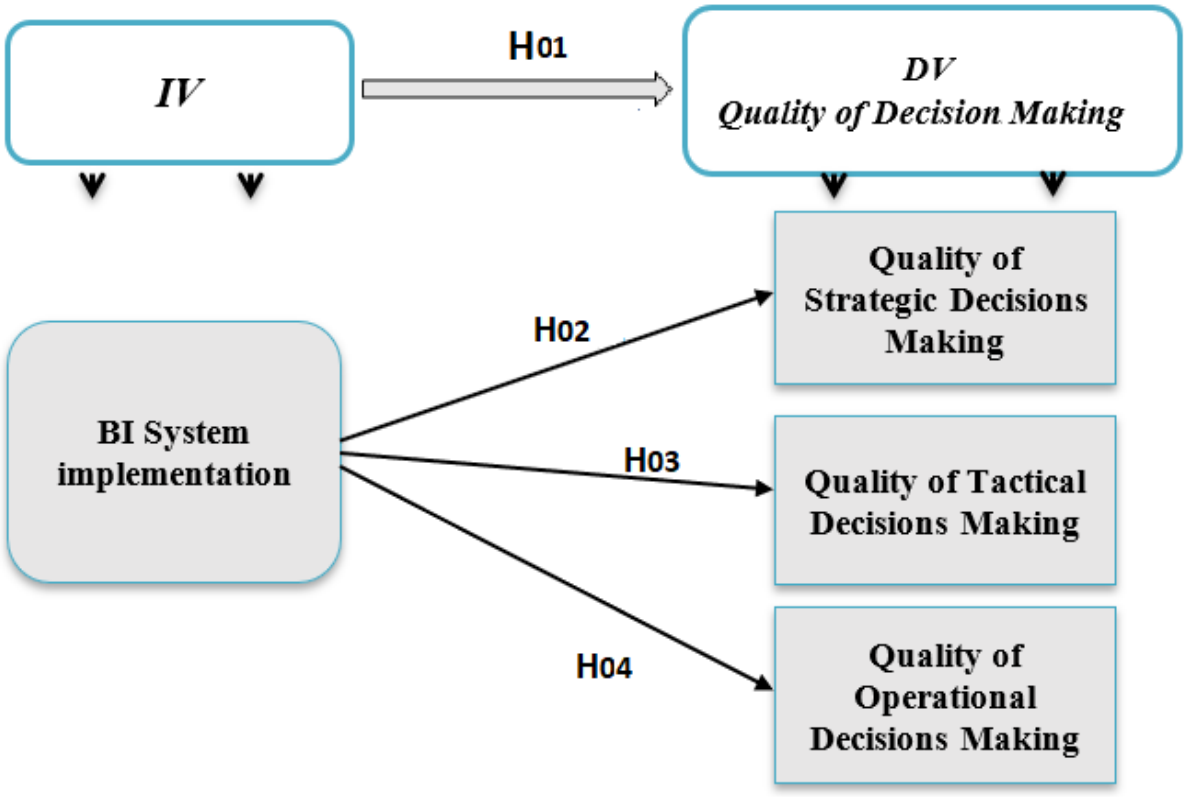

Figure (1-1): Study Modle

1.7 Study Limits

The study has the following limitations:

- **Place Limitations:** This study focuses on Emerson MAS.
- **Time Limitation:** This study was completed in the first and second semesters of the academic year 2021/2022.
- **Human Limitations:** This study includes Emerson MAS employees operating at top management, middle management, and lower-level management.
- **Limitations of Science:** Business intelligence was used as an independent variable while quality of decision making was selected a as dependent variable considering three main components for decision-making (strategic, tactical, and Operational). No mediator variables were considered in this study.

1.8 Study Delimitation

- From the viewpoint of the researcher, there is a lack of studies related to BI impact on the quality of decision-making.
- From the viewpoint of the researcher, there is a lack of Arabic publications on BI in general and its relation to decision-making in specific. This study will focus mainly on English publications.

1.9 Procedural definitions of keywords

Business Intelligence (BI): For the use of this study, BI can be defined procedurally as software tools and systems utilized using organization's IT infrastructure for the purpose of collecting, analyzing, reporting, and visualizing data to aid the process of decision-making. This was measured through items 1-10 from section 1 of the questionnaire.

Quality of Decision Making: For the use of this study, Quality of decision-making demonstrates system capabilities to satisfy organization needs in supporting the right decisions making. QDM was measured through section 3 of the three types of questionnaires.

Strategic decisions: For the use of this study Strategic decision making is defined as long-term organizational decisions that are taken with consideration of organizational mission and vision and focus on organization growth, major external risk, and key resources allocation. This was measured through items 1-9 from section 3 of Top Management questionnaire.

Tactical decisions: For the use of this study, tactical decisions are defined as medium-term decisions that are made by middle management to handle Production planning, cost control, budget planning and profitability in various units, key resources allocation, and other decisions related to the implementation of strategic decisions. This was measured through items 1-9 from section 3 of the Middle Management questionnaire.

Operational Decisions: For the use of this study, operational decisions can be defined as short-term decisions that are taken by lower management to handle daily execution activities like resource management, inventory, project budgets, and other daily activities. This was measured through items 1-9 from section 3 of the Lower-Level Management questionnaire.

Organization: Emerson MAS organization which operates in the industrial automation sector was considered as a base for this stud.

Chapter Two: Theoretical Framework and Previous Studies

This chapter focuses on two main areas. The first part starts with the definitions of dependent and independent variables, along with components of variables. After that, the second part will focus on conclusions and findings from the reviewed previous studies, what distinguishes this study from other studies, and an overview of Emerson company.

1.1 Definitions and components of variables

Conceptual Definitions of Keywords

Business Intelligence (BI): “Is an umbrella term that combines architectures, tools, databases, analytical tools, applications, and methodologies to enable interactive access to data, to enable manipulation of data, and to give business managers and analysts the ability to conduct appropriate analyses. The process of BI is based on the transformation of data to information, then to decisions, and finally to actions”. (Sharda, et al., 2022)

Quality of Decision Making: Decision-making quality permits the assurance of both efficiency and effectiveness in analyzing decision-making problems (Howard,1998).

Decision Making: "Decision-making is the selection based on some criteria from two or more possible alternatives" (Terry,1977)

Strategic decisions: Decisions related to the long-term future of an organization to increase the probabilities that the organization will be successful, these decisions are

considered important in terms of resources committed, actions taken, or the precedent set (Eisenhardt and Zbaracki, 1992).

Tactical decisions: Decisions related to the carrying out of strategic decisions and are concerned with developing of divisions plans, structuring, and acquisition of resources like manpower, materials, and money. The middle level of management is responsible for tactical decisions (Chand,2022).

Operational Decisions: Decisions that come as a result of strategic and tactical decisions with short-term planning that is usually related to day-to-day decisions (Misni and Lee, 2017).

Organization: A tool used by people to coordinate their actions and satisfy their needs in producing goods and services using human resources and technology (Jones, 2013).

Business Intelligence

Developments in IT in recent years demanded that organizations take more responsibility for IT impact on the environment (Aquinas, 2007). In numerous organizations, the top priority of IT managers is handling the large amounts of produced data and making these data available to decision-makers and analysts at all levels of the organization. This change is a result of management's need to create a data-driven organization (Gaardboe, Nyvang and Sandalgaard, (2017).

The first uses of the term BI were first invented by Gaetner Group in the mid-1990s, however, the concept behind BI has roots in Management Information Systems (MIS) and data reporting systems in the 1970s (Sharda, .et. al., 2022). The main objective of BI is to transform data into useful and valuable information for both companies and decision-makers

(Grandhi and Chugh, 2013). which provides insight to the decision-maker, so they “do not need to rely on gut feelings, guesses, or experiences” (Salles,2007)

BI is considered as a stack, which is used to support collecting, analyzing, presenting, and distributing business information (Dedić and Stanier 2017). BI ability in gathering, absorbing and strategically leverage new information is critical for the establishment of proper technology infrastructure and adopting BI for organizational benefit (Elbashir, Collier, and Sutton, 2011).

There are three main characteristics of BI system compared to other integrated management systems, the first one is that BI tools allow the integration of data across systems and presenting it through one system, which saves time for both data dealers and BI users. The second characteristic is BI capability in the automation of many data utilization steps and functions as possible, where data processing is done in the background without the use of local computers. The third main characteristic of BI tools is their ability to visually represent data, which enables users to find the needed information more quickly (Ilvonen, 2019).

There are four main BI systems usually used in a business: Reporting BI system, Analysis BI system, Monitoring BI system, and Prediction BI tools. (Sabanovic,2008). The reporting BI system focuses on the development of business documents that hold valuable information on what has already happened at a given point in time, while analysis BI systems provide information on why a certain event happened. In the other hand, the monitoring tools of BI allow businesses to monitor information in real-time. Lastly, the Prediction tool of BI helps on foreseeing what might happen to business-based data available on business trends (Gauzelin and Bentz, 2017).

BI systems provide direct and indirect value to business through time savings in decision-making processes and improvements of performance (Popovič, Hackney, Coelho, and Jaklič, 2014). BI serves three distinct types of users: the first group is executives who need BI for strategic information, the second group is analytical users, and the third group is operational users, who use BI for frequently occurring short-term decisions (Kyper, Douglas, and Blake, 2012).

Definition of Business Intelligence

BI term is used in academics and research to denote to variety of information management technologies and information-seeking activities, in addition to the information outcome of such activities" (Wixom and Watson, 2010).

BI Systems refer to a "wide range of technologies and applications useful for retrieving and analyzing a large amount of information with the goal to generate knowledge useful for making an effective business decision" (Bach, Zoroja and Celjo, 2017).

Recently BI is defined as large-scale systems that combine IT, data-reporting, and analytic processes for the purpose of supporting decision-making in the organization (Arnott, Gao, Lizama, Meredith ,and Song, 2019).

BI system is also used for referring to computerized methods and processes that are used to turn data into information, which eventually are converted to business (Gauzelin and Bentz, 2017).

BI system is commonly known also as a technological solutions suite which facilitates Organizations need to integrate and analyze a vast amount of data for the purpose of

understanding their opportunities, strengths, and weaknesses (Ul-Ain, Vaia, DeLonge, and Waheed, 2019)

BI is a system used for presenting up-to-date business information in an easily consumed way and provides users with the ability to realize the meaning behind this information (Ahmad, 2015).

BI is also defined as an approach which includes systems and processes that are used in transforming raw data into evocative and useful meaningful information which enables effective analysis of an organization and its competitive environment (Teixeira, Oliveira, and Varejao, 2019).

BI is also defined as a process and a product, that to be used in developing useful information which helps organizations to survive in the universal economy and be able to predict the behaviors of business environment (Jourdan, Rainer, and Marshall, 2008).

In terms of decision-making, BI is the mean that organizations use to make smarter business decisions. BI decisions generally fall into three main categories: (1) strategic, (2) tactical, and (3) operational. The Complete understanding of these decisions in BI will enable the organization to make better-informed decisions that can result in increased satisfaction by customers and stakeholders, and increase operational efficiency and revenue (Henn, 2021).

Importance of Business Intelligence

BI system has been an important priority for IT executives for many years and as a result, BI software products market continues to grow. Recently emergent BI trends like Business Analytics (BA) and Big Data management have also contributed to the continuous growth of

BI software market (Wieder and Ossimitz, 2015). There was a significant investment in BI systems by firms in the last decade through substantial investment of resources in BI systems in order to achieve competitive advantages (Kulkarni, et al., 2017).

BI tools are necessary in strategic and operational decisions-making to be able to compete in the global environment (Aziz, 2020). BI leads to accumulation of competitive intelligence and facilitates strategic planning in the organization, which is eventually used in strategic decisions making in a given organization or company (Gauzelin and Bentz, 2017).

The purpose of BI analysis is giving management the ability to scrape data for information about the business, that can be utilized in providing operational and tactical decisions support (Sharda, Delen, and Turban, 2022). The Complete understanding of these decisions in BI will enable the organization to make better informed decisions that can result in increased satisfaction by customers & stakeholders, increase operational efficiency, and revenue (Henn, 2021).

Executives consider technology, data, and analytics as a transformational force in business. Therefore, many organizations are adopting the implementation of BI and analytics to support reporting and decision-making (Rikhardsson and Yigitbasioglu, 2018).

