ENHANCING KNOWLEDGE MANAGEMENT IN THE ERA OF INDUSTRY 4.0 FOR PROJECT SUCCESS

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DEDICATION

I dedicate my dissertation work to my family and my partner. A special feeling of gratitude to my loving mom, Yap Siew Yoke whose words of encouragement and push the tenacity ring in my ears. My partner Foo Li Yan, who supported me throughout the process. I will always appreciate all they have done for me.

DECLARATION

I, **CHONG MAN FOONG** hereby declare that this project report is based on my original work except for citations and quotations which have been duly acknowledged. I also declare that it has not been previously and concurrently submitted for any other degree or award at UTAR or other institutions.

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APPROVAL SHEET

This dissertation entitled "**ENHANCING KNOWLEDGE MANAGEMENT IN THE ERA OF INDUSTRY 4.0 FOR PROJECT SUCCESS"** was prepared by CHONG MAN FOONG and submitted as partial fulfilment of the requirements for the degree of Master of Project Management at Universiti Tunku Abdul Rahman.

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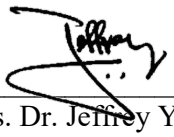

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ABSTRACT

Knowledge management is crucial when it comes to project success. In recent years, the importance of knowledge management in project management has become one of the important factors for project managers to achieve project success. In the era of digitalization, the introduction of the smartphone, artificial intelligence, and digital product is continuously changing our daily habits. The purpose of this dissertation is to gain an understanding of the methods that can be used to enhance knowledge management in the era of industry 4.0 for project managers to achieve better project success. For the study, a quantitative technique is utilised to assess the impacts of one set of variables on another set of variables identified. This aided in the collection of data from the intended population under study and the generalization of results based on numeric quantification. The findings suggested that new technologies in Industry 4.0 era make it easier to collect massive volumes of data, which may then be utilized to improve operational operations in terms of efficiency, productivity, and flexibility for project success. Total 330 respondents will be selected for the survey in this study. The sampling frame of this study will be the companies representatives who participating in project management and knowledge management systems in relation to Industry 4.0 practices. The study has the practical implications that it highlights the need to pay adequate attention to specific concepts/technologies introduced by Industry 4.0 for better project management. The study contributes through the findings that information in the Industry 4.0 environment originates mostly from knowledge sources, as a result, KM4.0 and project success are linked.

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LIST OF ABBREVIATIONS

3D	3-Dimensional
ANOVA	One-Way Analysis of Variance
Asymp. Sig	Asymptotic Significance
AI	Artificial Intelligence
CPS	Cyber-Physical System
ERP	Enterprise Resource Planning
GSM	Global System for Mobiles
ICT	Information Communication Technology
IT	Information Technology
KM	Knowledge Management
KW	Kruskal-Wallis
M2M	Machine-to-Machine
OS	Open System
PC	Personal Computer
PM	Project Management
PMMMs	Project Management Maturity Models
S-ERP	Sustainability Enterprise Resource Planning
SPSS	Statistical Package for the Social Science
Wi-Fi	Wireless-Fidelity

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Industry 4.0 is being considered the prime feature of the fourth industrial revolution in the world. Technology has been a prime factor behind the development of the industry and shaping the manufacturing business globally (Cárcel-Carrasco & Gómez-Gómez, 2021). The knowledge management system has been a prime component that is being used by the organization shaping their process and delivering better products to their consumers (Nikitina & Lapiņa, 2019). The present study focuses on the various features of the knowledge management system and its importance in improving the business process, in the changed business scenario. The study also will highlight the key features of the knowledge management system and its usefulness to the organization for building their business as per the new norm of industry 4.0.

1.2 Research Background

The industrial revolution that took over the manufacturing and distribution field using technological advancement has been identified as the fourth revolution in the industry or industry 4.0. The increased competitiveness in the market has

pressured industries to opt for knowledge-based solutions for resolving the raised issues (Manesh et al., 2020). For providing sustenance in the business process, the Knowledge management (KM) process has been used by the organizations for sharing or transferring, storing, or retrieving knowledge throughout its process. The KM process has been highly modified in the context of the Industry 4.0 norms to match its trend effectively (Phungphol et al., 2018). There is a need to undertake the transition approach to establish the 4.0 industry. Success is evitable when project managers look for improving and learning new components with the application of electronic media for increasing and supporting the knowledge of the workforce to formulate new ideas and act accordingly.

The industry 4.0 culture can be defined as an automated production unit where the manufacturing of goods takes place in a controlled environment and it is also responsible for producing the best quality products. Implementation of such a process in the organization is gaining popularity due to the increased competitiveness in the market (Ghobakhloo & Fathi, 2019). The manufacturing has become fully automated as the commodity market has become dynamic and competitive as well (Alicke et al., 2017). The design implementations in the organization do not usually take place organically but use technology as the prime mode of communication. The technology is more adaptive to a flexible environment.

Competition risk has become evident for organizations to sustain their business in the market. Hence, businesses have opted for technology-based solutions for addressing the competition and establishing their business. The

knowledge management process has successfully assisted businesses to apply specific knowledge-based solutions to match the market trends and needs. The knowledge management process has also played an important role in shaping consumer behavior and value creation among the customers (Jally et al., 2021). The process uses resources from the dual side of the business, such as, from the inside traits of the company and outside also. Using the process enhances the quality of the service in an organization. Businesses gain competitiveness using the KM process in their business effectively. Hence, the prime objective of the KM process is to make the organization aware of the knowledge and modify the resources as per the requirement. The major components of the KM process are 1) Creation of the Knowledge. 2) Storing Knowledge. 3) Transferring the knowledge and 4) Applying the Knowledge. Knowledge is being considered the most valuable asset for a company to utilize for its monetary gain. In this context, knowledge management focuses on the creation of specific knowledge and its propagation process (Stocker et al., 2021). Organizations gain a strategic advantage over using the primary process. Tacit and explicit knowledge are explored using the process and converting the same for the company's gain. The organization's power and process improvement also depend on the KM process development (Mohajan, 2017).

The knowledge management process is also involved in providing specific assistance for improving the project process in an organization effectively. The application of the knowledge in project management works effectively in shaping the process (Hughes et al., 2020). The various obstacles that a project faces in its initial time are effectively managed by using the Knowledge management process (Barão et al., 2017).

The role of the KM process in industry 4.0 has been immense. The advancement of technology has been assisting in business development. The process has been proven to be assisting in creating innovation for businesses effectively in the context of Industry 4.0. Value creation which is an important aspect of the revolutionized industry has been in focus for the process. The innovation generated the key components of the knowledge management process, such as using the internet and technology for assisting businesses with fine production quality (Ozturk & Yitmen, 2019). Moreover, the requirement of industry 4.0 is to change the operations of basic and traditional machines to self-learning and self-aware machines for improving their maintenance management and overall performance with the ambient interaction (Vaidya et al., 2018). Besides, the 4.0 based industry tends to construct a smart and open manufacturing foundation for industrial-channeled information application.

The project work can focus on growing awareness in the project format while initiating the knowledge management process. Developing the used knowledge would help the process to use repeatable approaches for improvement (Salzano et al., 2016). The gained knowledge can be applied for standardizing the process and afterwards the gained knowledge can be leveraged for improving the practices.

1.3 Problem Statement

Based on the research background, it is identified that detailed insight is required to get a clear picture of the impact and issue of integrating knowledge management framework in the process of the project given industry 4.0. According to Tien (2020), knowledge management is significant and businesses

cannot develop, produce, innovate, or adapt without relying on relevant knowledge sources. Since managers have gradually become aware that knowledge is one of the most important assets of an enterprise, its role in the formation, impact, and contribution to the building and strengthening of competitiveness and value of businesses in the market in today's knowledge economy, knowledge management is becoming more important. Moreover, information plays a significant role in project management, particularly in terms of disseminating and sharing knowledge in order to successfully implement projects. Therefore, when knowledge management approaches are used in project management, there are several advantages and issues that arise throughout the project implementation process may be swiftly resolved by all parties involved. Nonetheless, the concern is, information, knowledge, and skills are frequently linked to specific business activities, organizational departments, or even individuals, but they do not exist at the organizational level. As a result, businesses waste a lot of time and effort looking for information that one part of them requires but that is located in another section of the company. This leads to an emergent need of improving knowledge management processes for better project management and success.

According to Capestro and Kinkel (2020), the latest Industry 4.0 paradigm is revolutionizing all sectors and project-based industries as well. The new technologies facilitate the accumulation of huge amounts of information to be used accordingly to improve operational activities in terms of efficiency, productivity, and flexibility. Therefore, the present practices require further improvement in knowledge management for addressing the adoption of technologies of Industry 4.0 and better management of information for project

operations. The culture of the organization has also not been much explored yet. Though, the cultural aspect of the organization has been most important for transferring the knowledge in the entire company (Wilkesmann & Wilkesmann, 2018). The study of the organization culture for fruitful implementation of the knowledge management process in the business has been an important factor for industry 4.0 (Adamik & Nowicki, 2018). As per de Nadae & de Carvalho (2017), projects are important for knowledge production, but if there are no efficient management methods in place, the pool of information will be lost. Knowledge collection most probably occurs at the organizational memory level, whereas projects gain new knowledge assets, since it promotes structural modification. Furthermore, efficient and sustainable KM necessitates not only new technology and innovation but it also necessitates a knowledge of the factors of human-organizational cultural integration. For making the business process successful, the organizations need to choose a knowledge management framework for meeting the skill-oriented labor crisis effectively. In light of the above remark, the prime importance of the study has been focused on the major issue in the organization regarding the lack of skilled laborer's recruitment for meeting the objective.

1.4 Aims and Objectives

The specific aim of the study is to understand the importance of Knowledge management in the Industry 4.0 era, the usefulness of the knowledge management process in project work in the Industry 4.0 era, and the link between the application of the KM process and project success.

The specific objectives of this study are:

- To examine the approaches for improving knowledge management in the era of Industry 4.0
- To investigate the usefulness of KM4.0 for project management in the era of Industry 4.0
- To determine the relationship of applying KM4.0 and project success

1.5 Research Questions

a) What are the approaches that can be followed for improving knowledge management in the era of Industry 4.0?

b) How is KM 4.0 useful for project management in the era of Industry 4.0?

c) What is the relationship between KM 4.0 applied and project success?

1.6 Scope of Research

The current research is mainly focused on discovering the significant role of knowledge management in the emerging era of Industry 4.0. The scope of the study is to assess the impact of knowledge management practices on the project management and particularly the success of the project. Therefore, the research undertaken will take inputs from people in this industry to analyze the enhancement approaches for knowledge management and its influence on project management and success. The theoretical aspects of knowledge management and the attributes of Industry 4.0 will be examined in context to the study objectives.

