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Industry 4.0 Readiness – DBS Bank Singapore Case Study

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D e c l a r a t i o n o f A u t h e n t i c i t y

I hereby declare that the Bachelor's Thesis presented herein is my own work, or fully and specifically acknowledged wherever adapted from other sources. This work has not been published or submitted elsewhere for the requirement of a degree program.

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Signature

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Abstract

The fourth industrial revolution, which optimizes manufacturing processes through Artificial Intelligence (AI), autonomous systems along with Internet of Thing technology (IOT), is now no longer a buzzword but a reality for many countries. Industry 4.0 has been introduced and put into practice in almost each and every type of industry including financial sector. Meanwhile, a number of companies in Southeast Asia, well-known as one of the busiest commercial hubs in the world, have included digitalization in their strategic plans. This bachelor's thesis aims to determine the concept of Industry 4.0 (i4.0) and its most important driving factors, namely technologies and human capital. It focuses on corporate human resource strategies toward digital transformation by conducting a case study on a well-renowned Singaporean company, DBS Bank. This paper seeks to answer the question “How has human capital prepared corporations for Industry 4.0?”. To answer the research question, it is necessary to identify the relationship between technologies and human resource in a corporation and impacts of human capital on the journey to become a smart company.

Key words:

Industry 4.0, emerging technology, readiness, human capital, human resource management, five performance objectives

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Introduction

Today the world is facing a brand-new wave of technologies and innovations with a rapid speed of breakthroughs, the world has never seen before. All these creations allow businesses, manufacturers and governments to create, produce, control, monitor, analyze and even predict in a way that was not technically and physically feasible previous years ago.

This tremendous wave of technology is disrupting almost every industry in every country. Additionally, the breadth and depth of these changes reflects the transformation of entire systems of production, management, and governance. It is a new phase of industrialization, where almost everything takes place in virtual world and in real-time basis. It presents a number of opportunities. This digital advancement allows companies to gain a great deal in term of productivity, efficiency and quality. Furthermore, the adoption of these technologies on a global scale can unlock new data-driven business models and surge connectedness of global value chains. With the emerging technologies combining with human skills, productivity can be significantly boosted, and error rates at the same time can be reduced, while leading to the creation of new types of jobs and increasing demand for higher skill labor.

However, adopting these emerging technologies requires more than just financial capital from the company. Unlike previous industrial revolutions, Industry 4.0 is built around the system of the corporation. To successfully transform to Industry 4.0, it takes the entire system to work together, including the company's process, technology and most importantly the people.

This study aims to explore the importance of human capital, one of the major factors in the corporation in transforming to Industry 4.0 or in other words, to becoming digital. The purpose of this paper is also to discover several human resource strategies which can prepare companies to embark on the journey to Industry 4.0.

The author is inspired by the topic of digitalization and the success story of becoming digital by starting with its human capital. It is very delightful to reveal this secret that prepares one selected company for Industry 4.0. This paper seeks to investigate and answer the research question:

➤ *How can human capital prepare corporation for Industry 4.0?*

The bachelor's thesis consists of two main parts: theoretical and practical part. The theoretical section contains a brief history of industrial revolutions and the description of the concept of Industry 4.0. It then acquaints with the introduction to the emerging technologies that drive the digitalization. Furthermore, it explores the key factor in driving the industrial revolution – human capital. Additionally, this paper also contains the tools necessary for conducting the methodology of the research. This includes one of the operation management tools – five performance objectives and strategic analytical tools such as SWOT and PEST analysis.

To answer the research question above, the practical part of the thesis is dedicated to the case study on a selected company. The secondary data analysis will be used as the methodology. The analysis of a Singaporean company – DBS Bank, will be conducted to determine the company's HR strategies and the impacts of those strategic approaches on preparing the company for its digital journey. First of all, it is important to access the situation of the country the company is located along with the description of the company and PEST analysis. Afterwards, SWOT analysis is carefully conducted to access the capabilities, opportunities and possible threats for the company. Moreover, the paper evaluates the company's success story of becoming digital and elaborates on the HR strategies taken by DBS Bank to achieve that. Finally, the performance evaluation of the company is executed on the estimation of five operational objectives: quality, speed, flexibility, dependability and cost after the period of taking the strategic approaches on its human capital.

1 Industrial Revolution

Industry is the section of an economy that manufactures and assembles material goods which are highly mechanized, computerized and ultimately automatized. Ever since the beginning of industrialization (the rise of steam machine), innovations and technological leaps have led to paradigm shifts, in term of business operations, organizational structures, and more importantly the nature of business itself, which today are ex-post named “industrial revolutions”.