In summary, BI systems are modern technological tools came as a result for the recent developments in IT and data science, driven by the organizational need to close a gap in decision-making process and be more competitive in the global economy. The value of BI system comes from its ability not only to gather data and report information, but also to have the ability to convert these data and information into useful insights that can aid decision-making process.

Quality of decision Making

Decision-making is viewed as the cognitive process which results in the selection of action between several possible alternatives (Simon, 1977). Decision-making is the process of selecting among different alternatives (Aziz, 2020). Decision-makers need to permit themselves to be involved in the process of decision-making. This will provide them with the opportunity to derive alternatives and evaluate each one of them, after that they can select the best solution for the problem (Alhawamdeh and Alsmairat, 2019).

Decision-making is considered a daily process that takes place at every aspect of our life whether from homes to corporate boardrooms, and executive offices. While important decisions are usually made by managers and leaders located at the top of the organizational hierarchy (Hickson, Butler, Cray, Mallory, and Wilson, 1986). Decision-making in the organization is defined as the process managers use in identifying organizational problems and their attempt to resolve them (Bartol and Martin, 1994). Organizational decision-making is the process of answering problems by searching for and selecting a solution or action that can create value for stakeholders (Jones,2013). Decision-making Capabilities reflect ability of the organization to be resolute and astrong-minded in front of opportunities or threats (Teece, 2007).

Decision quality describes the processes leading to a high-quality decision. (Neal and Spetzler, 2015). The quality of decision-making relies on making decisions in less time with better accuracy (Aziz,2020) and is measured through the extent to which decisions achieved their intended objectives (Amason, 1996). Decision quality is based on “the reasonableness of the decision at the time it is made” (Spacey,2018). Decision

quality provides basis for a good decision while high-quality decisions should meet six main requirements: “Setting the right frame; Considering alternatives; Gathering meaningful data; Clarifying values and tradeoffs; Using logical reasoning; and committing to action” as illustrated in figure (2-1) (Spetzler, Winter and Meyer, 2016).

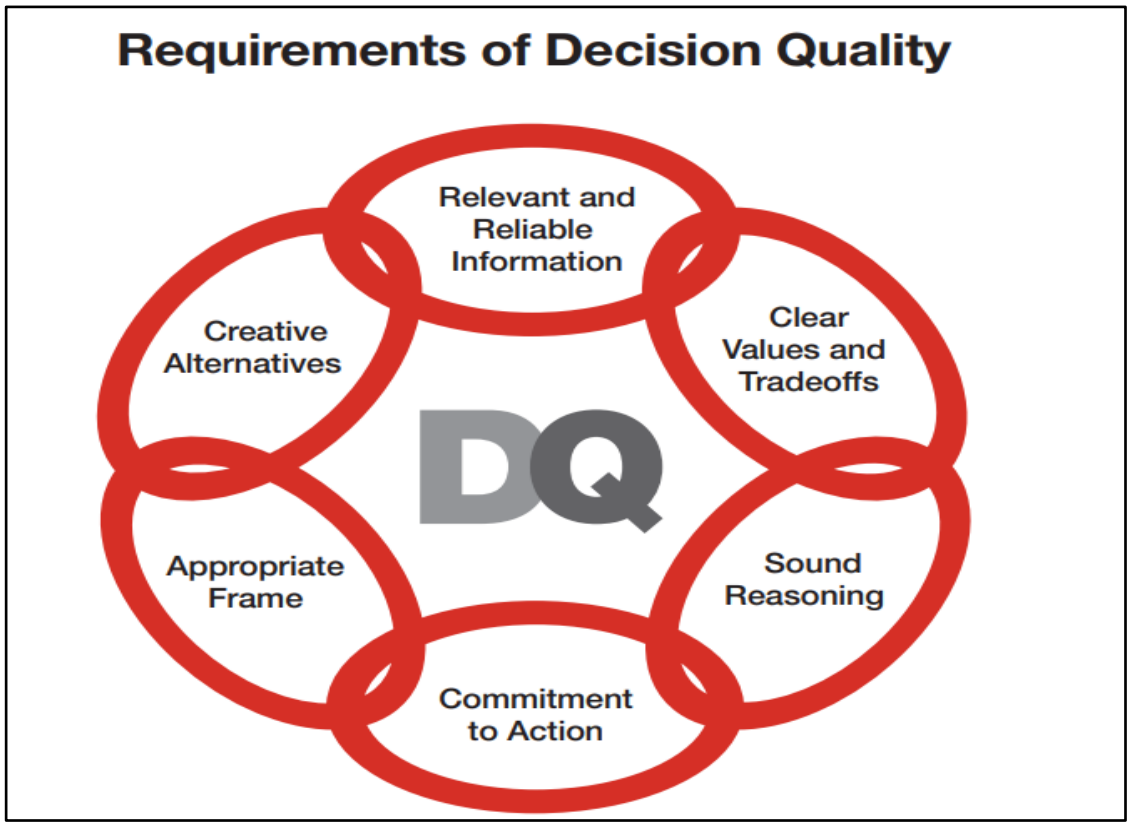

Figure (2-1) : Requirments of Decesion Quality(Spetzler, Winter and Meyer, 2016)

The Quality of the decisions making can be achieved by considering the following set of drivers: “environment factors, organization strategy, ethics, empowerment, information and feedback, programs, options, risk avoidance, resources, and opportunities” ((Negulescu and Doval, 2014). Managers consider that the quality of their decisions is influenced by the quantity of information available to them (Negulescu and Doval, 2014). Different decision-

makers will use different tactics which will have an impact on decision quality (Campbell and Clarke, 2018)

Also, the Quality of decision-making is influenced by several other factors, one of that is experience and Past decisions, which may affect mangers future decisions (Urumsah and Ramadhansyah, 2019). Effective decision-making is linked to experiences where more experienced Managers generally learn more and develop greater expertise that can help in making better decisions and provide them with support to know what additional information to seek before making a nonprogrammed decision (Terry,1977).

There are three main components for organizational decision-making based on management levels and organization size. These components are strategic, tactical, and operational decisions.

Components of Decision Making

Organizational decisions can be classified as strategic or tactical (Aquinas, 2007). Management of multinational companies takes decisions at three levels: strategic, tactical, and operational levels (Schmidt and Wilhelm, 2000). LathamDrive organization (2022) also described three types of decisions that are generally made by companies: Strategic, tactical, and operational decisions.

According to (Henn, 2021), BI supports the three main types of decision-making: strategic decisions, tactical decisions, and operational ones. Which are summarized in the following:

- Strategic Decisions: Long-term and complex that are made by senior management.

- Tactical Decisions: Medium-term and less complex that are made by mid-level management.
- Operational Decisions: Daily, simple, and routine that are made by junior (lower level) management

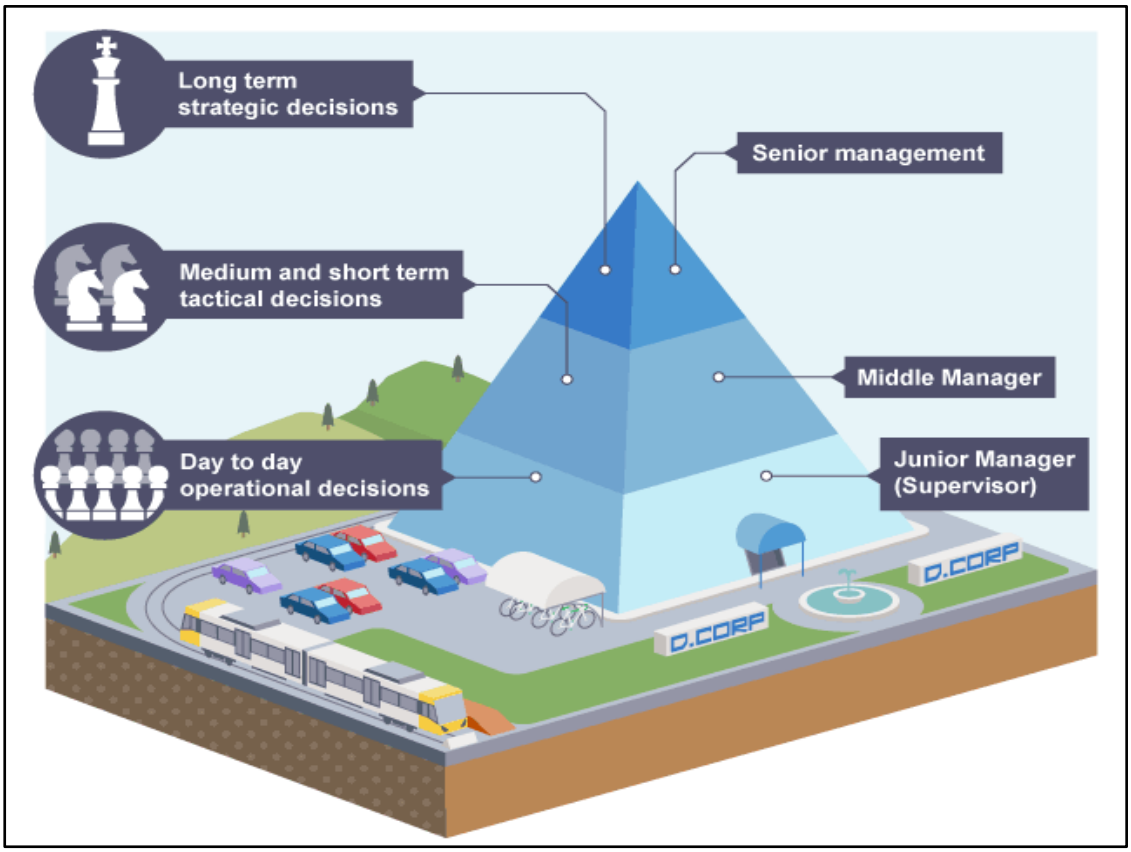

Figure (3-2): Types of Decision Making adopted from: https://www.bbc.co.uk/bitesize/guides/zkdc7nb

Strategic decisions

"Strategic decision-making belongs to one of the most important areas of current management and plays a crucial role in achieving success and survival of the company" (Papulova and Gazova, 2016) and is considered critical because it involves fundamental decisions that are shaping firms' future (Eisenhardt and Zbaracki, 1992).

Strategic decisions are defined as an attempt for the long-term planning of the organization's future is and considered significant in terms of actions taken and resources committed by management (Eisenhardt and Zbaracki, 1992). Strategic decisions are taken in accordance with organization mission and vison and deals mainly with organizational growth (Prachi Juneja ,2022). There are four types of strategic decisions: analytical decision-making, Heuristic decision-making, Expertise decision-making and random choice decision-making (LaMarco, 2018).

Strategic decision-making focuses on the objectives, therefore strategic decision-makers decisions are crucial factors for the activities in modern economies (Cowling and Sugden, 1998). At the strategic level. the organization works on establishing and planning its goals and objectives to attain and keep its competitive advantage. (Rouibach and Ould-ali, 2002). "Strategic decisions explore the goals and priorities for the response" (Campbell and Clarke, 2018). Successful strategic decision-making enables the organization to keep a competitive position and line up its internal operations with it's external environment. Also, it enables organizations to survive threats and challenges. In the other hand, poor strategic decisions lead to organization failure (Mueller, Mone, and Barker, 2007).

Top management establishes the bases for this kind of decision-making which is affected by the behavioral factors of top management (Wu T, Wu J, Tsai, and Li, 2017). "Managers have the power to influence the success of strategic decisions through the process they use to make decisions" (Dean and Sharfman, 1996). Strategic decisions making and managers are inseparable. Strategic decisions making is considered critical for managers who manage the organization (Alhawamdeh and Alsmairat, 2019). Organizations should value the experience

characteristics of their team members and make a great effort to create a respectful, comfortable, and trusting work environment that enhances ownership and improve the quality of their strategic decision-making (Wu T, Wu J, Tsai, and Li, 2017).

based on that, it's concluded that quality strategic decision is key for an organization to achieve a competitive position in the global market. Hence, Organizations require rich information to be able to make a quality strategic decision (Chen, et.al, 2022). where, adoption of BI systems in strategic decision-making is needed (Amir, Zare and Afshari, 2016)

Tactical decisions

Tactical decisions are medium-term decisions and generally come after strategic decisions planning (Misni and Lee, 2017). Tactical decisions are associated with the implementation and execution of strategic decisions where tactical decisions are directed towards the development of divisions plans, workflow structuring, distribution channels establishment, and acquirement of resources such as manpower, materials, and money (Smriti Chand,2022).