1.7 Contribution of the Study

This current thesis has both theoretical and practical contributions. Since the topic has focused on Knowledge management criteria, it can let the project managers understand the basic necessity behind the innovation in the industry 4.0. This study has also contributed to the criteria required for project success in this contemporary and advanced era. Knowledge management is the approach which can support the development of learning and make way for the identification for driving growth and prosperity. Moreover, project success is ensured when a competitive tool is implemented. Thus this study has major significance since it highlights the advanced technologies and required knowledge training for a consistent project growth.

The study has also proven to be useful to understand the effective use of the knowledge management process that can help in addressing the skilled laborer's issues in an organization for meeting their business goals. The study will also highlight the effective knowledge management process that is to be implemented for making the project successful in a business organization.

1.8 Thesis Structure

This current thesis study includes the below given chapters:

Chapter 1: Introduction

In this first chapter, background and overview of the topic is integral. Besides, aim and objectives have been framed as per the context of the thesis topic. The section of problems description has highlighted the reason to conduct the thesis.

Chapter 2: Literature Review

This second chapter emphasizes on the sub themes related to the selected topic. It gives an argumentative viewpoint of different authors from relevant secondary sources. It also includes a research gap and conceptual framework for better understanding of the topic. Identification of distinctive variables is important for the analysis of the study.

Chapter 3: Research Methodology

This chapter focuses on the methods, process and approach that have been selected by researchers to complete the thesis paper. It gives an in depth explanation and a proper justification behind the selection of the methods. It also includes data collection, source sampling and data analysis process.

Chapter 4: Findings and Analysis

This chapter details the findings of the paper selected as source for this current thesis. It has also focused on the hypothesis development criteria along with the analysis of the considered statistical tests.

Chapter 5: Conclusion and Discussion

This final chapter summarizes the entire study along with the specification of the key discussion that can be used for future research enhancing the scope of this present study and selected topic.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The idea of a literature review is to discuss other scholars' and researchers' thoughts and opinions on the subject at hand. This chapter is regarded as quite valuable and successful because it assists in the gathering of relevant and necessary information about the research topic. Furthermore, the researcher will be able to gain accurate and in-depth knowledge and understanding. As a result, a more effective study analysis can be carried out with the help of the same.

The chapter begins by discussing the industry 4.0 culture in detail. It discusses the way Fourth Industrial Revolution, fueled by advancements in new technological technology collectively referred to as Industry 4.0, has had a substantial impact on most enterprises. Then the chapter covers the aspects of Knowledge management in organizations. The chapter further covers the factors of knowledge Management in context to project management and Industry 4.0 in detail. Lastly the chapter summarizes the research gap identified, with presenting the conceptual framework and proposed hypotheses for the study.

2.2 Industry 4.0 Culture

Karacay (2018) stressed that in the present worldwide climate, supportability and upper hand of organizations rely generally upon their ability of variation to changing business necessities. The Fourth Industrial Revolution, driving from the progressions in new advanced innovations referred to aggregately as Industry 4.0, has been significantly changing elements of most businesses. Robotization of business measures together with development of novel plans of action force new computerized ability necessities for the labor force. The study concluded that creating the future labor force for Industry 4.0 requires not just drawing in and selecting new abilities which is required, yet in addition re-skilling current representatives through preparing programs, and, if vital, re-planning work cycles to discard the ability discrepancy among occupations and workers. Thus, associations should deal with offering new learning encounters, making new improvement openings, and building vigorous commitment frameworks to be utilized for their ability improvement rehearses.

El Hamdi et al. (2019) has attempted to sum up the setting of the Fourth Industrial Revolution, to refer to its standards and point out the most widely recognized difficulties, and to feature a less important component, like representatives, the focal segment of any change. Since the primary Industrial Resolution, numerous engineers endeavored to determine issues identified with activities, appliances and their upkeep, thus, they attempted to work on the effectiveness of creation measures. The study concluded that what we are seeing as of 2-3 years prior is an incredible blast of Internet – empowered gadgets for a wide range of applications, particularly in mechanical exercises and Data,

Communication and Technology are absolutely revolutionary. The level of utilization of smartphones, smartphone applications and the possibility of talking to anybody, whenever, and wherever is ceaselessly expanding, which shows that we are an unrivaled society as far as networks are concerned.

Galati and Bigliardi (2019) gave a piecemeal way to deal with the comprehension of Industry 4.0 as a technological revolution. Such a methodology prompted dispersed studies and the chance that the center could go out of the focus as far as the topics and future exploration patterns. Consequently, the point of this examination was twofold: First, to distinguish the primary general subjects talked about in the past and track their development over the long haul, and second, propose a future exploration plan for each all-encompassing subject that considers the multidisciplinary idea of exploration endeavors made on the theme. The study used a technique dependent on text mining to achieve the first objective. To arrive at the second one, an audit dependent on later and pertinent paper was made for each general topic. Text mining recommended four overall topics. First was Business which incorporated studies that research the effect of Industry 4.0 on business viewpoints and they recommend that administrations and enterprises have an adjustment in assembling point of view and endeavor to take advantage from this modern unrest wave. Second was operations which incorporated exploring the effect of Industry 4.0 new advancements on creation, coordination, and inventory network measures. Original copies had Technological solutions that briefed about mechanical arrangements at the center of Industry 4.0. Fourth was work and skills that endeavored the human component hiding behind the Industry 4.0 in regards to promising circumstances and suggestions.

Digitization changes reality. Industry 4.0, the computerized change of production changes the work market. The effects of quick innovation advancement of the fourth mechanical transformation presents enormous challenges for the general public and for strategy creators. Rajnai et al. (2017) tried to answer questions related to decrease of work by mechanization delivering human work power uncompetitive with machines and whether making new fields of business, new sorts of occupations make up for the deficiency of conventional work market necessities. The study concluded that digitization will make new positions, change current occupations. Occupations will likewise be lost, or potentially migrated to other areas. Predicting the equilibrium is by all accounts incomprehensible, models may help comprehend the general measures. Digitization will spread into different branches at various paces relying upon the difficulty of computerization and that of plans of action. It is normal that medium-wage occupations are at most threatened by substitution of machines. Overseeing difficulties and dangers of digitization is a joint liability of all partners.

2.3 Knowledge Management in Organization

Maier et al. (2011) aimed to examine the interrelationships among management of knowledge framework, management of knowledge cycle, cognitive capital, and association performance. The management of knowledge capacity is broadly utilized by associations, arriving at their greatest monetary and non-monetary exhibitions has not been completely investigated. This examination embraced a positive way of thinking and deductive way to achieve the principal objective. Besides, this exploration utilized a quantitative methodology since

this investigation was worried about causal connection between factors. A poll based review was intended to assess the examination model utilizing a comfort test of 134 representatives from the food business area in Jordan. Reviewed information was analyzed after the primary condition displaying strategies. Results showed that management of knowledge infrastructure had a good impact on management of knowledge. Likewise, management of knowledge had a good impact on the capital of intellect and association execution and intervened in the connection between management of knowledge and capital of intellect. But, management of knowledge didn't associate to the performance of association.

Current profit making and flourishing associations are those which make or gain new information and convert it into material techniques for working on their execution. Regardless, morals are the main points of interest in accomplishing such associations and acquiring achievement in execution of steady frameworks. The primary point of the examination by Akhavan et al. (2013) is thus to inspect the effect of moral standards on the process of management of knowledge. The study attempted to examine the effect of morals on the process of management of knowledge as per the model of Nonaka and Takeuchi. To quantify this issue, a theoretical model was created. To analyze the legitimacy of the model, workers in certain spaces of a modern association including PC, IT, electronic and specialist were approached to answer the survey. The outcomes show that there is a positive and critical connection among morals. Moreover, there is an immediate and critical connection among morals and management of knowledge processes.

It becomes basic for medical services associations to foster methodologies that intend to plan new work executions and to oversee knowledge. The presentation of learning associations is viewed as a promising decision for better management of knowledge and proceeding with improvement in medical care. The investigation by Gagnon et al. (2015) investigates the effect of a learning association on medical caretakers with proficient turn of events, management of knowledge, and maintenance in social administrations and a wellbeing of community in Quebec which is in Canada. The study concluded that learning association appeared to have an impact on day by day nursing work positively, notwithstanding its variable impact on different experts outside the emergency clinic focus. These progressions were especially articulated towards transfer of knowledge, help for nursing practices and the identity of medical services which the learning association had tried to meet since its origin. In any case, it appeared to limitedly affect nurture maintenance.

Change turns into the standard for indispensable and developing associations. The examination by Imran et al. (2016) investigated visions to execute association changes effectively and get their initial advantages by utilizing personalization and codification knowledge procedures and furthermore reveal the interceding impact of authoritative learning and status for change. The observational discoveries uncovered the significance of strategies knowledge management that are required at pre-execution stage. These methodologies can shape solid establishments for preparation for change and authoritative learning. Knowledge management procedures were demonstrated as the vital indicators for creating availability for change and

furthermore supportive to lessen change skepticism. In general, results featured how monetary establishments can carry out an ERP based change successfully.

Knowledge Management (KM) is an essential factor to effectively embrace projects. This exploration project by Sokhanvar et al. (2014) was embraced to examine the hole to address KM practices at the PMMMs (Project Management Maturity Models). This examination used qualitative methods. Altogether, three cases chose from various businesses: research; mining and government associations, to give general classes to research and research questions were inspected utilizing the created system. This paper presented the halfway discoveries of embraced examination of the research association with the least degree of development. The outcome shows that information creation and capturing are the main processes, while knowledge moving and reusing are not as significant as the other two cycles.

2.4 Improvement in Knowledge Management

Rodríguez-Molano et al. (2018) portrayed the genuine circumstances for the stages intended for business 4.0. The study pointed out that it is important to notice that organizations that are utilizing their plan of action for improving the various emerging areas for knowledge management can contribute to the organization's development.

Improvement of industry 4.0 is changing the method of information gathering, communicating and utilizing. In organizations that don't change their tasks over to industry 4.0, information was passed into the data frameworks by the workers and utilizing this information, different choices were made by the representatives. With the advancement of Industry 4.0, information acquired

from sensors with different electronic circuits are communicated to data sets kept in the cloud utilizing innovations like GSM, Wi-Fi. Enormous information achieved from various sources are assessed with keen programming and can be utilized continuously to control. In the study by Ediz (2018) different sorts of issues which are experienced in management of information during the progress to Industry 4.0 were examined.

Meski et al. (2019) examined that the development of new data and correspondence advances of ICT in assembling shop floors produced huge amounts of information and data streams, prompting huge data sets and enormous information issues. To determine these problems, there was a requirement for productive data and approaches of management of knowledge to deal with the distribution and translation of valuable information with improvement.

Shamim et al. (2016) targeted at offering a perspective on best practices of management which can advance the environment of development and learning in the association, and consequently work with the business to coordinate the speed of industry 4.0. The paper additionally proposed quantitative examination on these administration approaches with regards to industry 4.0.