Tactical or so-called middle-level decisions are made by different units or departments in the organization and must be consistent with organizational strategy (Visinescu, 2013), as they are planned for the accomplishment and execution of the strategic decisions (Balman, 2018). There are several criteria for tactical decisions, they mainly focus on how to achieve the strategic goals, midterm decisions, and middle-level management involvement (Hasan, Eckert, and Earl, 2011). These kinds of decisions are handled by the middle level of management (Smriti Chand,2022).

Operational and tactical decisions are short-term and medium-term decisions that can alternate daily, weekly, and annually (Awudu and Zhang, 2012). Tactical level deals with a mid-range horizon of, say, 6 - 24 months, forming a bridge between strategic and operational levels (Schmidt and Wilhelm,2000). Tactical decisions in usual aim to plan for mid-term activities to provide profitable operations while considering the limitations of strategic decisions (Balman, 2018). Tactical decisions work for creating medium-term schedules and plans for better utilization and support in securing efficiency in production, distribution, and other operations (Balman, 2018).

According to the United Nations command staff training guide, tactical decisions making is based on the events unfolding around decision-makers, as well as information they have received. There are indications that Poor information or data quality has a negative impact on operational, tactical, and strategic level decisions (Redman, 1998). BI system equips decision-makers with needed information in both tactical and strategic levels for better understanding (Amir, Zare and Afshari, 2016).

Operational decisions

Managers usually make plenty of decisions, and some of these decisions are operational (Negulescu and Doval, 2014). Operational decisions are specific business decisions that are made daily within every business. Everyday business uses operational decisions in running day-to-day activities by different people (Aghlara, 2021). These kinds of decisions are adjusted more frequently in correspondence to the current internal and external conditions, which mostly have impacts no longer than a year or sometimes a day (Yuea, Youa, and

Snyder, 2014). These decisions are based on facts regarding the events (Chand, 2022). The operational-level decisions are limited by tactical-level ones (Schmidt and Wilhelm,2000).

Operational decisions typically are made at a small scall compared to strategic and tactical decisions. Operational decisions usually includes: Production planning, inventory planning, logistics management, resources management ...etc (Lan, Park, and Yao, 2020). Operational decisions are about production and capacity expansion for the purpose of maximizing profit and minimizing cost (Babich and Sobel, 2004).

Operational decisions are related to lower-level managers and are considered of short-term nature (Gareth and Jones, 2013). Operational decisions look at a shorter duration of time and "a specific part of the response" (Campbell and Clarke, 2018). Operational decisions help to achieve tactical goals, comprising detailed scheduling and planning for one day or week of operation (Balman, 2018). While the actical level deals with a mid-range horizon, operational level decisions should be summoned daily to schedule operations in relation to current information about jobs in process (Schmidt & Wilhelm, 2000).

Information has the potential for improving people's ability to make higher-quality operational decisions. While making these decisions based on inadequate or inaccurate information leads to a lack of efficiency terms of: "increased operational costs, problems in production scheduling, and inefficient production system development" (Hellberg and Ekstrand, 2018). Information is an essential part "that underlies the foundation of operational decisions" (Frishammar, 2003). At the operational level, BI is used for managing and optimizing daily business operations to meet the need for responding to specific events that might happen (White, 2006).

Importance of quality of decision-Making

The Person or a company's ability to make timely decisions with continually good results is one of the most competitive advantages for a person or a company to have, therefore it is important to examine how to make decisions and how to enhance their quality (Chen and Chien, 2009). Properly utilized, it can enable the capturing of the maximum value in complex and uncertain scenarios (Neal and Spetzler, 2015).

Strategic decision-making in a dynamic business environment is a challenge encountered by many organizations (Richards, Yeoh, Chong, and Popovic, 2017). High-quality efficient and effective decision-making mostly results in higher levels of organizational capabilities and can be considered as a key competitive advantage (Rikhardsson and Yigitbasioglu, 2018).

Management implies Decision-making regarding the organization and operations of business in its different dimensions. Organization failure or success can be concluded through the quality of decisions taken by organization managers (Aquinas, 2007). Accordingly, the quality of decision-making is key for organization effectiveness (Negulescu and Doval, 2014).

The Quality of Decision making whether it was Strategic, tactical, or operational plays a significant role in organization effectiveness and successes. Hence, management needs to pay special attention and effort to the tools that support enhancing the decision-making process within their organizations.

The relationship between BI and quality of decision-making

Decision quality is a function of efficiency and effectiveness in the decision-making process (Allwood and Salo, 2017). Top management's actions in reinforcing rules that value the use of information in decision-making will be reflected in higher levels of organizational capabilities (Sharma and Yetton, 2003).

BI system has the ability to improve the quality of the input to the decision-making process (Negash, 2004). BI acts as necessary support for processing information and generating correct decisions (Negro and Mesia, 2020) but, if organizations are unable to achieve the appropriate level of BI use, then decision quality may be limited (Visinescu, 20). It's argued that the examination of decision quality in the BI context will help to reduce the gap in current understanding (Visinescu, Jones, and Sidorova, 2017)

using BI systems can be found beneficial by supporting and enhancing decision-making quality within the firms (Rouhani, Ashrafi, Ravasan, and Afshari, 2016). BI systems provide the ability to analyze business information for the purpose of supporting and improving decision-making across a wide range of business activities (Elbashir, Collier and Davern, 2008). BI helps in gaining insights and provides managers with valuable facts and information that improves the quality of their decisions. (Chaudhuri, Dayal & Narasayya, 2011) BI includes profound knowledge on the important aspects for good quality business decisions (Asif, Hina and Mushtaq, 2017). It also expedites decision-making, which result in competitively superior performance (Ranjan, 2009)

There are many success stories of organizations which decision process and quality improved with the proper implementation of BI system. At the same time, measuring BI

performance is challenging. One of the metrics firms uses is “the number and quality of decisions made as a result of insights generated via the BI tool” (Djerdjouri, 2020).

Decision-making is crucial for any organization to be successful. Being in the decision-making process, Organizations shall consider the specialty of each one of the decision-making components discussed earlier while maintaining proper integration and balance between them. High-quality strategic, tactical, and operational decision-making will lead high-quality decisions for the whole organization. Therefore, the quality aspect of BI impact on decision-making is an important factor to be investigated and analyzed to reach to a better understanding of this relationship and the degree of this impact on decision-making at different management levels in the organization.

1.2 Previous Studies

-The Study of Wieder and Ossimitz (2015) with the title: **"The impact of Business Intelligence on the quality of decision making–a mediation model".**

This study aims to explore the impact of BI management on the quality of managerial decisions considering the mediating role of data quality, information quality, and BI scope using quantitative analysis for data collected from a sample of IT managers in Australia. This study concluded a significant indirect effect of BI management on the quality of managerial decision-making through the mediators: data quality and information quality. While BI scope impact on decision making was not strong as predicted. What distinguishes this study according to the researcher is that this study provides "first time evidence of direct and indirect determinants of managerial decision support improvements related to BI solutions scope and active management of BI".

- The Study of Visinescu, Jones, and Sidorova (2017) with the title**: "Improving Decision Quality: The Role of Business Intelligence"**

This study is an exploratory study that aims to explore and examine decisions quality that was made in the context of BI Considering the Level of BI use, Problem Space Complexity, and information quality direct impact on Perceived decision quality. This study used quantitative analysis for data collected from a sample of BI users from several industries and organizations within the United States. This study concluded a significant direct effect of level of BI use, Problem Space Complexity, and information quality on perceived decision quality. Also, it was found that the effect of information quality on decision quality is weaker for more complex problems and the level of BI use has a stronger positive effect on perceived

decision quality when information quality is high. What distinguishes this study is its focus on interactions between antecedent variables and the significant influence of these interactions on perceived decision quality.

- The Study of Kulkarni, et al., (2017) with the title: **"Business Intelligence Capability: The effect of Top Management and Mediating Roles of User Participation and Analytical Decision-Making Orientation"**

This study aims to explore how top management affects the development of company BI capabilities using multiple mediator model. This study explained the roles of user participation and analytical decision-making orientation as propagating mechanisms which convey top management sponsorship positive effect on BI capabilities development. This study is distinctive from other studies by considering a large widespread sample along with focusing on top management relations and influence on BI systems.

- The Study of Richards, Yeoh, Chong, and Popovic, (2017) with the title: **"Business Intelligence Effectiveness and corporate performance Management: An Empirical Analysis".**

This study investigated the impact of BI and Business Analytics (BA) relative importance on corporate performance management (CPM) in collaboration with key consultancy groups (PWC and CATA) where data was collected from a survey sample of 337 respondents from different countries including top management employees from 331 companies. The study concluded a significant positive relationship between implementation of BI systems and corporate performance where BI showed stronger influence than BA

functions. This study is distinctive from other studies by being the first to consider CPM and the sample size used and wide global coverage.

- The study of Gauzelin and Bentz (2017) with the title**:" An examination of the impact of business intelligence systems on organization decision making and performance: The case of France"**.

This study aims to explore the impact of BI on organizational decision-making and performance with specific consideration for the impact on Small and Medium-sized Enterprises (SMEs). This study uses a qualitative descriptive approach by conducting semi-structured interviews for a sample of 20 personnel from selected 10 SMEs considering Mangers and junior employees. The study concluded that BI implementation has an important positive impact on SMEs functional, operational, and overall effectiveness but there are always concerns about the implementation cost of BI system that most SMEs can't afford. This study is distinctive from other studies by focusing on the implementation of BI in SMEs knowing that most BI systems are usually utilized by large enterprises.

- The study of Gaardboe, Nyvang and Sandalgaard, (2017) with the title: **"Business Intelligence Success Applied to Healthcare Information Systems (HIS)".**

This study aims to explore and test Delone and Mcleans IS success model on BI implementation in HIS in Denmark. The study focused on studying the relationship between information quality, System quality use, user satisfaction, and individual impact. This study used quantitative analysis for data collected from a sample of employees from 12 hospitals in a certain region in Denmark. The study concluded strong positive relation between information quality, system quality, user satisfaction, and individual impact while no significant relationship between use and other factors was identified, which partially supports

Delone and Mcleans IS model. This study is distinctive from other studies by focusing on HIS sector, which is considered huge data sector.

- The study of (Popovič, Puklavec, and Oliveira (2018) with the title: **"Justifying Business Intelligence systems adoption in SMEs: Impact of systems use on firm performance".**

This study aims to explore the impact of BI systems utilization on firms' performance considering the routine and innovation use partial impact of three main factors that have a direct impact on firm performance, these three are: Impact on marketing, impact on management & internal operations, and the impact on firm procurement. This study used quantitative analysis for data collected from a sample of top management employees from several SMEs who are most qualified on BI sytems. The study concluded a strong positive impact between the first two variables and the impact on firm performance. While the impact on the procurement variable has no significant impact on firm performance. According to the researcher, this study is distinctive from other studies by being the first to consider both routine and innovative behavioral use of BI as IT tools in their research model. Also, this study is distinctive from others by focusing on BI use in SMEs.

- The study of Torres, Sidorova, and Jones (2018) with the title: "**Enabling Firm Performance Through Business Intelligence and Analytics: A Dynamic Capabilities Perspective"**.

This study aims to explore the relationship between Business Intelligence and Analytics (BI&A) and firm performance considering BI &A technical infrastructure quality, BI&A management capability, BI and personal expertise impact on BI&A dynamic capabilities that in term have influence on the level of functional performance and firm performance. This

study used quantitative analysis for data collected from a sample of MBA students with professional experience in BI&A. The study concluded positive impact of BI& A on firm performance. This study is distinctive from other studies by considering significance of the BI&A seizing capabilities, and the importance level of business process change in translating BI&A output into improved performance.