Abubakar et al. (2019) featured the need and fostered a structure for knowledge management and making decision style while exploring existing administration writing. This exploration proposed a structure that upholds the connection between management of knowledge and factors that enable it and association's performance, and the interceding impact of information creation

measure. The article too suggested that decision making style will direct the connection between information creation measure and performance of association.

Nasiruzzaman and Dahlan (2013) stated that Knowledge Management and Project Management are considered as the most significant agents of change and play a competitive role in businesses in the modernization era. Projects that accomplish their objectives on schedule and on budget have traditionally been regarded successful. Many firms today focus on management of knowledge with success of projects in order to achieve project goals. The study performed by Nasiruzzaman and Dahlan (2013) confirmed that project success is dependent on knowledge management sharing. With successful knowledge sharing as the mediating role in between procures proper knowledge and practices, strong leadership, robust ICT Infrastructure and value based organization, the findings revealed that all these variables when implemented successfully, leads to successful knowledge sharing in the projects for its success. The study advised project managers to consider all elements in order to achieve the desired project success.

Fridgeirsson et al. (2021) mentioned that Artificial intelligence has augmented the context of project management. AI is expected to be an integrated component of coming PM practices and will affect the knowledge area under PM. Moreover, the management of schedule, risk and cost will be significantly affected by the implementation of AI. AI can also enhance the productivity of workers and be used as the key replacement of the labor force to a certain degree. This in hand increases the capability to deal with the change.

It is probable that AI will mold the discipline of PM and thus play a major role in the process of development. Best practices, training, education, OS (open system) theories and economical metrics that direct the scientific foundation of PM, are instances of professional challenges.

Chofreh et al. (2018) explained that even though knowledge management has a huge influence on the success of a project, sustainability is the key criteria which is important to consider. In this context, implementation of sustainable ERP (Enterprise Resource Planning) systems is a necessary part while aiming for knowledge enhancement. The process of S-ERP (sustainability ERP) implementation involves a broad knowledge covering technology and management. It is argued that consideration of sustainability implies embedded sustainability in the foundational business process for preserving and improving five capitals such as financial, social, manufactured, human and natural capitals.

2.5 Knowledge Management in Industry 4.0

There has been a huge competitive pressure on the organizations to maintain the consistency of business operations. Considering this fact, modern business enterprises tend to depend on knowledge, advanced learning and its exploitation for sustaining long-term benefits in the operating market. This requires an in-depth assessment of KM processes and particularly how knowledge is shared, acquired, created, applied and retrieved from an organizational system. Current technological development in the digitized era has the capability to promote knowledge driven business and economy (Manesh et al., 2020). The 4.0 industrial revolution has become integral in research areas like computer science, material science, engineering and electrical engineering. In this context,

Industry 4.0 is referred to as the tool which can undertake a shift from the paradigm of manufacturing where equipment and machines basically functionalized routines to digitized manufacturing. This way machines are able to interconnect with each other and corporate autonomously. On the other hand, new ideas and knowledge can flow easily in an organic project or organization since expertise is structured in a horizontal information process or decision making. The people involved in the process are supported with better decision-making via horizontal communication since they possess appropriate knowledge from innovative KM systems or digitized devices for enhancing their competencies and skills. Besides, there is intelligent automation which has changed the outlook of conducting projects. Agent-based software is developed to ensure that vehicles work together in an autonomous mode and interact with other components like lift for better coordination (Wilkesmann & Wilkesmann, 2018). It is observed that the human labor force has been entirely replaced by the automated system. This kind of system is not bound to a linear management system. Although it requires human workforce to make development in the fourth industrial revolution. This indicates that effective KM process can help in attaining a competitive market for business enterprises due to the arrival of Industry 4.0 in the context of undertaking pocket. After the advent of the digitized era, industry (fourth) revolution and smart manufacturing have made way for advanced success in the consideration of projects. Smart manufacturing system characterized by M2M (Machine 2 Machine). Big Data analytics, cloud, robotics and 3D Printing will be dependent on the intelligent human workforce for its optimal utilization. Thus, major emphasis needs to be stressed in the criteria of the KM process and associated system. CPS (cyber-Physical systems)

to distal Networks are basic physical components with developed computing power and embedded software (Agolla, 2018). It is expected that the utility of computing power and the KM system will be dependent on the extent of connectivity and self-management capabilities. Moreover, Knowledge-grounded progression in the contemporary global economy has emerged to be the capability of countries to transfer, apply and generate knowledge with the consideration of the criteria that it is required to apply external learning and get adapted to that knowledge for meeting specific demands. On the contrary, the implication within the business organizations and intensification of the competition has led the business operators to acknowledge the significance of intangible assets for the competitiveness of project-0based organizations. Intellectual capital is the key source of innovation and creativity and the factors behind the success of project and business enterprises, particularly it is the catalyst and initiator for achievement and development. Organizations are required to assess business processes and consider trading strategies, manage requirements of economic openness and deal with the complex criteria of information revolution through the consideration of practical practices and methods. It is also necessary to focus on intellectual capital via its polarization, sustenance and development of intangible resources. Consequently. Knowledge has become a key wealth for the development of reactive capabilities, skills and expertise of individuals. The formulated knowledge and its interconnection with the human components like beliefs, skills and values are the most influential, adopted and effective elements in the process of management across the business enterprises (Abualoush et al., 2018). Although it has been acknowledged that there is a significant relationship between KM and

intellectual capital and their collaborating positive influence between organizational performances, the significance of the KM infrastructure is often overlooked in developing and supporting KM processes and optimal utilization of intellectual capital.

The literature reviewed for the study is presented in the table below:

Table 2.1: Summary of Literature Review

S. No	Author Name	Study Title	Variables under Study
1	Maier et al. (2011)	Knowledge management systems	Knowledge framework, management of knowledge cycle, cognitive capital, and business performance
2	Imran et al. (2016)	What's organization knowledge management strategy for successful change implementation?	Knowledge management procedures, change management
3	Sokhanvar et al. (2014)	Importance of knowledge management processes in a project-based organization: A case study of research enterprise.	Knowledge Management, Project Management
4	Ediz (2018)	Evaluation of Industry 4.0 from a knowledge management perspective.	Industry 4.0, Knowledge management.
5	Abubakar et al. (2019)	Knowledge management, decision-making style and organizational performance.	Knowledge management, decision making, business performance
6	Nasiruzzaman and Dahlan (2013)	Project success and knowledge management (KM) practices in Malaysian Institution of Higher Learning (IHL)	Knowledge Management sharing (proper knowledge and practices, strong leadership, robust ICT infrastructure and value based organization) and Project Success
7	Fridgeirsson et al. (2021)	An Authoritative Study on the Near Future Effect of Artificial	Use of Artificial intelligence technology, knowledge area under

		Intelligence on Project Management Knowledge Areas.	Project Management
8	Chofreh et al. (2018)	Sustainable enterprise resource planning systems implementation: A framework development	Sustainability, knowledge management, project success, ERP technology
9	Manesh et al. (2020)	Knowledge management in the fourth industrial revolution: Mapping the literature and scoping future avenues.	KM processes, Industry 4.0

2.6 Research Gap

The concept of knowledge management plays a vital role in outlining how innovative strategies can be planned and applied to improve business operations. It can also help in delivering quality outcomes to enrich success over the period of time. Here, in this current study, the major emphasis has been on the aspect of knowledge management for a consistent success of a project. Previous studies have either focused on the criteria of technology management and KM in the context of labor productivity. However, the current thesis paper has taken both the factor of team collaboration and technology implementation under consideration. Thus the integration of both the factors have helped researchers to assess which of the factors has significant dependence on the project success. This indicates that there is a major research gap in the already existing literature and journals to identify the crucial effect or role of KM to the management of projects and practices related to it. The current study has also stressed on the potentiality of KM infrastructure to facilitate project success. Moreover,

previous studies have also overlooked the criteria of integrating KM process and practices with the necessities demanded in the industry 4.0. This present thesis paper has addressed the research gap by incorporating the requirement particularly in the fourth Industrial revolution; thus letting contemporary business and project leaders be aware of the skills and advanced tools for an effective project completion. While discussing the significance of the human labor force, the current thesis has focused on the term 'value-based' to highlight the skills, knowledge or any other IT based learning acquired which the working team can add value to the project. Aligning management practices with values is an essential component. Without the presence of skilled laborers, it is challenging to get the advanced IT infrastructure, AI and big Data analytics into work. Thus, researchers in this current study have prioritized both the components of automated technology along with the labor force which are the core foundation of all these advancement and development. On the other hand, the present study has taken the factor of project sustainability through effective KM into consideration which previous studies have lacked.

2.7 Conceptual Framework

The following diagram (Figure 2.1) illustrate the conceptual framework and the relationship between selected independent and dependent variables.

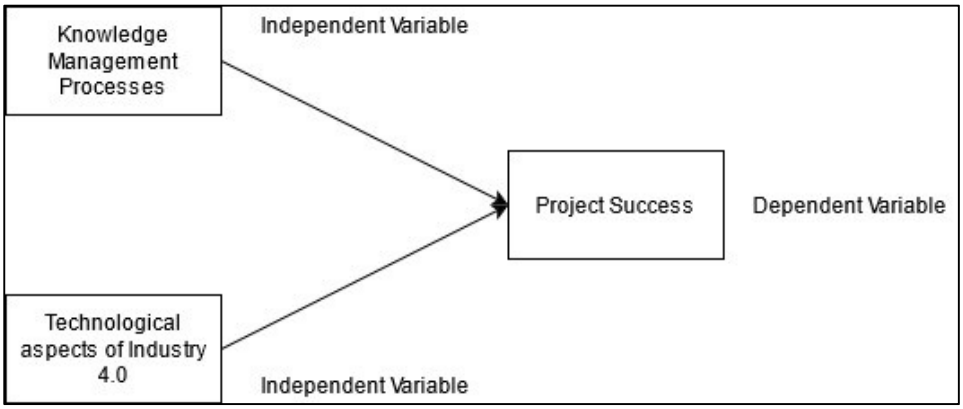

Figure 2.1: Conceptual Framework and Relationship between variables.

2.8 Hypothesis Development

Based on the conceptual framework, following hypotheses are proposed:

H0: Implementation of Knowledge Management processes does not have a significant impact on the project success.

Ha: Implementation of Knowledge management processes has a significant impact on the project success in the industry 4.0.

H1: Technological aspect of Industry 4.0 does not have a significant impact on project success.