- The study of Urumsah and Ramadhansyah, (2019) with the title of "**Investigating the Influence of Business Intelligence on the Quality of Decision Making in an Indonesian Fertilizer company".**

This study aims to explore and evaluate the factors which influence the quality of decision-making by considering Indonesian's fertilizer sector as case study. The researcher focused on studying the factors impacting the quality of decision-making by considering BI Management, BI scope, data quality, content quality, and information quality as examining factors. This study used quantitative analysis for data collected from a sample of employees working in Indonesian fertilizer sector. The study concluded that BI management is the key factor that influences the quality of decision-making. This study is distinctive from other studies by providing practical insights to managers in fertilizer producer companies on the impact of BI strengthening their strategic decision-making process.

- The study of Teixeira, Oliveira and Varajao, (2019) with the title: **"Evaluation of Business Intelligence Projects Success- a Case Study".**

This is exploratory study that aims to evaluate the success criteria for BI projects in large scale firms by selecting one company in Portuguese as case study. Data collected through eleven interviews for employees within the company. This study concluded a positive impact

both at organizational and at individual levels from BI projects successful evaluation. The study also highlighted that there are important conditions for successful evaluation such as sales results, customers numbers, the margin of sales, optimization & standardization of information, and performance of people who are working with data resulting from BI projects. Also, it concluded that there should be continuous evaluation for BI projects to correct any deviations. This study is distinctive from other studies by focusing on the evaluation criteria of BI success instead of focusing on the impact of BI on the company considering factors like performance and decision-making.

- The Study of Aziz (2020) with the title: "**The Impact and Power of Business Intelligence (BI) on the Decision-making Process in Uppsala University: A Case Study".**

This study aims to investigate how BI system adaption may influence the decision-making process in educational institutes. Uppsala University was used as a case study using qualitative analysis. The study concluded that the BI system positively affects the decision-making process at Uppsala University since decision-making activities take less time to provide better quality decisions. what distinguishes is study is the focus on the educational sector which was not considered in most of other studies.

- The study of Wren. et al., (2021) with the title: **"Reconciling Business Intelligence, Analytics (BI&A) and Decision Support Systems (DSS): More data, deeper insight"**.

This is an empirical study that aims to explore the relation between DSS and BI&A where interviews were conducted with senior level BI&A Provisionals and leaders from several industries. The findings of this study are summarized as set of new research opportunities for BI&A by exploiting unexplored DSS foundational literature along with

evaluation of the linkage between BI&A and DSS research. This Study is distinctive from other studies by opening the opportunity for new research to close the research gap in BI&A and DSS.

- The study of Wibiayu and Siallagan, (2022) with the title: "**The Influence of Business Intelligence Dashboard in Decision-Making Process: A Case Study in Government Agency".**

This study aims to explore the employee perception on data visualization that is available in the Indonesian Food and Drug Authority (FDA) and list the possibilities to improve it using sing quantitative analysis for data collected from an employee survey. This study concluded that BI dashboards could help employees faster and more precise decisions by providing an overview of real-time data. Also, this study concluded that data filtration is the most important functionality incorporated in BI dashboards for the Indonesian FDA. This study focused on the visualization feature of BI through dashboards which has top importance for end-user of the BI system. What distinguishes this study is the focus on the public service sector where BI influence will have an indirect impact on people's life.

- The study of Al Eid and Yavuz, (2022) with the title: "**The Effect of Using Decision Support Systems Applications and Business Intelligence Systems in Making Strategic Decisions: A Field Study in the City of Gaziantep"**

This study aims to explore the importance level of BI and decision support systems for Syrian civil society organizations along with the impact of the dimensions of decision DSS and BI in making strategic decisions using quantitative analysis for data collected from sample of employees working for civil society organizations. This study concluded DSS, and

BI are among the most important tools that are used by Syrian civil society organizations at Gaziantep and in business organizations in general. Also, this study concluded significant positive relation between BI & DSS and strategic decision making. What distinct this study from others is the focus on BI impact in non-profit organizations sector, where the decision-making purpose is to improve people's lives and not profit.

Expected contribution for current study compared to previous studies.

Most of the reviewed previous studies on BI focused on three main topics: The first one focused on the evaluation of BI practice within organizations and institutes, the second one focused on the evaluation of BI impact on performance while the third one focused on BI impact on the quality of decision making. This study falls in the third category where the researchers showed special concern for BI impact on decision-making within the different organizations and institutes justifying that with the key role of BI as a decision support tool and the importance of decision-making for organizations.

This study focused on studying the impact of BI system on the quality of decision-making by considering BI System implementation direct impact on the pillars of decision-making in any organization: Strategic, Tactical, and operational decisions as the totality of the quality of these decisions is what shapes the quality of decision-making in the whole organization. At the same time, a gap in the quality of any one of these decisions will impact the whole organization as they all work together as a whole, which was not considered in other reviewed studies. Some of the previous studies focused the on quality of strategic decision, others focused on the quality of operational decisions while most of them focused on quality decision-making as general concepts without classification.

Additionally, this study considered the impact within three different management groups with a dedicated survey for each one: Top Management for strategic decisions, Middle management for tactical decisions and lower-level management for operational decisions which provides more validity and accuracy for the study results and helps in evaluating the proper integration of BI practices in the targeted organization to identify any gaps in BI practice. It's also good to note that the selected organization operates in various geographical and cultural regions which enrich the study results.

Overview of Emerson Machines Automation Solutions (MAS)

Emerson company was established in 1890 in St. Louis, Missouri as Emerson Electric Manufacturing Co. By Veteran John Wesley Emerson to manufacture electric motors. Emerson expanded now to be of the top leading industrial companies operating worldwide. Emerson consists of two core business platforms: Automation Solutions and Commercial & Residential Solutions. Total number of direct employees at Emerson exceeds 88,000 employees along with 205 manufacturing locations worldwide (Emerson, 2022a).

Earlier in 2019, Emerson acquired the GE Intelligent Platforms business, creating Emerson Machine Automation Solutions (MAS) with focus on expanding Emerson business in the machine control and discrete applications in process industry and hybrid markets. Based in Charlottesville, Virginia, Emerson MAS has More than 700 Direct employees worldwide with sales of $210 million in 2017. The business has a 25-year track record as an industrial automation innovator for machine control, industrial computing, networking devices, project and integration services, and other hardware/software solutions (Emerson, 2022b).

Emerson MAS is managed by a top executive acting as President of the house for MAS along with seiner Management staff on top of several functional units: finance, projects, Life cycle services, product development, product management, Sales, marketing, human resource, technology, administrative and human resources. Emerson MAS operates globally with teams distributed in several geographical regions like North and south America, Europe & Middle east, India, and Asia pacific. Typically, there three management levels in Emerson MAS: Top management, middle management, and lower management

Chapter Three: Methodology

This chapter is dedicated for presenting the research methodology in terms of study design, study population & sample, data collection methods, validity, and study tool reliability. This chapter also details the procedures and statistical processes that was used in this study.

3.1 Study Design

This is a descriptive and analytical study. Its objective is to study the Impact of Implementing Business Intelligence System on Quality of Decision-Making at Emerson MAS. The study started with a literature review and experts interview in BI domain to develop a model for evaluating the impact of BI as an independent variable on the quality of decision-making as a dependent variable. This study focused on three main components for the quality of decision-making: Quality of strategic decisions for top management, Quality of tactical decisions for Middle management, and quality of operational decisions for lower-level management. Expert judgment was used to improve the measurement tool. After that, the survey was done, and data were collected from employees who are actively using BI System and are involved in the decision-making process inside Emerson MAS within the three management levels. After Editing, the data were coded against SPSS 21. After that validity and reliability were checked and descriptive analysis was carried out. Finally, correlation among variables was checked and the impact was tested using regressions analysis.

To test questionnaire clarity and provide a coherent research questionnaire, a detailed review that covers all the research constructs was thoroughly performed by well-known academics with extensive experience and scientific expertise. Along with an internal review with one of Emerson MAS Senior managers and other BI experts in the company. Some questionnaire items were modified based on their valuable recommendations to be more accurate and enhance the research instrument. The academic reviewers were (2), (refer to appendix "1").

3.2 Study Population, Sample, and Unit of Analysis

Recently many global and regional organizations started adopting and implementing BI systems. Emerson is one of these organizations that are actively using BI systems. Machines Automation solution (MAS) business unit which is part of Emerson was selected, and this eliminated the need for sampling.

Unit of Analysis: The survey unit of analysis is composed of MAS employees who are actively using BI System and are involved in the decision-making process in the organization, and who were available at the time of questionnaires distribution and ready to participate in the survey. The survey covered three levels of management: Lower Management, Middle Management and Top management. A total of 64 copies of the three questionnaires were distributed electronically as follows: 35 numbers were distributed for lower management where 29 of them responded. 17 numbers were distributed for middle management where 16 of them responded while 12 numbers were distributed for top management where 9 of them responded. The Sample size is considered limited due to the nature of the questionnaire and

the number of management roles in Emerson MAS (total number of employees is around 700 while targeted management roles 64).

3.3 Data Collection Methods

To achieve the purposes of this study, data were collected from two sources: primary and secondary data sources:

- **Primary Data:** Data were collected from employees who actively use BI System and are involved in the decision-making process at Emerson-MAS using designed questionnaires that reflects study questions and objectives.
- **Secondary Data:** Secondary data was collected from secondary data sources like Articles, Published Papers, Research, Thesis, Case studies, and the internet.

The Questionnaire

This study consisted of three questionnaires covering three different management levels in the organization:

- **Questionnaire (1)**: Dedicated to top management with a focus on the quality of Strategic decisions.
- **Questionnaire** (**2)**: Dedicated to middle management with a focus on the quality of tactical decisions.
- **Questionnaire** (**3)**: Dedicated to lower management with a focus on the quality of operational decisions.

Each one of these questionnaires was divided into two parts:

1- **First part** contains the demographic dimensions related to age, qualification, experience, and position within the organization. This is covered under section 1.

2- **Second part** includes both independent and dependent variables as follows:

- **Independent variables** (Business Intelligence), which was common for all questionnaires. This is covered under section 2 through (10) items.
- **Dependent variable** (Quality of decision making) based on management level and covered through sections 3 with (9) items each as follow:
    - For Top Management questionnaire: The impact of implementing BI systems on Quality of Strategic decisions.
    - For Middle Management questionnaire: The impact of implementing BI systems on Quality of Tactical decisions.
    - For Lower management questionnaire: The impact of implementing BI systems on Quality of operational decisions.

The basis of the questionnaire measurement would be a five-point Likert scale as indicated below:

Strongly agree	Agree	Neutral	Disagree	Strongly disagree
5	4	3	2	1

3.4 Data Collection and analysis

Study data were collected using a survey during the time period of the month of April 2022, Then the data were checked and coded against SPSS 21. After that the following analyses were carried out:

1. Validity: Previous studies were used to check content validity, and Exploratory factor analysis (EFA) was used for construct validity (factors analysis).

2. Reliability: Cronbach's Alpha was used to check the reliability of the tool.

3. Descriptive analysis: Number and frequency of demographic, mean, standard deviation, t-value, and ranking.

4. Cause-Effect: Regression analysis was used to test the effect of the independent variable on the dependent variable.

5. Relative importance assigned due to:

$$\text{Class Interval} = \frac{\text{Maximum Class} - \text{Minimum Class}}{\text{Number of Level}}$$

$$\text{Class Interval} = \frac{5-1}{3} = \frac{4}{3} = 1.33$$

The Low degree from 1- less than 2.33
The Medium degree from 2.33 – 3.66
The High degree from 3.67 and above.

3.5 Demographic Dimensions of Study Sample

Table (3-1) shows the demographic Dimensions of the study sample (Age, Educational level, Years of Experience, Years of services within current organization and position).

Table (3-1) Descriptive sample of the demographic Dimensions of the study:

NO.	Variables	Categorization	Frequency	Percent%
1	**Age**	30 years or less	0	0
		from 31-40 years	26	48.1
		from 41-50 years	11	20.4
		51 years and more	17	31.5
	Total		**54**	**100.0**
2	**Education Level**	BSC	19	35.2
		High Diploma	11	20.4
		Master	24	44.4
		PhD.	0	0
	Total		**54**	**100.0**
3	**Experience**	5 years or less	0	0
		6-10 years	2	3.7
		11-15 years	16	29.6
		16 years and more	36	66.7
	Total		**54**	**100.0**
4	**Years of service**	5 years or less	21	38.9
		6-10 years	11	20.4
		11-15 years	9	16.7
		16 years and more	13	24.1
	Total		**54**	**100.0**
5	**Position**	Top Management	9	16.7
		Middle Management	16	29.6
		Lower Management	29	53.7
	Total		**54**	**100.0**

Table (3-1) is the results of the descriptive analysis of demographic variables for the study sample responding members. The table shows that (51.9%) of the sample are above 41 years old and no respondents are below the age of 30 years, which indicates that the focus of in study will be on the middle age element which is a good indication for Emerson-MAS since it's not considered aging organization.

When it comes to educational level; It's observed that all members of the study sample have a scientific degree, which is a clear indication of the adoption of high educational qualifications to accomplish the work at Emerson as an engineering company.

The result of descriptive analysis for Years of experience of the respondents, clearly indicates a high experience level since most respondents (96.3%) have more than 11 years of experience, and most of them are 16 years and more (66.7%). This is a good indication of the respondent's level of expertise in their domain.

In term of years of service in current organization, it's noticed that years of service varies and differs from years of experience which indication of new blood from outside the current organization. The biggest percentage is for 5 years or less (38.9%), and the experience from 6 -10 years is (20.4%), while from 11-15 years of services is (16.7%). On the other hand, 16 years and more are (24.1%).

Finally, the analysis of position within the organization shows that (16.7%) of the sample of the study are from p management and (29.6.1%) are from middle management, while the remaining (53.7%) are from lower management. The percentage distribution for management levels in the organization follows the typical pyramid hierarchy which concedes with the typical practice

3.6 Validity

Exploratory factor analysis (EFA) is used for construct validity (factors analysis) to verify the internal consistency of study tool.

The results are indicated in Table (3-2) and Table (3-3) below:

Table (3-2): Saturation matrix (loading rates) for the paragraphs on the dimensions of the study tool

NO.	Item	Loadings (BI. System)	Loadings (QSD. System)	Loadings (QTD. System)	Loadings (QOD. System)
BI-1	The company considers that information is highly valued for decision-making	0.895			
BI-2	The company uses the information to predict future trends	0.949			
BI-3	The company develops the decision-making process	0.85			
BI-4	The company develops new technological tools that aim to enhance the decision-making process	0.744			
BI-5	The company commits to actions driven by the utilization of new technological tools (i.e., BI system)	0.932			

BI-6	The company uses a BI system that is easy to use in day-to-day practices	0.938			
BI-7	BI provides added value for decision-making that can you go beyond dashboard visualizations	0.811			
BI-8	The company uses BI system to support Group communication and collaboration	0.72			
BI-9	The company considers BI system a source of sustainable competitive advantage	0.686			
BI-10	The company uses BI system to allow different working teams to collaborate and build on each other's decisions	0.463			
QSD-1	The company's top management relies mostly on information for decision-making		0.929		
QSD-2	BI system provides top management with easy access to crucial information for decision-making		0.712		
QSD-3	BI system allows for better alignment of strategic decisions to the company mission, vision, and goals		0.874		

QSD-4	The company’s BI system increases the effectiveness of strategic decision-making		0.789		
QSD-5	The company's BI system allows for better risk response to external dynamic environment changes		0.818		
QSD-6	The company’s BI system allows the organization to accelerate the decision-making process		0.789		
QSD-7	The company's BI system allows for better decisions in terms of allocation of strategic resources		0.885		
QSD-8	The company’s BI system provides top management with the ability to make better decisions in terms of long-term growth plans		0.529		
QSD-9	The company’s BI system helps the organization to reduced decision-Making cost		0.875		
QTD-1	The company’s BI system leads to more reliable information for day-to-day decisions			0.416	
QTD-2	The company BI system enables the managers to have doable alternatives for day-to-day decisions (i.e projects execution decisions)			0.576	

QTD-3	The company BI system helps managers to have timely accurate decisions during project execution			0.459	
QTD-4	The company's BI system allows for better decisions in terms of Customer management			0.453	
QTD-5	The company's BI system allows for better decisions in terms of procurement control			0.644	
QTD-6	The company’s BI system enhances the efficiency of time management decisions for projects			0.75	
QTD-7	The company's BI system allows for better decisions in terms of resources allocation			0.745	
QTD-8	The company's BI system allows for better decisions in terms of Procurement control			0.694	
QTD-9	The company's BI system allows for better decisions in terms of inventory management activities			0.541	
QOD-1	The company’s BI system leads to more reliable information for day-to-day decisions				0.7

QOD-2	The company BI system enables the managers to have doable alternatives for day-to-day decisions (i.e projects execution decisions)				0.479
QOD-3	The company BI system helps managers to have timely accurate decisions during project execution				0.83
QOD-4	The company's BI system allows for better decisions in terms of Customer management				0.838
QOD-5	The company's BI system allows for better decisions in terms of procurement control				0.651
QOD-6	The company’s BI system enhances the efficiency of time management decisions for projects				0.898
QOD-7	The company's BI system allows for better decisions in terms of resources allocation				0.483
QOD-8	The company's BI system allows for better decisions in terms of Procurement control				0.914
QOD-9	The company's BI system allows for better decisions in terms of inventory management activities				0.775

Table (3-3): KMO + Bartlett's Test of Sphericity – Chi-Square + Eigen value

Variable	Item	KMO	Bartlett's Test of Sphericity – Chi-Square	Df	Eigen Value	.Sig
BI. System	1 2 3 4 5 6 7 8 9 10	0.626	333.329	45	4.19	0
QSD.	1 2 3 4 5 6 7 8 9	0.779	291.824	36	4.89	0
QTD.	1 2 3 4 5 6 7 8 9	0.759	219.566	36	3.272	0
QOD.	1 2 3 4 5 6 7 8 9	0.763	295.609	36	4.538	0

It is concluded from the results of Table (3-3) that all Eigen Value values were greater than (1) true, and all KMO values were greater than (0.50) , So the values of KMO suggests an acceptable data adequacy for factor analysis (Hair, et al., 2010), and all Bartlett's test of Sphericity values are Statistically function at the level of statistical significance ($\alpha = 0.05$) which indicates significant relationships between the factors included in the analysis.

Also, all the values of the factors were loaded on one factor and their values exceeded (0.40) which indicates reasonable convergent validity.

Based on the above, the results of the Exploratory Factor Analysis (EFA) indicate that this study tool has a high degree of construct validity.

3.7 Study Tool Reliability

Cronbach's Alpha was used to assess the internal consistency and reliability of Questionnaire Dimensions. The results of this test are indicated in the below table.

Table (3-4): Reliability Test (Cronbach's Alpha) for all Variables.

NO.	Dimensions	Cronbach's Alpha (Alpha Value (α))
1	Independent (Business Intelligence system (BI System).	0.797
2	Dependent (QDM).	0.90
3	Quality of Strategic decisions.	0.877
4	Quality of tactical decisions.	0.888
5	Quality of operational decisions.	0.928
Overall		**0.904**

It’s noted from Table (3-4) that all the values of the stability coefficients for the resolution dimensions were high. It is clear from the previous table that all values are acceptable ratios since they are all higher than the permissible limit (0.70) (Pallant, 2005). Therefore, these values indicate that the study tool has acceptable stability coefficients, and therefore the study tool is suitable for the application to achieve the purposes of the study.

Based on the above and the result of the reliability test, the study tool has acceptable stability coefficients and is suitable for application.

CHAPTER FOUR

Analysis Results & Hypotheses Test

This chapter is dedicated to the discerption of statistical analysis results for data collected from research questionnaires on study questions and hypotheses. This includes discerption of the mean and standard deviation for the study questions along with simple linear and regression analysis.

4.1 Descriptive analysis of study variables:

- **Business Intelligence system (BI System)**

This study used the arithmetic-mean, standard deviation, item importance, and importance level as indicated in Tables: (4-1), (4-2), (4-3), and (4-4). These values were calculated separately for each questionnaire group (Top Management, Middle Management, and lower Management), after that, a common table was provided Table (4-4) for the calculations of the combined groups as one result, since they share the same questions. This will help in checking the consistency of results between the three management levels in the various questionnaires.

Table (4-1) Arithmetic mean, SD, item importance, and importance level of (Business Intelligence system (BI System)) – For (TM)

NO	Items	Mean	Std.	t- value Calculate	Sig	Item importance	Importance level
1	The company considers that information is highly valued for decision-making	4.78	0.67	8	0.00*	1	High
2	The company uses the information to predict future trends	4.11	0.6	5.55	0.001*	5	High
3	The company develops the decision-making process	4	0.87	3.46	0.009*	6	High
4	The company develops new technological tools that aim to enhance the decision-making process	4.22	0.67	5.5	0.001*	4	High
5	The company commits to actions driven by the utilization of new technological tools (i.e., BI system)	4.44	0.53	8.22	0.000*	3	High
6	The company uses a BI system that is easy to use in day-to-day practices	4.22	0.97	3.77	0.005*	4	High
7	BI provides added value for decision-making that can you go beyond dashboard visualizations	4.11	0.78	4.26	0.003*	5	High
8	The company uses BI system to support Group communication and collaboration	4.11	0.78	4.26	0.003*	5	High
9	The company considers BI system a source of sustainable competitive advantage	4.56	0.53	8.85	0.000*	2	High

10	The company uses BI system to allow different working teams to collaborate and build on each other's decisions	4	0.71	4.24	0.003*	6	High
BI System		**4.26**	**0.51**	**High**			

* The impact is significant at level the ($\alpha \leq 0.05$)

This table clarifies the importance level of BI for top management, since the general arithmetic mean value is (4.26) is considered high. Also, it's observed that the highest mean is for item 1: **"Information is highly valued for decision making"** While the lowest arithmetic mean is for both items 3 and 10: **"The company is interested in developing decision-making process in different management levels in the organization"** and **"Utilizing BI systems allows different working teams to collaborate and build on each other's decisions"**

Generally, it appears that the importance level of BI for top management under study is high. All standard deviation (std) values were less than 1 which is an indication of consistency in the responses of top management.

Table (4-2): Arithmetic mean, SD, item importance, and importance level of (Business Intelligence system (BI System)) – For (MM)

NO	Items	Mean	Std.	t- value Calculate	Sig	Item importance	Importance level
1	The company considers that information is highly valued for decision-making	4.44	1.09	5.26	0.00*	1	High
2	The company uses the information to predict future trends	4.25	0.68	7.32	0.00*	4	High
3	The company develops the decision-making process	4.19	0.66	7.25	0.00*	5	High
4	The company develops new technological tools that aim to enhance the decision-making process	4.19	0.54	8.73	0.00*	5	High
5	The company commits to actions driven by the utilization of new technological tools (i.e., BI system)	4.31	0.7	7.46	0.00*	3	High
6	The company uses a BI system that is easy to use in day-to-day practices	3.94	0.93	4.04	0.001*	6	High
7	BI provides added value for decision-making that can you go beyond dashboard visualizations	4.31	0.7	7.46	0.00*	3	High
8	The company uses BI system to support Group communication and collaboration	3.94	0.68	5.51	0.00*	6	High
9	The company considers BI system a source of sustainable competitive advantage	4.38	0.81	6.82	0.00*	2	High

10	The company uses BI system to allow different working teams to collaborate and build on each other's decisions	4.44	0.51	11.22	0.00*	1	High
BI System		**4.24**	**0.32**	**High**			

* The impact is significant at the level ($\alpha \leq 0.05$)

This table clarifies the importance level of BI for middle management, since the general arithmetic mean value is (4.24) is considered high. It's observed that the highest mean is for both items 1 and 10: "**Information is highly valued for decision making"** and **"Utilizing BI systems allows different working teams to collaborate and build on each other's decisions"**. While the lowest arithmetic means is for both items 6 and 8: **"BI systems utilized at the company are easy to use in day-to-day practices"** and **"Implementing BI supported Group communication and collaboration a cross various operation regions and departments"**.

Generally, it appears that the importance level of BI for Middle management under study is high. All standard deviation (std) values were less than 1 which is an indication of consistency in the responses of Middle management. This value was the lowest compared to Top and Middle management which indicates more consistency in middle management responses.