Hb: Technological aspects of Industry 4.0 does have a significant impact on project success.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

The goal of research is to improve society through expanding knowledge by developing scientific theories, beliefs, and viewpoints (Blaikie and Priest, 2019). The process of uncovering new knowledge is known as research. This knowledge might come through the creation of new conceptions or the progression of current information and theories, resulting in a previously unknown understanding (David and Sutton, 2011). The methodology chapter is methodically constructed in such a way that it is easy to understand and can assist in continuing with the study work in the same manner while evaluating its direction without encountering any difficulties (Chawla and Sodhi, 2011). Research methodology encompasses more than just analytical techniques. As a result, while designing research methodology, not only research techniques are stated, but also the logic behind selecting appropriate methods for the research study, as well as a relevant justification for employing the particular method or approach to aid in the assessment of the findings (Pandey and Pandey, 2015).

The literature on research linked to improving knowledge management

to enable improved project management in the era of Industry 4.0 was reviewed in the preceding chapter. Research was undertaken in accordance with the goals of the current study to address the research gap found at the end of the literature review. This research methodology chapter, which follows, assists in the development of a specific plan for the current study. In terms of the outcomes of the thesis, the approaches and strategies adopted in this study are of best interest. This chapter of the study discusses the research paradigm and applicable research approach, as well as their relationship to applied research design, based on the stated research questions. Further, the data collection approach followed with the identified sample population as well as relevant sample is presented. Lastly, the data analysis approach adopted with ethical considerations of the study are discussed.

3.2 Research Paradigm

Kuhn (1962) proposed the idea of a paradigm in scientific philosophy. A research paradigm is a collection of thorough standards, as well as a shared knowledge among researchers, of the procedures that must be followed to identify and determine the study objectives. It is a method of investigating research that has been validated by the researcher's society for a long period. There are two major types of research paradigms: positivism and interpretivism (Žukauskas et al., 2018). As per Pham (2018), the positivist paradigm, which is classified as objectivism epistemology, is a scientific philosophy that uses natural science approaches to examine social sciences. It is commonly associated with quantitative research. In this paradigm, reality must be measured and well-supported by evidence. This paradigm helps positivist

researchers use empirical testing and procedures like sampling, measurement, questionnaires, and focus group discussions to acquire a clear understanding of the objects.

As a result, positivist researchers' results have a higher level of validity and credibility. Chowdhury (2014) defines interpretivism as "methods that emphasize the value of people's character and engagement in social and cultural life." It stipulates that people's perceptions of reality are the result of social construction by human agents, thereby ruling out natural scientific methodologies. Interpretivists study the meanings and causes of people's actions in society and culture, such as their behavior and interpersonal interactions.

Adopted research paradigm for the study

It is vital to comprehend and express opinions about the type of reality, associated facts, and techniques for getting this knowledge while carrying out research. The main purpose of the research is to determine the significance of knowledge management in the Industry 4.0 era, the utility of the knowledge management process in the entire project within the Industry 4.0 era, and the relation between the implementation of the KM process and project success. Therefore, the study is focused on collecting and analyzing data related to knowledge management processes followed by project management people in organizations. The researcher seeks to establish hypotheses for the study that are supported up by measurable objectives, therefore the positivist approach appears to be the most suited. As the study aims to measure the effect and relationship between variables of the study, through the positivism paradigm, the investigator can observe the data compilation and interpretation in an

objective manner. As experiments, observations, data gathering, and data analysis are all part of the positivist technique, which also relies on quantitative assessment, with subsequent hypotheses testing, the proven aspects will aid in the authentication of the link between the study variables as well as data collection.

3.3 Research Approach

The research approach can be referred to as a set of methodologies and processes that entails the steps of a wide range of assumptions to carry out the procedure of data accumulation, analysis, and conclusion (Vogt et. al., 2012). As a result, depending on the type of research question, it entails addressing and selecting an approach for data gathering, further analysis, and reasoning (Walliman, 2015). Affirmation of the research approach is aided by the problems found, which lead to the investigation of the study's already established objectives and can be classified into two types:

a. Data collection approach
b. Data reasoning approach

Data collection approach

Quantitative approach and qualitative approach are two types of data collection approaches generally followed. As per Apuke (2017), quantitative research is regarded as a systematic examination of occurrences by the collection of quantifiable information with findings and the application of statistical, arithmetical, or calculative techniques through the use of survey procedures or questionnaires. Quantitative research collects data from available and potential

respondents through sampling processes and suitably mapping the same results throughout the whole population under study for the justification of specific situations. According to Maxwell (2012), the qualitative research concentrates on the features of the items and supports those methodologies and logics that are not observable or judged as a number, magnitude, or rate of recurrence by the execution of experiments. Qualitative researchers are associated with socially constructed reality, a strong linking between the researcher and the subject of study, and interim restraints that give coherence to the analysis. The goal of qualitative research is to demonstrate certain and improved information, such as human comprehension through observations, and respondents are assessed in their natural settings.

Adopted Research Approach for the Study

Quantitative research focuses on objectivity and is especially useful when it is possible to collect measurable determinants of the constructs under investigation and findings from samples of the target group. The current study concentrates on comprehending and analyzing the role of enhancing knowledge management in the era of Industry 4.0 based on the variables identified. This study uses a quantitative technique to assess the impacts of one set of variables on another set of variables because the quantitative research approach makes extensive use of measurements and also studies those parts of the research subject that are measurable based on the developed hypotheses. As a result, the quantitative approach for the current study will aid in the collection of data and the generalization of results based on numeric quantification.

Data Reasoning Approach

Inductive and deductive reasoning are the two major approaches to data reasoning that are commonly used (Babbie, 2015). These have been explained as follows:

Inductive reasoning approach

Inductive reasoning is a rational procedure in which a number of principles, referred to as credible or ascertained to be mostly accurate, are consolidated to arrive at a particular conclusion or to provide affirmation for the conclusion's accuracy. Inductive reasoning is a technique of reasoning that is utilized to develop forecasts or estimates. This reasoning approach overlooks the research hypotheses and instead moves forward by seeking the research's main aims and objectives in a systematic way (Hayes et al., 2010).

Deductive reasoning approach

The deductive approach entails formulating presumptions based on pre-existing concepts and rigorous testing of hypotheses. It locates a well-known theory or occurrence and determines whether the theory is valid in the context of specific events. The hypotheses proposed are put to the test by being exposed to observations that either affirm or reject the hypotheses (Goswami, 2011).

Adopted reasoning approach for the study

The deductive approach was approved for the current research since it is quantitative in nature and the goal is to understand the function of the KM process in industry 4.0 for project success. Since this study focuses on obtaining objective outputs for examining the link between the variables under consideration, the deductive reasoning approach appears to be acceptable. The

deductive approach will facilitate the data accumulation by adopting procedures to understand the respondents' views and motives. Furthermore, the deductive reasoning approach will aid in the formulation of hypotheses based on existing theories as well as the design of a research strategy for hypothesis testing.

3.4 Research Design

The importance of research design is that it facilitates the easy implementation of various research tasks, resulting in vital research by utilizing the majority of the data with less effort, time, and money. The research design has a significant impact on the consistency of the outcomes. The most common types of research designs are exploratory, descriptive, explanatory, and experimental (Bickman et al., 2009). Whenever the researcher has no prior data or only a few studies to refer to, the exploratory research design is used. Exploratory research design is useful in studying the topic chosen for the study in order to archive crucial and relevant insights as well as grasp the underlying difficulties (Malhotra and Malhotra, 2012). Descriptive research design provides a different viewpoint on a self-sustaining natural process. This design structure is used to rationalize current practices and, as an outcome, it helps in developing new theories based on that base. Descriptive design determines whether hypotheses should be accepted or rejected by establishing a link between existing variables (Siedlecki, 2020). An investigation that follows a scientific research strategy is known as experimental research. It includes a hypothesis, a manipulable variable, and variables that the researcher can track, compute, and compare. The experimental research design is also used to establish a link between the independent and dependent variables as well as to create hypotheses (Thyer, 2012). The extent

and nature of cause-and-effect relationships are determined using explanatory research design, also known as Causal research design. The causal research design is used to study a condition or a problem in order to understand patterns of variable interactions. In order to examine causal linkages, causal research always includes one or more independent variables (or assumed causes) and their relationships with one or more dependent variables (Oppewal, 2010).

Adopted research design for the study

The study design has a significant impact on the trustworthiness of the results collected. The current study employs a descriptive research design. When a small number of occurrences necessitate in-depth narrative descriptions, the research uses description as a way to arrange data into patterns that emerge during analysis, as opposed to other research methodologies. The current study will use a descriptive research methodology to establish the amount of contribution of knowledge management procedures as factors in the context of project success in the Industry 4.0 era. Hypotheses are generated for the study based on the objectives and require further testing to identify the connections between the identified variables. Among the several research designs mentioned, a descriptive research design will aid in the discovery of these links between the various factors connected to the study and will give a systematic and coherent account of the phenomena and the characteristics of the population under investigation.

3.5 Data Collection Method

Data collection is characterized as a procedure of gathering and estimating data based on predetermined variables in a consistent and systematic manner that

facilitates researchers to answer research questions, test hypotheses, and evaluate data outcomes. The collection of data is an integral component of research that is often carried out in all fields of study, including physical and social sciences, humanities, and business. Any data collection process should have its primary goal to record high-quality evidence that can be converted into rich data analysis. The aim of the data accumulation method should be to provide a convincing as well as trustworthy response to the questions that were asked in the first place (Harrell and Bradley, 2009). Data gathering is an important part of statistical analysis, and it is divided into two categories: primary data and secondary data.

Primary data collection

Original data is information gathered through firsthand experience or from primary sources for the first time, specifically for a research study, and which may be disseminated widely to be used in other studies. Primary data is actual and legitimate information that is acquired with the goal of solving a specific study topic. It is factually correct and free of personal bias. Its real-time data, yet is implemented meticulously because of the significant operational costs and time commitment. Surveys, observations, experiments, questionnaires, and personal interviews are examples of primary data sources (Islam and Islam 2020).

Secondary data collection

Secondary data is information that already exists from a number of sources that was gathered in the past, not particularly for any occurrence or as part of a purposeful endeavor to acquire the needed data. This sort of data is less costly

and easier to get than primary data. Secondary data is commonly used as a beginning point for gathering information, and it is one of the most significant sources of information for the data collection process since it contains the necessary information that must be acquired to support the study (Daas and Arends-Tóth, 2012).

Data collection instrument

Quantitative research is conducted in a systematic and organized manner based on measurement. Data collection must be exact and rigorous in order to conduct scientific research. Data collection techniques and instruments may include document reading, observation, questioning, measurement, or a mix of these approaches, depending on the research style (Da Costa and Schneider, 2016). Survey research is a quantitative way of collecting data from a group of individuals by asking a large number of survey questions. Data is often collected using standardized procedures to ensure that each respondent can reply to the questions on an equal terms, eliminating biases that might impact the research or study's conclusion. This technique of data collection includes asking individuals for information using a questionnaire that may be completed online or offline. A questionnaire is a sort of data collection instrument that consists of a set of questions meant to elicit data from users. A questionnaire is made up of a set of questions that have been organized or formatted in a specific way (Brace, 2018). The observation technique is frequently employed in behavioral science research, particularly qualitative research. When observation meets a specific study goal, is carefully planned and documented, and is subjected to validity and reliability checks and controls, it becomes a scientific instrument and a

technique of data collection for the researcher (Cowie, 2009). In terms of data collecting instruments, interviews differ from questionnaires as they entail social contact and are part of data gathering methods that ask questions from respondents. Interviews might take place in person or over the telephone (Kvale, 2012).

Adopted data collection method and instrument for the study

The data collection will be based on the items that are specified explicitly under knowledge management, project performance in Industry 4.0 as variables, since the present study uses a quantitative research technique to identify the inter-linking and connections elements under investigation. As a result, primary data gathering approaches will be used in the current investigation. Quantitative research, as previously said, is based on the measurement of variables and is conducted in a scientific and systematic manner. The major data collection for this study is carried out using the survey approach. The data collection tool used for sufficient and appropriate primary data collection is a questionnaire, which is created according to the variables under investigation for the intended population under study. The variables or constructions are measured using multi-item scales, and each construct is measured using its own multi-item scale independently. The survey technique is customized in nature, and it is aided by the appropriate data obtained from the responses. The questionnaire will be designed based on the questions concerning various alternatives on a Likert scale.

3.6 Population and Sampling

It is challenging for researchers to acquire data from the whole spectrum of

organizations targeted for the study in order to react to the stated research challenge and related objectives. As a result, this circumstance demands sample selection. The whole set of entities from which the researcher draws the sample is referred to as the population. Due to a lack of time or resources to analyze the whole population, appropriate sample procedures are used to reduce the number of entities (Acharya et al., 2013). The first stage in the sampling process is to visually classify the target population. The sampling frame, which depicts a collection of actual things from which the sample will be taken, is then chosen. The sampling approach is frequently employed to draw conclusions about a population or to simplify an existing theory. There are two sorts of sampling techniques in general namely probability or random sampling and non-probability or non- random sampling (Etikan and Bala, 2017).

Rationale for choosing the Study Population and Sampling Technique

Inclusion criteria are the primary features of the target group that researchers employ to reply to their research question. In most situations, the inclusion criteria include demographic, clinical, and geographical variables. Exclusion criteria are typically traits or attributes that prevent a population from participating in a research. The respondents for the quantitative study were found based on the inclusion criteria as representatives of companies participating in project management and knowledge management systems in relation to Industry 4.0 practices. The current study will adopt a non-probability sampling method and specifically a snowball method. The logic behind adopting this sampling technique is that project management in context to the emerging Industry 4.0 era is a new and niche area. Therefore, snowball sampling

techniques will assist in finding a few professionals initially for the survey and then getting similar kinds of respondents through reference and their willingness to participate within organizations. The respondents will be selected with utmost care and with informed consent to participate. In consideration of the standard sample calculation method, a sample of 330 participants will be selected for the survey. Due to the Covid-19 pandemic outbreak and the effect of movement control order, most of the project on hold and the workers are work from home. Therefore, only 200 participants will received a hardcopy of questionnaire. The remaining selected participants will receive the questionnaire in google form format.

3.7 Data Analysis and Interpretation

Data analysis is a method that displays, explains, and analyzes data by adding value to it when used in a systematic manner utilizing statistical or logical approaches. As a result, no clear technique for evaluating the available data has been identified. The accurate and appropriate examination of the research results is a critical component of establishing data accuracy (Ott and Longnecker, 2015). Based on the facts obtained, the researcher forms an opinion on the data analysis tool. When the data is numeric, numerous statistical techniques are utilized to investigate the quantitative data, while qualitative data is examined using thematic and content analysis.

Rationale for choosing the data analysis technique

The major goal of this study is to conduct a survey to assess and understand the perspectives of respondents on knowledge management, project management, and success in the Industry 4.0 era. Furthermore, since the study's methodology

is quantitative in nature and focuses on determining the relationship between variables, quantitative data will be analyzed using statistical techniques. As a result, the data is analyzed and interpreted with the help of SPSS statistical analysis tools in order to provide a conclusion and make further judgments. This statistical analysis program allows for a variety of forms of analysis, data transformations, and the generation of predicted outputs that are appropriate for the study aims and purpose. SPSS will aid in quantitative data analysis related to the testing of the proposed relationships between the identified variables.

3.8 Ethical Considerations

In research, ethical principles are highly essential. Methods or actions that are important to the framework of behaviour and further distinguish between right and wrong are referred to as ethics. It provides necessary direction and control to the research efforts. It is important, according to research ethics, that respondents are neither troubled nor forced throughout the data collection procedure. It needs to be ascertained that when respondents do not desire to continue, an option to withdraw their participation should be provided at any time. Prior to conducting an interview or survey, it is important to ensure that participants understand the principal purpose of the study and that their consent is properly acquired (Ketefian, 2015). Third-party access must be avoided, and the researcher would have to provide assurance on data security measures for the gathered data. Data privacy is a key issue throughout the research, therefore the information obtained should be used for educational aims only rather than commercial objectives (Arifin, 2018).

Ethical Considerations in this study

The ethics of the current study are protected by keeping the information acquired for the study confidential and by prohibiting third-party access. This research study's data collection and presentation procedures were not unethical by any means. The core objectives of the study have not been exaggerated in any manner, and every effort has been made to include references and affiliations wherever data was obtained from a secondary source. Respondents were reassured for their willingness to engage with the survey study as well as the confidentiality of their responses. As a consequence, the current study meets the necessary standards for privacy and research ethics.

CHAPTER 4

RESULTS AND DISCUSSIONS

4.1 Introduction

The previous chapter of the current research framework presented the varied empirical findings of the study. It outlined the major results established after channelizing the data analysis techniques. The current chapter, therefore, aims at discussing these empirical findings elaborately. The statistical findings are predominantly shaped through expressive tables and charts for better understanding. The findings of the study are categorized especially to serve the pre-defined objectives of the study in a concise manner. Hence, a study cannot be accomplished in a precise manner if the results of the data analysis are not interpreted and discussed comprehensively in alignment with the objectives of the study. Data for the current research framework was analyzed using SPSS software and were analyzed using descriptive statistics. Various statistical techniques like frequency distribution, regression analysis, factor analysis, and correlation analysis have been used to analyze the data. The following sections will elaborate explain the results obtained in the data analysis and provide a comprehensive discussion of the same. The results obtained using each of the analysis techniques will be explained along with the hypotheses that have been tested. The section will end with a conclusion on the overall results and a discussion of the study.

4.2 Duration of Data Collection and Response Rate

In this study, a google form survey and 200 hardcopy questionnaires were distributed to individual working in the consultants or contractors firms in Klang Valley area. 147 fully completed hardcopy questionnaire and 183 fully completed google form questionnaire survey were received out of 234. A total of 330 fully completed questionnaires were received within a survey period of approximately 1 month i.e. from 19th August 2021 until 25th September 2021. The respond rate for hardcopy achieved 73.5%, whereas the respond rate for google form achieved 78.2%. The overall respond rate has achieved 76%.

4.3 Frequency Distribution

In statistics, the frequency distribution is a graphical or tabular representation of data that demonstrates the number of observations within the interval considered. The size of the interval is based on the data being evaluated and the primary objectives of the researcher. As a tool of data analysis in statistics, a frequency distribution serves as a visual representation for the distribution of the sample within the specific test. The various data acquired in a sample are visualized or illustrated by the researcher with the help of frequency distribution. In the following section, the data for the demographic profile of the respondents are illustrated with the help of frequency distribution using tables and graphs. The demographic profile consists of data pertaining to the type of organization the respondent belongs to, job title of the respondent, gender of the respondent, age of the respondent, education of the respondent and work experience of the respondent.

Table 4.1 shows the demographic profile of the respondents. As for type

of organization, it is observed from the table that out of the total 330 respondents, the majority of the respondents belonged to the contractor category accounting for 33.9% (N=112) of the respondents, followed by the manufacturing category accounting for 25.5% (N=84) and the other category accounting for 22.7% (N=75) of the respondents. The lowest percentage of the respondents belonged to the IT services category accounting for 17.9% of the respondents. This indicated that the majority of the respondents considered in the study belonged to the category of contractors.

The valid percent corresponding to the contractor category is the highest, which indicates that the data for this category is valid and accurate, as the missing data has been excluded. Similarly, the cumulative percent indicates that there are no missing pieces of data and that all the data have been included in the chosen sample size.

As for Job Titles, it is observed from the table that out of the total number of respondents the majority of the respondents belonged to the Senior manager category accounting for 36.1% (N=119) of the respondents, followed by the top Management category accounting for 24.5% (N=81) and the Manager category accounting for 21.5% of the total respondents. The lowest percentage of the respondents, that is, 17.9% of respondents belonged to the category of Executive. Therefore, this indicates that the majority of the respondents in the company who participated in the study were senior managers.

As for Gender, it is observed from the table that out of the total 330 respondents the majority of the respondents belongs to the female category accounting for 58.2% (N=192) of the respondents while 41.8% (N=138) of the

respondents belonged to the male category. This clearly indicates that the majority of the representatives of the company who took part in the survey were females while the rest were males. It has been found that the female participation rate in most studies pertaining to industries is higher than the male participation rate.

As for Age, it is observed from the table that out of the total number of respondents, the majority of the respondents belonged to the age group of 40-50 and accounted for 33% (N=109) of the respondents, followed by the age group of 30-40 accounting for 28.8% (N=95), and 50 and above years of age accounting 20.9% (N=69) of the respondents. This indicated that the majority of the respondents who participated in the survey belonged to the middle age group, which is also justified as the majority of the respondents belonged to the senior management and top management of the company.

As for Education Level, it is observed from the table that out of the total 330 respondents, the majority of the respondents had a Diploma degree accounting for 32.4% (N=107), followed by 25.2% (N=83) of the respondents corresponding to the Bachelor's degree and 24.5% (N=81) of the respondents corresponding to the high school category. The lowest percentage of respondents, that is, 17.9% of the respondents had a Postgraduate (Ph.D., Masters) degree. This indicated that the majority of the representatives of the company were diploma degree holders.

As of Work Experience, it is observed from the table that out of the total respondents, the majority of the respondents had work experience of 16years-20 years accounting for 42.7% (N=141) of the respondents, followed by 41.5%

(N=137) of the respondents with a work experience of over 20 years. The rest of the respondents had a work experience of 7.3%(24), 5.2% (N=17) and 3.3% (N=11) each corresponding to 5 years- 10 years, less than 5 years and 11 years-15 years respectively. This indicated that the majority of the company representatives had a decent work experience of 16-20 years and over, which also justifies the fact that the majority of the respondents belonged to the senior and top management category in the company.