Table (4-3): Arithmetic mean, SD, item importance, and importance level of (Business Intelligence system (BI System)) – For (LM)

NO	Items	Mean	Std.	t- value Calculate	Sig	Item importance	Importance level
1	The company considers that information is highly valued for decision-making	4.45	0.91	8.57	0.00*	1	High
2	The company uses the information to predict future trends	4.21	0.86	7.55	0.00*	4	High
3	The company develops the decision-making process	4.03	0.94	5.9	0.00*	5	High
4	The company develops new technological tools that aim to enhance the decision-making process	4.24	0.83	8.05	0.00*	3	High
5	The company commits to actions driven by the utilization of new technological tools (i.e., BI system)	4.28	0.65	10.59	0.00*	2	High
6	The company uses a BI system that is easy to use in day-to-day practices	4	0.65	8.23	0.00*	7	High
7	BI provides added value for decision-making that can you go beyond dashboard visualizations	4.1	0.77	7.7	0.00*	6	High
8	The company uses BI system to support Group communication and collaboration	3.97	0.78	6.68	0.00*	8	High
9	The company considers BI system a source of sustainable competitive advantage	4.24	0.64	10.52	0.00*	3	High

10	The company uses BI system to allow different working teams to collaborate and build on each other's decisions	4.1	0.72	8.2	0.00*	6	High
BI System		**4.16**	**0.5**	**High**			

* The impact is significant at the level ($\alpha \leq 0.05$)

This table clarifies the importance level of BI for lower management, since the general arithmetic mean with the value of (4.16) is considered high. It's observed that the highest mean is for item 1 **"Information is highly valued for decision making"**. While the lowest arithmetic mean is for item 8: **"Implementing BI supported Group communication and collaboration a cross various operation regions and departments"**.

Generally, it appears that the importance level of BI for lower management under study is high. All standard deviation (std) values were less than 1 which is an indication of consistency in the responses of lower management.

Table (4-4): Arithmetic mean, SD, item importance, and importance level of (Business Intelligence system (BI System)). Total for all sample from different management levels.

NO	Items	Mean	Std.	t- value Calculate	Sig	Item importance	Importance level
1	The company considers that information is highly valued for decision-making	4.5	0.93	11.9	0.00*	1	High
2	The company uses the information to predict future trends	4.2	0.76	11.61	0.00*	5	High
3	The company develops the decision-making process	4.07	0.84	9.36	0.00*	8	High
4	The company develops new technological tools that aim to enhance the decision-making process	4.22	0.72	12.51	0.00*	4	High
5	The company commits to actions driven by the utilization of new technological tools (i.e., BI system)	4.31	0.64	15.12	0.00*	3	High
6	The company uses a BI system that is easy to use in day-to-day practices	4.02	0.79	9.49	0.00*	9	High
7	BI provides added value for decision-making that can you go beyond dashboard visualizations	4.17	0.75	11.49	0.00*	7	High
8	The company uses BI system to support Group communication and collaboration	3.98	0.74	9.75	0.00*	10	High
9	The company considers BI system a source of sustainable competitive advantage	4.33	0.67	14.56	0.00*	2	High

10	The company uses BI system to allow different working teams to collaborate and build on each other's decisions	4.19	0.68	12.9	0.00*	6	High
BI System		**4.2**	**0.45**	**High**			

* The impact is significant at the level ($\alpha \leq 0.05$)

This table clarifies the importance level of BI for all management levels together, since the general arithmetic mean value (4.2) is considered high. It's observed that the highest mean is for item 1: **"Information is highly valued for decision making"**. While the lowest arithmetic mean is for item 8: "**Implementing BI supported Group communication and collaboration a cross various operation regions and departments"**.

Generally, it appears that the importance level of BI for all management levels under study is high which concedes with the individual results from each management level with considerations of small differences but agree on the top significance of item 1: **"Information is highly valued for decision making"**. Also, all of them agreed that even that item 8: "**Implementing BI supported Group communication and collaboration a cross various operation regions and departments"** has high importance level but it's the least important among BI items.

General arithmetic mean values were all high with slight differences, but still the value for top management was the highest which is an indication for the special importance for BI to top management

- **Quality of Strategic decisions: For Top Management.**

This study used the arithmetic mean, standard deviation, item importance, and importance level as shown in Tables (4-5). These values were calculated based on questionnaire data collected from top Management in relation to the impact of BI system on quality of strategic decisions.

Table (4-5) Arithmetic mean, SD, item importance and importance level of (Quality of Strategic decisions: For Top Management (QSD)) – For (TM).

NO	Items	Mean	Std.	t- value Calculate	Sig	Item importance	Importance level
1	The company's top management relies mostly on information for decision-making	3.89	0.33	8	0.000*	4	High
2	BI system provides top management with easy access to crucial information for decision-making	4.33	0.71	5.66	0.000*	1	High
3	BI system allows for better alignment of strategic decisions to the company mission, vision, and goals	4.22	0.67	5.5	0.001*	2	High
4	The company's BI system increases the effectiveness of strategic decision-making	4	0.71	4.24	0.003*	3	High
5	The company's BI system allows for better risk response to external dynamic environment changes	3.44	0.53	2.53	0.035*	7	Medium
6	The company's BI system allows the organization to accelerate the decision-making process	3.89	0.93	2.87	0.021*	4	High

7	The company's BI system allows for better decisions in terms of allocation of strategic resources	3.78	0.44	5.29	0.001*	5	High
8	The company's BI system provides top management with the ability to make better decisions in terms of long-term growth plans	3.67	0.71	2.83	0.022*	6	High
9	The company's BI system helps the organization to reduced decision-making cost	3.33	0.87	5.15	0.000*	8	Medium
Quality of Strategic decisions		**3.84**	**0.48**	**High**			

* The impact is significant at level the ($\alpha \leq 0.05$)

This table clarifies the importance level for quality of strategic decisions for top management since the general arithmetic mean value is (3.84) is considered high. Also, its observed that the highest mean is for item 2 "**Implementing BI systems provided top management with easily accessible to Crucial Information for decision making"**. While the lowest arithmetic mean is for item 9: **"Implementing BI systems allowed the organization to reduced decision-Making cost"** which has a medium importance level which indicates less agreement on BI impact on reducing decision cost. The same can be extended to BI impact on risk response in item5.

Generally, it appears that the importance level of quality of strategic decisions for top management under study is high. All standard deviation (std) values were less than 1 which is an indication of consistency in the responses of top management.

- **Quality of tactical decisions: For Middle Management.**

This study used the arithmetic mean, standard deviation, item importance, and importance level as shown in Tables (4-6). These values were calculated based on questionnaire data collected from Middle Management in relation to the impact of BI system on quality of tactical decisions.

Table (4-6): Arithmetic mean, SD, item importance and importance level of (Quality of tactical decisions: For Middle Management (QTD)) – For (MM)

NO	Items	Mean	Std.	t- value Calculate	Sig	Item importance	Importance level
1	BI system leads to faster decisions making	4.44	0.51	11.22	0.000*	1	High
2	The company's BI system provides the management with better insights in terms of Production planning, inventor optimization, and logistics	4.19	0.91	5.22	0.000*	2	High
3	The company's business intelligence system allows for better decisions in terms of key resources allocations	4.13	0.5	9	0.000*	3	High
4	The company's BI system allows for better decisions in terms of efficiency improvement in various units	3.94	0.85	4.39	0.001*	5	High
5	The company's BI system allows for better decisions in terms of cost control in various units	4	0.73	5.48	0.000*	4	High
6	The company's BI system allows for more accurate decisions related to risk identification and containment	3.75	0.93	3.22	0.006*	6	High

7	The company's BI system allows for better financial decisions toward more profitability for the business unit.	3.94	0.77	4.86	0.000*	5	High
8	The company's BI system allows for better decisions in terms of budget planning and allocation	4.13	0.72	6.26	0.000*	3	High
9	The company's BI system allows for better decisions in terms of employees' management	3.56	0.89	2.52	0.023*	7	Medium
Quality of tactical decisions		**4.01**	**0.56**	**High**			

* The impact is significant at the level ($\alpha \leq 0.05$)

This table clarifies the importance level for quality of tactical decisions for middle management since the general arithmetic mean value is (4.01) is considered high. It's observed that the highest mean is for item 1 **"Implementing BI systems leads to faster and more accurate decisions making"**. While the lowest arithmetic mean is for item 9: **"Implementing BI systems allows for better decisions in term of Employees"**) which has a medium importance level which indicates less agreement on BI impact on Employees management.

Generally, it appears that the importance level of quality of tactical decision for Middle management is high. All standard deviation (std) values were less than 1 which is an indication of consistency in the responses of middle management.

- **Quality of operational decisions: For lower Management**

This study used the arithmetic mean, standard deviation, item importance and importance level as shown in Tables (4-7). These values were calculated based on questionnaire data collected from lower Management in relation to impact of BI system on quality of operational decisions.

Table (4-7): Arithmetic mean, SD, item importance and importance level of (Quality of operational decisions: For lower Management (Projects Mangers) (QOD)) –For (LM)

NO	Items	Mean	Std.	t- value Calculate	Sig	Item importance	Importance level
1	The company's BI system leads to more reliable information for day-to-day decisions	4.28	0.7	9.79	0.00*	1	High
2	The company BI system enables the managers to have doable alternatives for day-to-day decisions (i.e projects execution decisions)	3.93	0.75	6.66	0.00*	8	High
3	The company BI system helps managers to have timely accurate decisions during project execution	4.03	0.68	8.19	0.00*	5	High
4	The company's BI system allows for better decisions in terms of Customer management	4.21	0.68	9.63	0.00*	2	High
5	The company's BI system allows for better decisions in terms of procurement control	4.1	0.77	7.7	0.00*	4	High
6	The company's BI system enhances the efficiency of time management decisions for projects	4.28	0.8	8.62	0.00*	1	High

7	The company's BI system allows for better decisions in terms of resources allocation	4.17	0.71	8.89	0.00*	3	High
8	The company's BI system allows for better decisions in terms of Procurement control	4	0.8	6.72	0.00*	6	High
9	The company's BI system allows for better decisions in terms of inventory management activities	3.97	0.87	6.01	0.00*	7	High
Quality of operational decisions: For lower Management		**4.11**	**0.6**	High			

* The impact is significant at the level ($\alpha \leq 0.05$)

This table clarifies the importance level for quality of operational decisions for lower management since general the arithmetic mean value is (4.11) is considered high. It's observed that the highest mean is for item 6: **"Implementing BI systems enhanced the efficiency of time management decisions in projects"** with arithmetic mean of (4.28) and standard deviation (0.8). While the lowest arithmetic mean is for item 2: "**Implementing BI systems enables the mangers to have more creative and doable alternatives for day-to-day decisions (or projects execution decisions)"** with arithmetic mean of (3.93) and standard deviation of (0.75). Generally, it appears that importance level of quality of operational decision for lower management under study is high.

For all previous tables (4-1) to (4-7), all standard deviation (std) values were less than 1 which is indication of consistency in the responses.

4.2 Study Hypotheses Test

The hypotheses were tested using simple linear regression with F test using ANOVA table as follows:

H01: BI System implementation has No impact on quality of decision-making at the level ($\alpha \leq 0.05$).

Table (4-8) Simple Linear Regression Analysis test results for the impact of BI on quality of decision making

	R	R^2	F Calculated	DF	Sig.	β	T Calculated	Sig.
Dependent (QDM)	0.631	0.398	34.353	1 52 53	0.00*	0.799	5.861	0.00*

* The impact is significant at the level ($\alpha \leq 0.05$)

From the results indicated in the above table, it's concluded that **there is a significant positive direct impact of BI System implementation on quality of decision-Making at the level ($\alpha \leq 0.05$).**

Table (4-8) indicates that R value is (0.631) at the level ($\alpha \leq 0.05$) which means that there is a positive correlation value of 63.1%, while the coefficient of determination R^2 value is (0.398) which means that the variations in BI has explained 39.8% of the variances in QDM. The β value is 0.799 which means that increase of one unit in BI will increase QDM in the organization by (0.799). F calculated value is (34.353) and it's significant at the level ($\alpha \leq 0.05$).

Based on the above analysis, **We reject the first null hypothesis (H01) and accept the alternative hypothesis** that: There is a statistically impact at the significance level (α≤0.05) for BI System implementation on quality of decision-making.