Table 4.1: Demographic Profile of Respondents

Demographic Profile	Frequency	Percent	Valid Percent	Cumulative Percent
Type of Organization				
IT Services	59	17.9	17.9	17.9
Manufacturing	84	25.5	25.5	43.3
Contractor	112	33.9	33.9	77.3
Others	75	22.7	22.7	100.0
Job Title				
Executive	59	17.9	17.9	17.9
Manager	71	21.5	21.5	39.4
Senior Manager	119	36.1	36.1	75.5
Top Management	81	24.5	24.5	100.0
Gender				
Male	138	41.8	41.8	41.8
Female	192	58.2	58.2	100.0
Age				
21-30	57	17.3	17.3	17.3
31-40	95	28.8	28.8	46.1
41-50	109	33.0	33.0	79.1
51 and above	69	20.9	20.9	100.0
Education Level				
Post Graduate Degree (PhD, Masters)	59	17.9	17.9	17.3
Bachelor's Degree	83	25.2	25.2	43.0
Diploma	107	32.4	32.4	75.5
High School	81	24.5	24.5	100.0

Work Experience				
Less than 5 years	17	5.2	5.2	5.2
5 years – 10 years	24	7.3	7.3	12.4
11 years – 15 years	11	3.3	3.3	15.8
16 years – 20 years	141	42.7	42.7	58.5
Over 20 years	137	41.5	41.5	100.0

4.4 Cronbach's Alpha Reliability Analysis

Reliability test is conducted to ensure that the variables and factors taken into consideration in the study for the test are reliable. In other words, reliability refers to the fact that if the analysis of the data involved in the research is performed with the help of the same variables for several numbers of times, it has the potential to fetch the same results every time the test is conducted or repeated. This offers the information that is concerned with the internal consistency of the data assembled and analyzed. A measure is considered to have high reliability if it generates results that are similar under consistent conditions. For example, the measurements of the weight and height of people are considered extremely reliable.

Cronbach Alpha is a "measure of internal consistency" therefore it is a reliability test conducted within SPSS in order to measure the internal consistency that is the manner in which the set of items are closely related as a group. It is considered a measure of the reliability of the measuring instrument. It is the most commonly used reliability measure when the questionnaire is developed using multiple Likert scale statements and determines if the scale is reliable or not.

The Cronbach Alpha acquired is 0.749 which is greater than 0.7. This indicates high internal consistency as well as reliability of the sample data.

Table 4.2 show the Item-wise reliability of the data pertaining to the objectives of the study such as knowledge management, technological aspects of industry 4.0, and project success. It is observed from the table that for each of the item values of alpha pertaining to each of the objectives is greater than 0.7 which indicates good internal consistency. When the Cronbach Alpha for some of the items falls below 0.7, the items are usually deleted in order to increase the Cronbach Alpha above 0.7. In the present study therefore it has been observed that if the item is deleted the Cronbach Alpha for each of the 19 items will be above 0.7. Therefore the fourth column shows how much above 0.7 the value of Cronbach Alpha would be if a certain item would be removed from the scale altogether. However, in the case of the present study, none of the items have been removed since the Cronbach Alpha is strong. Eliminating any of these statements would therefore be a mistake. Thus it can be concluded that for a set of items or variables, the reliability coefficient is achieved through Cronbach Alpha and using this measure the reliability test can be accomplished.

Table 4.2: Item-Total Statistics

Items	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Part B.1 Statement 1	73.050	60.140	0.187	0.742
Part B.1 Statement 2	72.950	57.581	0.385	0.727
Part B.1 Statement 3	72.880	58.545	0.284	0.734
Part B.1 Statement 4	72.920	58.315	0.337	0.730
Part B.1 Statement 5	72.960	57.640	0.338	0.730
Part B.1 Statement 6	73.050	60.140	0.187	0.742
Part B.1 Statement 7	72.950	57.581	0.385	0.727
Part B.2 Statement 1	72.880	58.545	0.284	0.734
Part B.2 Statement 2	73.010	56.675	0.356	0.728

Part B.2 Statement 3	73.050	59.684	0.209	0.741
Part B.2 Statement 4	73.000	56.474	0.441	0.722
Part B.2 Statement 5	72.890	55.822	0.461	0.719
Part B.2 Statement 6	72.960	57.193	0.392	0.736
Part B.2 Statement 7	72.980	57.258	0.354	0.739
Part B.3 Statement 1	73.020	60.544	0.161	0.744
Part B.3 Statement 2	72.970	57.048	0.425	0.733
Part B.3 Statement 3	72.880	55.792	0.452	0.730
Part B.3 Statement 4	73.060	60.546	0.150	0.746
Part B.3 Statement 5	73.020	60.960	0.144	0.745

Cronbach Alpha is a key concept in the process of evaluation of the data from the questionnaires. It is important for the researcher to conduct this test to render the data accurate and reliable for further interpretation.

4.5 Descriptive Statistics

Table 4.3 shows the descriptive statistics of the demographic profile that the Mean value is larger for Work Experience that is 4.08 and the smallest for Gender that is 1.655. The standard deviation is minimum for Gender is 0.4940 and the maximum for Work Experience is 1.095. Therefore, a larger mean value for work experience indicates that the data for this variable is more spread out and the maximum standard deviation for work experience indicates the values of the variable are spread out over a broader range.

Table 4.3: Descriptive Statistics of Demographic Profile

Demographic Profile	N	Range	Minimum	Maximum	Mean	Std. Deviation
Type of the Organization	330	3	1	4	2.615	1.028
Job Title	330	3	1	4	2.673	1.035
Gender	330	1	1	2	1.582	0.494
Age	330	3	1	4	2.576	1.006
Education	330	3	1	4	2.636	1.041

Work Experience	330	4	1	5	4.080	1.095
Valid N (listwise)	330					

The descriptive statistics for the different items demonstrate that the Mean value is larger for "Role of knowledge in project management is important from the perspective of distributing as well as sharing knowledge to implement projects successfully" and "There exists an organizational environment where the effectiveness of the upcoming Industry 4.0 transformations is positive for the organization" that is 4.15 and smallest for "The benefits of industry 4.0 can be useful for the sustainability of projects" that is 3.964. Standard deviation is minimum for "Knowledge management acts as a key resource for gaining sustainable competitive advantage for project-based organizations" that is .930 and maximum for "Adequate attention is being paid to specific concepts/technologies introduced by Industry 4.0 for better project management" that is 1.126.

Table 4.4: Descriptive Statistics of Items

Items	N	Range	Minimum	Maximum	Mean	Std. Deviation
Part B.1 Statement 3	330	4	1	5	4.150	1.013
Part B.2 Statement 1	330	4	1	5	4.150	1.013
Part B.3 Statement 3	330	4	1	5	4.142	1.049
Part B.2 Statement 5	330	4	1	5	4.133	1.029
Part B.1 Statement 4	330	4	1	5	4.110	0.930
Part B.1 Statement 2	330	4	1	5	4.080	0.942
Part B.1 Statement 7	330	4	1	5	4.080	0.942
Part B.2 Statement 6	330	4	1	5	4.067	0.981
Part B.1 Statement 5	330	4	1	5	4.060	1.028
Part B.3 Statement 2	330	4	1	5	4.055	.9405
Part B.2 Statement 7	330	4	1	5	4.052	1.049
Part B.2 Statement 4	330	4	1	5	4.030	0.984
Part B.2 Statement 2	330	4	1	5	4.020	1.126
Part B.3 Statement 1	330	4	1	5	4.012	.9831
Part B.3 Statement 5	330	4	1	5	4.003	0.944
Part B.1 Statement 1	330	4	1	5	3.980	0.986

Part B.1 Statement 6	330	4	1	5	3.980	0.986
Part B.2 Statement 3	330	4	1	5	3.980	1.010
Part B.3 Statement 4	330	4	1	5	3.964	1.022
Valid N (listwise)	330					

4.6 Kruskal-Wallis Test

The Kruskal-Wallis test which is also termed as the "one-way ANOVA on ranks" is explained as a nonparametric test which is based on ranks and is applied to identify if statistically significant differences exists between the two or more groups of an independent variable on a continuous or ordinal dependent variable. This test analyzes the differences against the average ranks in order to ascertain if or not they are likely to have come from samples drawn from the same population. Table 4.5 shows that among all items tested by using Kruskal-Wallis test, there has been no significant difference in responses with age.

Table 4.5: Kruskal-Wallis Test

	Chi-Square	df	Asymp. Sig.
Part B.1 Statement 1	1.050	3	0.789
Part B.1 Statement 2	5.080	3	0.166
Part B.1 Statement 3	1.519	3	0.678
Part B.1 Statement 4	2.099	3	0.552
Part B.1 Statement 5	2.405	3	0.493
Part B.1 Statement 6	1.050	3	0.789
Part B.1 Statement 7	5.080	3	0.166
Part B.2 Statement 1	1.568	3	0.667
Part B.2 Statement 2	1.983	3	0.576
Part B.2 Statement 3	1.940	3	0.585
Part B.2 Statement 4	7.553	3	0.056
Part B.2 Statement 5	4.916	3	0.178
Part B.2 Statement 6	0.221	3	0.974
Part B.2 Statement 7	2.930	3	0.403
Part B.3 Statement 1	2.952	3	0.399
Part B.3 Statement 2	7.551	3	0.056
Part B.3 Statement 3	2.823	3	0.420
Part B.3 Statement 4	4.461	3	0.216
Part B.3 Statement 5	0.221	3	0.974

4.7 Ranking Analysis

In terms of the relative importance of the index value for all factors the findings of the ranking analysis revealed that all criteria were at lower, medium, high and high-medium important levels in "Enhancing Knowledge Management in the Era of Industry 4.0 for Project Success." Table 4.6 shows that among the total of 19 criteria, it has been observed that all the 19 criteria were at a "high" important level. A "high" level for a variable indicates that the mean of the variable is higher than the "overall average rank" and the observed values of the variable tend to be higher than those of other variables.

Table 4.6: Ranking Analysis

Factors	RII values	Levels
Part B.1 Statement 1	0.796	H-M
Part B.1 Statement 2	0.816	H
Part B.1 Statement 3	0.83	H
Part B.1 Statement 4	0.822	H
Part B.1 Statement 5	0.812	H
Part B.1 Statement 6	0.796	H
Part B.1 Statement 7	0.816	H
Part B.2 Statement 1	0.83	H
Part B.2 Statement 2	0.804	H
Part B.2 Statement 3	0.796	H
Part B.2 Statement 4	0.806	H
Part B.2 Statement 5	0.8266	H
Part B.2 Statement 6	0.8134	H
Part B.2 Statement 7	0.8104	H
Part B.3 Statement 1	0.8024	H
Part B.3 Statement 2	0.811	H
Part B.3 Statement 3	0.8284	H
Part B.3 Statement 4	0.7928	H
Part B.3 Statement 5	0.8006	H

4.8 Hypothesis Testing with Correlation Analysis

In statistics, Correlation analysis is a method that is employed to measure the linear relationship between two variables, assess the strength of the relationship as well as evaluate their association. In simple words, correlation analysis computes the extent to which a change in one variable leads to a change in the other variable. A high correlation indicates a strong relationship between the variables involved while a low correlation indicates a weak relationship between the two variables. In quantitative research correlation analysis helps in identifying the "relationship, patterns, significant connections, and trends between two variables or datasets." When an increase in any one of the variables results in the increase of the other variable, a positive correlation is said to exist between the variables. On the other hand, "a negative correlation exists when the decrease in one variable leads to a decrease in another." The scale in which the correlation coefficient is measured ranges from +1 through 0 to -1. Therefore the correlation between two variables is demonstrated by either +1 or -1. "When one variable increases as the other increases the correlation is positive; when one decreases as the other increases it is negative." Zero (0) represents the absolute absence of correlation.