H02: BI System implementation has no impact on quality of strategic decisions making.

Table (4-9) Simple Linear Regression Analysis test results of the impact of BI System implementation on quality of strategic decisions making.

	R	R^2	F Calculated	DF	Sig.	β	T Calculated	Sig.
Dependent (QSD)	0.665	0.443	5.558	1 7 8	0.041*	0.625	2.40	0.04*

* The impact is significant at the level (α ≤ 0.05)

From the results indicated in the above table, it's concluded that **there is a significant positive direct impact of BI System implementation on quality of Strategic decisions making at the level (α ≤ 0.05).**

Table (4-9) indicates that R value is (0.665) at the level (α ≤ 0.05) which means that we have a positive correlation value of 63.1%, while the coefficient of determination R^2 value is (0.443) which means that the variations in BI has explained 44.3% of the variances in QSD. The β value is 0.625 which means that increase of one unit in BI will increase QSD in the organization by (0.799). F calculated value is (5.558) and it's significant at the level (α ≤ 0.05).

Based on the above analysis, we reject the second null hypothesis (**H02)** and accept the alternative hypothesis that: There is a statistically impact at the significance level (α≤0.05) for BI System implementation on quality of strategic decisions making.

H03: BI System implementation has positive impact on quality of tactical decisions making.

Table (4-10) Simple Linear Regression Analysis test results of the impact of BI System implementation on quality of tactical decisions-making

	R	R2	F Calculated	DF	Sig.	β	T Calculated	Sig.
Dependent (QTD)	0.796	0.634	24.217	1 14 15	0.0*	0.796	4.921	0.0*

* The impact is significant at the level ($\alpha \leq 0.05$)

From results indicated in the above table, it's concluded that **there is a significant positive direct impact of BI System implementation on quality of tactical decisions making**

Table (4-9) indicates that R value is (0.796) at the level ($\alpha \leq 0.05$) which means that we have a positive correlation value of 79.6%, while the coefficient of determination R^2 value is (0.634) which means that the variations in BI has explained 63.4% of the variances in QTD. The β value is 0.796 which means that the increase of one unit in BI will increase QSD in the organization by (0.796). F calculated value is (24.217) and it's significant at the level ($\alpha \leq 0.05$).

Based on the above analysis, we reject the third null hypothesis (**H03)** and accept the alternative hypothesis that: There is a statistically impact at the significance level ($\alpha \leq 0.05$) for BI System implementation on quality of tactical decisions making.

H04: BI System implementation has no impact on quality of operational decisions making.

Table (4-11) Simple Linear Regression Analysis test results of the impact of BI System implementation impact on quality of operational decisions

	R	R2	F Calculated	DF	Sig.	β	T Calculated	Sig.
Dependent (QOD)	0.632	0.399	17.956	1 27 28	0.0*	0.757	4.237	0.0*

* The impact is significant at the level ($\alpha \leq 0.05$)

From the results indicated in the above table, it's concluded that **there is a significant positive direct impact of BI System implementation on quality of operational decisions making at the level ($\alpha \leq 0.05$).**

Table (4-11) indicates that R value is (0.632) at level ($\alpha \leq 0.05$) which means that we have a positive correlation value of 63.2%, while the coefficient of determination R2 value is (0.399) which means that the variations in BI has explained 39.9% of the variances in QOD. The β value is 0.757 which means that the increase of one unit in BI will increase QSD in the organization by (0.757). F calculated value is (17.956) and it's significant at level ($\alpha \leq 0.05$).

Based on the above analysis, we reject the fourth null hypothesis (**H04)** and accept the alternative hypothesis that: There is a statistically impact at the significance level ($\alpha \leq 0.05$) for BI System implementation on quality of operational decisions making.

CHAPTER FIVE
Results, Conclusions and Recommendations

This chapter is dedicated to discussing the results, conclusions, and recommendations of this study based on the results of statistical analysis of study sample responses related to the items of the study variables, with the purpose of identifying the impact of implementing BI system on quality of decision-making.

5.1 Results Discussion

Examination of study hypotheses is the base root for this research. Analysis and testing results of this study hypotheses can be summarized in the following:

Results related to the first hypotheses (**H_{01}**) test indicated that there is a significant positive direct impact of BI System implementation on quality of decision-making at the level ($\alpha \leq 0.05$). This result is extended to all the three management levels within the organization which means that BI system implementation at Emerson MAS contributed to increasing the quality of their decision-making.

The above result concedes with the result of (Al Eid and Yavuz, 2022) and (Urumsah and Ramadhansyah, 2019) study for having a positive direct impact of BI on quality of decision making and partially agree with the result of (Wieder and Ossimitz, 2015) as their study concluded a positive direct and indirect effect for BI on the quality of managerial decision making.

The results of remaining hypotheses **(H_{02}, H_{03} and H_{04})** related to Quality of Strategic, tactical and operational decisions making were as follows:

- There is a significant positive direct impact of BI System implementation on quality of Strategic decisions making ($\alpha \leq 0.05$). which means that BI system implementation at Emerson MAS contributed to increasing the quality of strategic decisions for top management.
- There is a significant positive direct impact of BI System implementation on quality of tactical decisions making at the level ($\alpha \leq 0.05$). which means that BI system implementation at Emerson MAS contributed to increasing the quality of tactical decisions for middle management.
- There is a significant positive direct impact of BI System implementation on quality of operational decisions making at the level ($\alpha \leq 0.05$). which means that BI system implementation at Emerson MAS contributed to increasing the quality of operational decisions for lower-level management.

Based on questionnaires data analysis the following results are highlighted:

- The importance level of Business Intelligence in the organization was high from the viewpoint of the study population at Emerson MAS as indicated in Table (4-4).
- The importance level of quality of decision-making (Strategic, tactical, and operational) was high from the viewpoint of the study population at Emerson MAS as indicated in tables (4-5), (4-6), and (4-7).
- There is agreement among all management levels on the top importance of Information for supporting the decision-making process as indicated from the results

of statistical analyses of BI variable. This result concedes with the outcome of the theoretical literature review.

- There was less agreement among top management on the impact of BI implementation on responding to risks and external dynamic environment changes as indicated in the table (4-5): item 5 which opens a window for further investigation for this concern. The same is extended to BI impact on reducing decision-making cost in the table (4-5): item 9.
- There was less agreement among middle management on the positive impact of BI on employee management as indicted in the table (4-6): item 9 which opens another window for further investigation to support or deny this assumption

5.2 Conclusions

Based on study results the following are concluded:

- Even though Business Intelligence is considered relatively new, but it has deep roots in decision-making systems and management information systems (MIS) as concluded from the theoretical review. The concept behind BI has roots in Management information System (MIS) and data reporting systems in 1970s (Sharda, .et. al., 2022).

- Information is highly valued for decision-making process in any organization, thus there is special attention for developing technological tools and IT infrastructure for the purpose of data collection and analysis as concluded from questionnaire results analysis of BI section: items 1,3 and 4 and this also concedes with the results of theoretical literature review in chapter 2. Developments in IT in recent years

demanded that organizations take more responsibility toward IT impact on the environment. (Aquinas, 2007). This change is a result of management needs to create data-driven organization (Gaardboe, Nyvang and Sandalgaard, 2017).

- BI system is considered as a source of competitive advantage which requires special attention from top management and commitment to actions driven by the utilization of BI systems and this agrees with the analyses results of Section 1 of BI questionnaire in the tables (4-1),(4-2),(4-3), and (4-4): items: 5 & 9. At the same time this agrees with what was stated in literature review of previous studies. Top management's actions in reinforcing rules that value the use of information in decision-making will be reflected in higher levels of organizational capabilities (Sharma and Yetton, 2003). There was significant investment in BI systems, in order to achieve competitive advantages (Kulkarni, et al., 2017).

- BI system provides easily access to Crucial Information and provide insights to mangers in way that simplifies decision-making process and close knowledge gaps by providing intelligence to data management and analytics process in a way that enhance quality of decision making in different management levels as concluded from top management questionnaire results analysis of QSD section table (4-5) and QTD section table (4-6): item2.

- Decision-making differs from one line of management to another, for example top management focus is for strategic decisions while middle management focus will be on tactical decisions. On the other hand, the lower-management focus is operational decisions.

- Based on practical experience and expert interviews within Emerson MAS, it's concluded that BI systems provide flexibility and simplicity that helps users from different management levels to use reports and dashboards that each management level needs. This also agrees with the analysis results of section one of the questionnaires, tables (4-1), (4-2), (4-3) and (4-4): items: 5.
- Even though BI system is making decision-making an intelligent process, but still BI is an interactive system that is directly impacted by users where several important factors that have significant influence need to be considered like age, educational level, experience, individual differences, and familiarity with technology.
- Enhancing decision-making quality whether Strategic, tactical, or operational in different management levels through the implementation of BI system will eventually impact the overall decision-making process within organization and the result will be reflected in more efficient, accurate faster, and integrated decisions as concluded from analysis result of QSD, QTD and QOD tables (4-5,4-6 and 4-7).

5.3 Recommendations

based on study results and researcher work experience at Emerson MAS, the following practical recommendations are suggested:

- Emerson-MAS shall increase awareness of the use of BI systems among other employees outside the three management levels in a way that maximizes gains of such systems by proper utilization and use as employees outside management have less exposure to such tools.

- Integration of BI systems between different departments and business units in the organization will maximize capabilities in achieving competitive performance. It's noticed that in the case of acquisition, the newly acquired business mostly are using different tools and needs time to integrate with the new system.
- It's advised to extend the benefits of utilizing BI Systems to trusted partners and suppliers by sharing BI reports and dashboards that support collaborative decisions-making and provides insights that enhance special collaborative efforts like supply chain.

based on the study results, the following recommendations are suggested for future research:

- The researcher recommends conducting a separate study dedicated to studying the impact of BI system use on predicting future trends and behaviors since it was noticed during the literature review phase that there is a noticeable lack of studies concerning this topic from the viewpoint of the researcher, especially in Arabic studies.
- The researcher recommends conducting separate research on the impact of implementing BI system on reducing decision-making cost by building a model that is based on financial numbers as this study concluded less agreement on BI impact on reducing decision-making cost (refer conclusions section).
- Other researchers are advised to review this study results and to evaluate if similar effects can be repeated in other organizations operating in similar or different fields like Emerson MAS and consider organizations that differ in size and geographical presence.

- Based on the literature review of previous studies, researchers are recommended to investigate the effect of other moderating variables such as data integrity, user experience, and cultural differences as a factor that affects organizational decision-making. Despite the increased application of BI in decision making, it is important to consider the manner of the decision-maker (Mohammadi and Hajiheydari, 2012).

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Appendices

Appendix (1)

List of arbitrators

Name	Major	Academic rank	workplace
Abdullah Batinah	Business Administration	Associate Professor	Middle East University
Basel J. A. Ali	Business Administration	Assistant professor	Applied Science University/Bahrain

Appendix (2)

Questionnaire

Dear Respectful Doctor

Attached to this letter you find attached a questioner that I have prepared as a requirement for my master thesis in Business Administration in Management Department-Business Faculty, Middle East University, Amman-Jordan.

In acknowledgment of your esteemed, well-known academic extensive experience and scientific expertise I am asking your support in respect of evaluating the attached questionnaire, which was developed based on previous studies and publications relevant to the study variables along with interviews with experts in the domain of business intelligence and experience mangers operating at Emerson company (the subject study sample). Your notes and advise will highly value in bolstering the questionnaire's paragraphs making them more valid for the purpose they were composed for.

Thanks & Best regards,

Abdelhafez Salameh

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The Impact of Implementing Business Intelligence System on Quality of Decision Making

أثر تطبيق نظام ذكاء الأعمال على جودة اتخاذ القرار دراسة حالة

إستبيان

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This Questionnaire is provided as supplement to the Master Thesis

Business Department

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Introduction

This questionnaire is proposed by the researcher with the purpose of exploring “The impact Implementing Business Intelligence System on Quality of Decision Making at Emerson- MAS considering the three different Management Levels in The Organization.

Recently many of the global and regional organizations started adoption and implementation of BI system. Machines Automation solution (MAS) business unit which is part of Emerson Electric corporation is selected for study considering three levels of management within MAS business unit: Tope management, Middle Management, and lower-level management. MAS is operating globally covering 5 main geographical areas: North America, South America, Europe & Middle east (EMEA), India and Asia pacific. As global organization Emerson utilizing different technological tools including Business Intelligence systems to aid and support management operations and decision-making process in various departments and business units.

Study Questions and Hypotheses

Derived from the study problem, this study will examine the following questions and hypotheses:

- **Study Questions**

The key question derived from the study problem:

Q1. Is there an impact of BI system implementation on quality of decision-making?

Q2. Is there an impact of BI system implementation on quality of strategic decisions making?

Q3. Is there an impact of BI system implementation on quality of tactical decisions making?

Q4. Is there an impact of BI system implementation on quality of operational decisions making?

- **Study Hypotheses:**

Ho_1: BI System implementation has no impact on quality of decision-making at ($\alpha \leq 0.05$).

Ho_2: BI System implementation has no impact on quality of strategic decisions making at ($\alpha \leq 0.05$).

Ho_3: BI System implementation has no impact on quality of tactical decisions Making ($\alpha \leq 0.05$).

Ho_4: BI System implementation has no impact on quality of operational decisions making ($\alpha \leq 0.05$)

Study Model

The researcher relied on the previous studies of (Wieder and Ossimitz, 2015) and (Urumsah and Ramadhansyah, 2019) for building the main structure of the model and selecting independent and dependent variables, but in contrast to these studies, the researcher didn't select mediating variables.

For the dependent variable and after a deep review of current BI practice at Emerson MAS and a series of interviews with BI experts within the company, the researcher decided to consider: Quality of Strategic decisions Making, Quality of Tactical decisions Making, and Quality of operational decisions Making considering their crucial impact on decision-making in the organization.

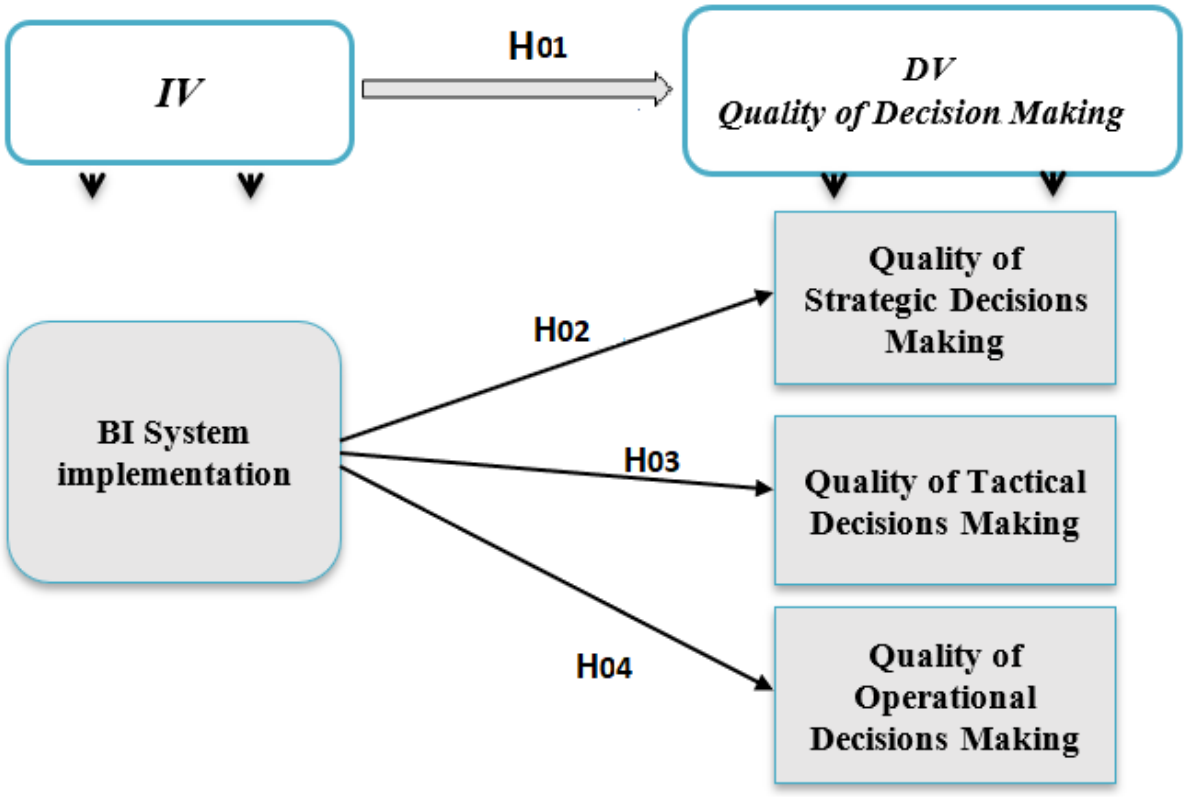

Figure (1-1): Study Modl

Questionnaire

"This study consists of three questionaires as follow

- Top Management questionnaire: For evaluating the impact of implementing BI systems on Quality of Strategic decisions.
- Middle Management questionnaire: For evaluating the impact of implementing BI systems on Quality of Tactical decisions.
- Lower-level management questionnaire: For evaluating the impact the impact of implementing BI systems on Quality of operational decisions.

The basis of the questionnaire measurement would be a five-point Likert scale as indicated below:

Strongly agree	Agree	Neutral	Disagree	Strongly disagree
5	4	3	2	1

Items in below questionaries are based on literature review of published studies, articles and other questionnaires related to the field of business intelligence. Below is list of key studies used. Additional references are listed in reference section.

- The study of Wieder and Ossimitz, (2015)
- The Study of Ahmad (2015)
- The study of Gaardboe, Nyvang and Sandalgaard, (2017)
- The study of Gauzelin and Bentz, (2017)
- The Study of Elbashir, Collier and Davern, (2008)
- The Study of Richards, Yeoh, Chong and Popovic, (2017)
- The Study of Shepherd, Mooi, Elbanna and Rudd, (2021)
- The Study of Chen, Liu, Zhou, Chen and Chen, (2022)

Questionnaire 1: Top Management

The Impact of Implementing Business Intelligence System on Quality of Decision Making: Study Questionnaire 1	
Section 1	**Demographic information** **All questions about demographic information are error-free.**
1	**Age** 30 years or less ☐ from 31-40 years ☐ from 41-50 years ☐ 51 years and more ☐
2	**Education Level** BSC ☐ High Diploma ☐ Master ☐ Ph.D. ☐
2	**Experience** 5 years or less ☐ 6-10 years ☐ 11-15 years ☐ 16 years and more ☐
3	**Years of service** 5 years or less ☐ 6-10 years ☐ 11-15 years ☐ 16 years and more ☐
4	**Position** Top Management ☐ Middle Management ☐ Lower Management ☐
#No	**Question**
Section 2	**Business Intelligence system (BI System): Common to all**
1	The company considers that information is highly valued for decision-making

2	The company uses the information to predict future trends
3	The company develops the decision-making process
4	The company develops new technological tools that aim to enhance the decision-making process
5	The company commits to actions driven by the utilization of new technological tools (i.e., BI system)
6	The company uses a BI system that is easy to use in day-to-day practices
7	BI provides added value for decision-making that can you go beyond dashboard visualizations
8	The company uses BI system to support Group communication and collaboration
9	The company considers BI system a source of sustainable competitive advantage
10	The company uses BI system to allow different working teams to collaborate and build on each other's decisions
#No	**Question**
Section 3	**Quality of Strategic decisions: For top management**
1	The company's top management relies mostly on information for decision-making
2	BI system provides top management with easy access to crucial information for decision-making
3	BI system allows for better alignment of strategic decisions to the company mission, vision, and goals

4	The company’s BI system increases the effectiveness of strategic decision-making
5	The company's BI system allows for better risk response to external dynamic environment changes
6	The company’s BI system allows the organization to accelerate the decision-making process
7	The company's BI system allows for better decisions in terms of allocation of strategic resources
8	The company’s BI system provides top management with the ability to make better decisions in terms of long-term growth plans
9	The company’s BI system helps the organization to reduced decision-making cost

Questionnaire 2: Middle Management

The Impact of Implementing Business Intelligence System on Quality of Decision Making: Study Questionnaire 2	
Section 1	**Demographic information** **All questions about demographic information are error-free.**
1	**Age** 30 years or less ☐ from 31-40 years ☐ from 41-50 years ☐ 51 years and more ☐
2	**Education Level** BSC ☐ High Diploma ☐ Master ☐ Ph.D. ☐
2	**Experience** 5 years or less ☐ 6-10 years ☐ 11-15 years ☐ 16 years and more ☐
3	**Years of service** 5 years or less ☐ 6-10 years ☐ 11-15 years ☐ 16 years and more ☐
4	**Position** Top Management ☐ Middle Management ☐ Lower Management ☐
#No	**Question**
Section 2	**Business Intelligence system (BI System): Common to all**
1	The company considers that information is highly valued for decision-making

2	The company uses the information to predict future trends
3	The company develops the decision-making process
4	The company develops new technological tools that aim to enhance the decision-making process
5	The company commits to actions driven by the utilization of new technological tools (i.e., BI system)
6	The company uses a BI system that is easy to use in day-to-day practices
7	BI provides added value for decision-making that can you go beyond dashboard visualizations
8	The company uses BI system to support Group communication and collaboration
9	The company considers BI system a source of sustainable competitive advantage
10	The company uses BI system to allow different working teams to collaborate and build on each other's decisions
#No	**Question**
Section 3	**Quality of tactical decisions: For Middle Management**
1	BI system leads to faster decisions making
2	The company's BI system provides the management with better insights in terms of Production planning, inventor optimization, and logistics
3	The company's business intelligence system allows for better decisions in terms of key resources allocations

4	The company's BI system allows for better decisions in terms of efficiency improvement in various units
5	The company's BI system allows for better decisions in terms of cost control in various units
6	The company's BI system allows for more accurate decisions related to risk identification and containment
7	The company's BI system allows for better financial decisions toward more profitability for the business unit.
8	The company's BI system allows for better decisions in terms of budget planning and allocation
9	The company's BI system allows for better decisions in terms of employees' management

Questionnaire 3: Lower-level Management

The Impact of Implementing Business Intelligence System on Quality of Decision: Study Questionnaire 3	
Section 1	**Demographic information** **All questions about demographic information are error-free.**
1	**Age** 30 years or less ☐ from 31-40 years ☐ from 41-50 years ☐ 51 years and more ☐
2	**Education Level** BSC ☐ High Diploma ☐ Master ☐ Ph.D. ☐
2	**Experience** 5 years or less ☐ 6-10 years ☐ 11-15 years ☐ 16 years and more ☐
3	**Years of service** 5 years or less ☐ 6-10 years ☐ 11-15 years ☐ 16 years and more ☐
4	**Position** Top Management ☐ Middle Management ☐ Lower Management ☐
#No	**Question**
Section 2	**Business Intelligence system (BI System): Common to all**
1	The company considers that information is highly valued for decision-making

2	The company uses the information to predict future trends
3	The company develops the decision-making process
4	The company develops new technological tools that aim to enhance the decision-making process
5	The company commits to actions driven by the utilization of new technological tools (i.e., BI system)
6	The company uses a BI system that is easy to use in day-to-day practices
7	BI provides added value for decision-making that can you go beyond dashboard visualizations
8	The company uses BI system to support Group communication and collaboration
9	The company considers BI system a source of sustainable competitive advantage
10	The company uses BI system to allow different working teams to collaborate and build on each other's decisions
#No	**Question**
Section 5	**Quality of operational decisions: For lower Management**
1	The company's BI system leads to more reliable information for day-to-day decisions
2	The company BI system enables the managers to have doable alternatives for day-to-day decisions (i.e projects execution decisions)
3	The company BI system helps managers to have timely accurate decisions during project execution

4	The company's BI system allows for better decisions in terms of Customer management
5	The company's BI system allows for better decisions in terms of procurement control
6	The company’s BI system enhances the efficiency of time management decisions for projects
7	The company's BI system allows for better decisions in terms of resources allocation
8	The company's BI system allows for better decisions in terms of Procurement control
9	The company's BI system allows for better decisions in terms of inventory management activities

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