The hypothesis test allows the researcher to decide whether the value of the correlation coefficient of the population is "close to 0" or "significantly different from 0." The decision is made by the researcher on the basis of the "sample correlation coefficient" and the "sample size." The hypothesis test helps in determining the significance of the correlation coefficient. "If the test statistic concludes that correlation coefficient is significantly different from 0, it is said

that the correlation coefficient is significant." When there exists adequate evidence to infer that there is a significant relationship between the two variables, the correlation coefficient is said to be significantly different from 0. This indicates that the regression line can be used to develop the relationship between the independent variable and the dependent variable. However, "if the conclusion of the test states that the correlation coefficient is not significantly different from 0 or is close to 0, the correlation coefficient is not significant." When there is inadequate evidence to support that there is a significant relationship between the two variables, the correlation coefficient is said to be "not significantly different from 0." This indicates that the regression line cannot be used to develop the relationship between the independent variable and the dependent variable.

The null hypothesis states that "the correlation coefficient is not significantly different from 0 indicating that there is not a significant linear relationship (correlation) between the two variables." The alternative hypothesis states that population correlation coefficient is significantly different from indicating that there is a significant linear relationship (correlation) between the two variables."

In the present study, the primary objective of the first hypothesis is to examine the impact of technological aspects of Industry 4.0 on project success. Here, the independent variables are the technological aspects of Industry 4.0 and the dependent variable is project success.

Table 4.7 shows the relationship between the technological aspects of industry 4.0 and the project success. The correlation column shows the value of

the correlation of the different variables that range between +1 and -1; the significance column shows the level of significance where a significance level of 0.05 or less indicates that a "correlation exists" between the variables, that is, the variables are statistically significant to each other and the corresponding significance level greater than 0.05 indicates that "no correlation exists" between the variables, that is, the variables are not statistically significant to each other.

The findings presented in the table show that the correlation value for the association between technological aspects of Industry 4.0 and project success is 0.708. Moreover, the corresponding significance value is 0.000 which is significant at both 0.05 and 0.01 level of significance. Additionally, as the correlation value of 0.708 is closer to 1, or +1 (positive), it indicates that there is a strong correlation which shows a positive relationship between the independent variables and the dependent variable, that is, technological aspects of Industry 4.0 have a positive impact on project success. Therefore this positive relationship between the variables indicates that if technological aspects of industry 4.0 increase positively, project success also increases positively. Hence, it can be said that technological aspects of industry 4.0 have a positive and statistically significant impact on project success. Thus, based on the findings of the study it can be stated that the projects are vital for knowledge development, but if there are no efficient management procedures in place, the pool of information would be lost (Nadae and de Carvalho, 2017). In alignment with this, it can be stated that Industry 4.0 provides this scaffold for efficient management of the knowledge and thereby attain project success.

Table 4.7: Correlation between Project Success and Technological Aspects of Industry 4.0

		Project Success	Technological aspects of Industry 4.0
Project Success	Pearson Correlation	1	0.708**
	Sig. (2-tailed)		0.000
	N	100	100
Technological aspects of Industry 4.0	Pearson Correlation	0.708**	1
	Sig. (2-tailed)	0.000	
	N	100	100

**. Correlation is significant at the 0.01 level (2-tailed).

In the present study, the primary objective of the second hypothesis is to determine the relationship between the implementation of knowledge management processes and project success. Here the independent variables are the dimensions of knowledge management processes and the dependent variable is project success.

Table 4.8 shows the relationship between knowledge management processes and project success. The findings presented in the table show that the association between knowledge management processes and project success is 0.695. Moreover, the corresponding significance value is 0.046 which is significant at 0.05 level of significance. Additionally, as the correlation value of 0.695, it showcases a strong relationship between the independent variables and the dependent variable that is implementation of knowledge management processes has a positive impact on project success. Therefore this positive relationship between the variables indicates that if knowledge management processes increase positively, project success also increases positively. With respect to the significance level it has been observed that for the majority of the statements

pertaining to the implementation of knowledge management processes, the significance level is less than 0.05 which indicates that implementation of knowledge processes has a statistically significant impact on project success. Therefore it can be said that implementation of knowledge processes has a positive and statistically significant impact on project success. As a result, the findings of the current study are in alignment with the study conducted by Nasiruzzaman and Dahlan (2013) and Chofreh et al., (2018) which accentuate that knowledge management has a significant role to play in ensuring the project success. In accordance with this, it can be outlined that a better knowledge management process which enables the success of the project.

Table 4.8: Correlation between Project Success and Knowledge Management

		Project Success	Knowledge management
Project Success	Pearson Correlation	1	0.695
	Sig. (2-tailed)		0.046
	N	100	100
Knowledge management	Pearson Correlation	0.695	1
	Sig. (2-tailed)	0.046	
	N	100	100

4.9 Discussion

The results obtained based on the data analyzed for this study mainly indicates that the questionnaire designed for the study was reliable in collecting the required information and was helpful in generating outcomes. Since the main focus area of the study was project management and its success due to improvement in knowledge management areas, the combination of various representative organizations from different sectors gave a wider outlook in the

context of Industry 4.0. Moreover, the results highlighted that the responses were majorly collected from senior managers as well as top management with experience as high as 16 years - 20 years. Therefore, the sample selection and data collection appeared to be relevant for the study. The results of descriptive statistics revealed that all the items as part of the questionnaire were valid in terms of responses collected from 330 respondents. Based on the ranking analysis of all criteria of the research instrument, the results indicate that most of the criteria were considered to be highly appropriate and important. The KW test applied indicated that the items tested has no significant differences in response with age.

In context to Industry 4.0, the project management landscape is changing rapidly with evolving technologies, tools, and the latest trends. The key components of the knowledge management process emerged as a result of the innovation, such as the use of the internet and technology to support firms that are assisting the project management processes and the technological input is considered to be contributing. The results from the correlation analysis for hypothesis testing 1 showed that there exists a correlation between the different technological aspects of Industry 4.0 and the success of the project. Based on the correlation analysis results it is identified that successful project management is aided by intelligent technology and devices. This is agreed by Capestro and Kinkel (2020) that the current Industry 4.0 paradigm is transforming all businesses, including project-based enterprises. New technologies make it easier to collect massive volumes of data, which may then be utilized to improve operational operations in terms of efficiency, productivity, and flexibility. As a result, current systems require additional refinement in

knowledge management in order to handle the adoption of Industry 4.0 technologies and improved information management for project operations. Moreover, in context to technological aspects of Industry 4.0, the organizations under study agreed that businesses need technologies of Industry 4.0 to manage their projects for improved project management. This is highlighted by Manesh et al. (2020) that in the digital era, current technological advancements have the potential to boost knowledge-driven business and economic growth. Furthermore, there is intelligent automation, which has altered the way projects are managed. The results also highlighted that the importance of latest technologies in project management is crucial from the standpoint of spreading and sharing information in order to properly implement projects. It has appeared to be the main resource for accomplishing sustainable competitive advantage specifically for project-based organizations. If knowledge management evolves, the industry 4.0 era will proceed in a better direction. Since knowledge management methods provide value to the information accessible for use in projects, adequate attention should be paid to specific concepts/technologies introduced by Industry 4.0 for better project management. Therefore, the presence of a favorable organisational environment is effective for Industry 4.0 transformation and project management needs to match with the technological transformations of Industry 4.0. This enhances the communication within the organization and the ability to manage extremely complex technical projects. In addition to this, the study also found that Industry 4.0 transformations facilitates the organizations for handling extremely complex technical projects appropriately. Furthermore, it allows better project management which contributes to the overall success of the project. This finding of the study is in

alignment with the study conducted by Shamim et al. (2016). This study strategically highlighted that Industry 4.0 technologies can enhance the prevailing process of project management and knowledge culture which in turn is creates positive impact for the business on a whole.

Knowledge management (KM) is a critical aspect of embracing projects in an efficient manner and involves information creation and capturing are the main processes. Knowledge management techniques have been shown to be important indicators for increasing change readiness and supporting the reduction of change skepticism. The advancement of Industry 4.0 is altering the methods of acquiring, conveying, and utilizing data. Successful knowledge sharing serves as a bridge resulting in correct knowledge and practices, strong leadership, a solid ICT infrastructure, and a value-based business. As a result, firms that use their plan of action to improve the numerous growing areas of knowledge management may contribute to the development of the company. The results from the correlation analysis for hypothesis testing 2 showed that there exists a correlation between the different aspects of knowledge management as per Industry 4.0 and the success of the project. Based on the correlation analysis results it is identified that in the deployment of Industry 4.0 innovations for projects, knowledge management is critical. However, inappropriate knowledge management process can have a negative impact on project success even with the benefits offered by Industry 4.0. Besides this, in context to aspects of knowledge management, knowledge sharing can help projects succeed by facilitating useful information at the right time. The results also highlighted that for better communication and knowledge sharing, project participants and management must leverage new digital technology and

physical infrastructure. This is in line with the study by Rajnai et al. (2017) that stated that digitization will make new positions, change current occupations and require involvement of people. In light of this, modern corporate companies increasingly rely on information, advanced learning, and their application for long-term success in the marketplace. The results obtained are in agreement with the findings of Maier et al. (2011) which stated that management of knowledge infrastructure had a good impact on management of knowledge. By finishing the project on schedule, on budget, and with the needed quality, knowledge management influences project success factors directly or indirectly. The results for this hypothesis are in agreement with the study by Nasiruzzaman and Dahlan (2013) which explained that project success is dependent on knowledge management sharing. The study advised project managers to consider all elements in order to achieve the desired project success. Therefore, businesses require knowledge management culture and best practices to improve and apply the best knowledge to manage their projects, since the knowledge management as per Industry 4.0 is considered to be beneficial for project success. As a result, based on the technological inputs for project management in Industry 4.0, the gathered information can be employed to standardize the process, and then leveraged to improve the practices.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

In this chapter, conclusions will be drawn from the findings which were analyzed and discussed in the previous chapter. Recommendations and limitations of this study are summarized and the further research are outlined.

5.2 Major Findings

Knowledge is a critical resource for achieving a long-term competitive advantage, which is shown in more efficient business operations and higher quality. With respect to Objective 1 of the study, it is found that modern firms rely on information and its utilization to maintain a long-term advantage as a result of growing competitive pressure. The fourth industrial revolution has had a significant impact on management of knowledge and related systems. It has been noted that successful organizations continually develop new knowledge, circulate it across the organization, and quickly deploy it into new products. This unique knowledge is transformed into goods and services that enable businesses to continue to develop and thrive. Individually, or as part of a knowledge management or knowledge management system concept, knowledge could be investigated. Knowledge management refers to what a business understands about its customers, products, and procedures, and it is stored in databases or obtained via internal and external exchange of

experiences and best practices. Organizations should strengthen their KM processes to scan and recognize relevant pieces of information and develop more sophisticated applications of this knowledge to effectively profit from this digital revolution. In context to this important aspect, the current study aimed to determine the significance of knowledge management in the Industry 4.0 era, the utility of the knowledge management process in project work in the Industry 4.0 era, and the relationship between the technological aspects of Industry 4.0 and project success. The results discussed and analyzed have provided different outcomes. In context to the approaches for improving knowledge management in the era of Industry 4.0, it is found that the establishment of organizational culture can facilitate better knowledge sharing and management practices. The application and use of innovations driven by Industry 4.0 has the potential to enhance the KM approaches as identification of relevant information and effective use of information as well as knowledge is possible. The growth of communication technology has enabled organizations to gather and manage knowledge from a broader range of sources both within and beyond their walls. Therefore, the improvement for best practices can facilitate technological solutions to transfer knowledge from the individual to the organizational level. As a result, it is clear that Industry 4.0 technologies are rapidly growing, and knowledge must be gathered in real time. Furthermore, the incorporation of new technologies, particularly the introduction of Industry 4.0, is facilitating cooperation while also speeding up the creation of innovative outputs. The findings of the current study revealed that Industry 4.0 is not only applicable to a restricted set of industries, but is also extremely suited for all types of industrial organizations.

With respect to Objective 2 of the study and in context to the usefulness of KM4.0 for project management in the era of Industry 4.0, it is found that knowledge management is a type of project management that makes use of knowledge as a resource for the company. Organizations that maximize their knowledge assets recognize the competitive advantage they may get by managing projects more intelligently and effectively. The usefulness of KM4.0 can be observed for managements of projects as organizations nowadays confront dynamic market rivalry and continual technological advancements, and they must create unique knowledge through innovation in order to remain competitive. Since project management involves the application of information, skills, tools, and methods to project activities in order to achieve project requirements, the findings revealed that improved knowledge and associated approaches contribute to increased productivity in a cost-cutting context. It was also discovered that KM4.0 makes sense in the current environment for improved project management. Organizations would benefit greatly if knowledge (both tacit and explicit forms) could be recorded and shared within the project management system.

With respect to Objective 3 of the study and in context to the relationship of applying KM4.0 and project success, it is found that the application of knowledge management strategies has a favourable impact on project management. It has been shown that information in the Industry 4.0 environment originates mostly from knowledge sources, however projects might greatly benefit by sharing and codifying various knowledge connected with previous project management. As a result, KM4.0 and project success are linked. It may also be stated that project management maturity will improve as

a consequence of knowledge generated, transmitted, captured, and reused inside a project. A project's success may be measured by how well it was accomplished in terms of time, money, and quality. Hence, based on matured project management practices due to KM 4.0, project management guarantees that the project is completed to the stakeholders' requirements, on schedule, within budget, and with a high-quality product or service as the end result. As a result, the project's success is assured. Continuous learning is required for an organization to execute successful projects and to increase its capabilities. Continuous learning may be defined as the development of standards for producing, sharing, and reusing information in a project management context, thereby combining knowledge management with project/program management. As a result, improving knowledge management techniques, which businesses may implement in project management practices, reduces the risk of project failure and increases the likelihood of project success. Project-based organizations are becoming the norm, and project management is a well-defined method. However, in order for the organization to continue to change, knowledge management must be connected with project management in order to respond quickly to gather information in order to solve particular challenges and effectively and efficiently share knowledge assets. As a result, knowledge bases must be integrated into projects so that project participants may combine their particular contributions to the project's objectives and connect with the organization's strategic goals.

5.3 Managerial Implication

This study suggests that enhancing the knowledge management in the era of industry 4.0 will lead to higher chances of project success. From the result and discussion, one of the managerial implications is to improve the current systems related to knowledge management to handle the adoption of Industry 4.0 technologies and improve the information management for project operations. In the era of emerging Industry 4.0 and technologies, companies shall keep up the speed with enhancing knowledge management to meet the speed of evolving technologies. So that the systems can collect massive volumes of data easily, which is important to be utilized to improve operational operations. Companies should upgrade their knowledge management systems from time to time as the technologies are evolving at high speed now compared to before. The latest technologies in project management is playing a crucial role for project implementation.

Besides that, managers need to improve the knowledge management process for better project management. Inappropriate knowledge management process will reduce the project success rate even with the benefits offered by Industry 4.0. One of the ways to improve knowledge management process is to improve the communication and sharing skills of project team members. Managers can provide trainings to project team members to improve communication and sharing skills. A good knowledge sharing can help projects to succeed by facilitating useful information at the right time. The managers and project team members can also leveraging the new digital technology and physical infrastructure for better knowledge management.

5.4 Recommendations

Based on the outcomes of the study, it can be stated that the way organizations handle knowledge is not only an issue of efficiency, it is also critical to their ability to compete in markets and maintain their competitive advantage while managing the projects. In context to the emerging technological era represented in the form of Industry 4.0, it is recommended that since technology evolves from a source of information extraction to a facilitator of collaboration and sharing across internal and external stakeholders, the function of technology in knowledge management should be carefully evaluated. The "Industry 4.0" term encompasses a wide range of technologies with varying features and application fields. As an outcome, it is recommended that Industry 4.0 technologies be evaluated appropriately for project management, as these technologies provide intriguing prospects for resource management and knowledge sharing among the stakeholders. It is recommended, from a knowledge management standpoint, to identify the potential associated with Industry 4.0 technologies, which relates to the availability of new procedures and instruments for acquiring and elaborating dispersed knowledge. As a result, it is recommended that initiatives should be taken to get insights into emerging technologies and how they might be applied in businesses to improve knowledge management systems and procedures.

5.5 Limitations

The current study undertaken has few limitations as well. According to prior studies, knowledge management and its practices are evolving in the current digital era and are influential on different aspects of organizations. There are many ways these KM processes are affecting the performance of business, however, the current study is limited to improvement of the KM approaches that are applicable in the Industry 4.0 era. Moreover, the effect of KM processes with technological advancements is observed on the performance and efficiency of the organizations. Nonetheless, the current study is limited to assess the impact of improvement of the KM approaches on the success of the projects. Therefore, the outcomes of the current study is limited to project-based organizations or operations as the findings highlight the scope of improvement in KM approaches for the success of the projects. Besides that, this study is carried out during the Covid-19 pandemic outbreak. The questionnaire survey for hard copy are limited to 200 due to most of the project were on hold and most of the workers were work from home. Therefore, google form survey were created and distributed to the sampling population who were work from home during that period for data collection.

5.6 Further Research

Given the newness of Industry 4.0, systematizing its influence on project management and success, as well as knowledge management, is a significant contribution. As a result, it is advised that more current sub-streams of study in this domain, as well as the essential KM processes in the context of Industry 4.0, be discussed in the literature in order to identify some valuable topics for future

research. This study was more focused on improving knowledge management practices within the Industry 4.0 era and understanding the impact on project success specifically, hence, it is suggested that future research should concentrate on the nature of the association among the KM processes and the further emerging technologies in the Industry 4.0 era. This will highlight the unique contribution of KM processes that can be generalized with its implication in different areas of businesses. Therefore, future research should be directed towards integration of different dimensions of Industry 4.0 advancements with organizational-related knowledge management practices, especially knowledge sharing. Future research might expand the conversation on leveraging technology for effective knowledge management by considering the technology-related KM practices that may be included in using technological inputs for monitoring and process modelling.

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APPENDICES

Appendix A: Survey Questionnaire

Enhancing Knowledge Management in the era of Industry 4.0 for Project Success

Part A – Demographic Profile

1. **Type of the organization**

	IT Services
	Manufacturing
	Contractor
	Others

2. **Job Title**

	Executive
	Manager
	Senior Manager
	Top Management

3. **Gender**

	Male
	Female

4. **Age**

	21-30
	31-40
	41-50
	51 and above

5. Education

	Post Graduate Degree (PhD, Masters)
	Bachelor's Degree
	Diploma
	High School

6. Work Experience

	Less than 5 years
	5 years – 10 years
	11 years – 15 years
	16 years – 20 years
	Over 20 years

Part B.1 – Knowledge Management

No.	Statement	1	2	3	4	5
1	Knowledge management plays an important role in the implementation of Industry 4.0 innovations for projects					
2	The organization is capable in handling and managing high flows of knowledge for better project management in the Industry 4.0 era					
3	Role of knowledge in project management is important from the perspective of distributing as well as sharing knowledge to implement projects successfully					
4	Knowledge management acts as a key resource for gaining sustainable competitive advantage for project -based organizations					
5	Knowledge management helps in adapting to emerging changes in the environment for the success of the projects					
6	Knowledge management processes add value to available information to be used in projects					
7	Initiatives are being taken for insights regarding emerging technologies and their practical application in organizations to improve knowledge management systems/practices					

Part B.2 – Technological Aspects of Industry 4.0

No.	Statement	1	2	3	4	5
1	There exists an organizational environment where the effectiveness of the upcoming Industry 4.0 transformations is positive for the organization					
2	Adequate attention is being paid to specific concepts/technologies introduced by Industry 4.0 for better project management					
3	The technologies as part of Industry 4.0 era are perceived to be useful for the success of projects					
4	Businesses need to technologies of Industry 4.0 to manage their projects					
5	The aspects of project management has to keep pace with the transformations brought by Industry 4.0 to avoid economic problems					
6	Industry 4.0 transformations gives the ability to manage extremely complex technical projects					
7	Industry 4.0 technologies gives the ability to communicate effectively for better project management					

Part B.3 – Project Success

No.	Statement	1	2	3	4	5
1	Intelligent technologies and devices leads to better project management for success					
2	Knowledge management can facilitates useful information in time for success of projects					
3	Project people and their managers must use new digital technologies and physical systems for better communication					
4	The benefits of industry 4.0 can be useful for sustainability of projects					
5	Knowledge management influence project success factors directly or indirectly by completing the project in a predetermined time, budget, and with required quality					