It all started with the very first classic industrial revolution or in other name, the rise of steam power. This transition began roughly in the mid of 18th century in Britain thanks to the coal, iron and the great invention of steam-powered machine (Vries, 2008). The use of it for industrial purposes was the greatest breakthrough for increasing human productivity. Instead of weaving looms powered by muscle, steam-engines could be used for power.

The second industrial revolution began from 1870s onwards owing to the prominent discovery of electricity and assembly line production (Vries, 2008). A great example and a well-renowned figure in that time was Henry Ford (1863-1947), who took the idea of mass production in Chicago, USA and later became one of the most successful people in the history of automobile.

The third industrial shift took place between 1950s and 1970s through partial automation using memory-programmable controls and significantly computers (Luenendonk, 2017). With these technologies, factories and manufacturers are able to automate the production process with the very least human intervention or amazingly without human assistance at all.

Today we are facing another phase of the revolution with a new wave of emerging technologies, which results in the emergence of Industry 4.0 (i4.0). Such technologies originate from different subjects including cyber-physical Systems (CPS), Internet of Thing (IoT), cloud computing, Industrial Integration, Enterprise Architecture (EA), Business Process Management, Industrial Information Integration and others (Xu et al., 2018).

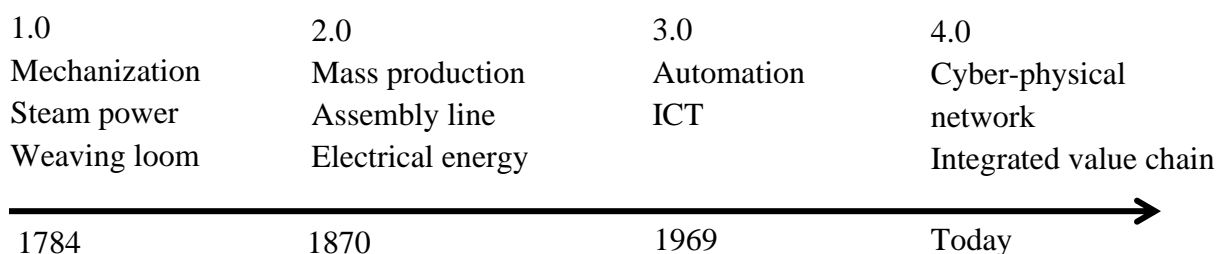


Figure 1 Summary of The Industrial Revolution Timeline (Author based on Gregory, 2019)

2 Industry 4.0

The terminology “industry 4.0” was publicly introduced by a group of German experts in 2011 (Luenendonk, 2017). The Internet of Thing (IoT) can now be listed in the historical records along with mechanization, electricity and information technology as the forces powering the industrial revolutions (GTAI, 2020). According to German Trade and Investment (GTAI), industry 4.0 potentially guarantee an increase of manufacturing productivity levels by up to 50 percent and at the same decreasing the amount of required resources by half. The number promised is very impressive and such thing has attracted more and more industries to implement such technologies. This has resulted in the brand-new faces of industries and a brave new world of decentralized and autonomous real-time production.

According one study (Agolla, 2018) these are the characteristics of Industry 4.0:

- Cyber-Physical Systems – a fusion of the physical and the virtual worlds.
- Internet of Things (IoT) – comprises communicating smart systems using IP addresses on Internet technologies. The advantage of this is that the detection, identification and location of physical objects and it communicates through connectivity.
- Internet of Services (IoS) – a new method to deliver Internet-based services, concepts for specific product on demand
- Internet of Data (IoD) – management and sharing of data using Internet technologies.

2.1 Emerging Technologies

The Fourth Industrial Revolution and emerging technologies are stimulating the advancement of new production techniques as well as business models, which will necessarily change global production systems. According to World Economic Forum Readiness Assessment Report in 2018, there are twelve emerging technologies that drive the industrial revolution. **Table 1** summarizes and explains each of technologies.

Technology	Description
Artificial intelligence and robotics	Advancement of machines and robots that can replace humans in tasks related to thinking, multitasking and fine motor skills.
Ubiquitous linked sensors	Known as “Internet of Things.” The use of networked sensors to remotely connect, track and manage products, systems and grids.

Virtual and augmented realities	Advanced interfaces between humans and computers involving immersive environments, holographic readouts and digitally produced overlays for mixed-reality experiences.
Additive manufacturing	Additive manufacturing with advancement of technology like 3D bioprinting of organic tissues.
Blockchain and distributed ledger technology	Blockchain technology allows secure transactions and ledger accounting – cryptocurrencies like bitcoin...
Advanced materials and nanomaterials	Creation of new materials and nanostructures varying in shapes, efficiency and functionality.
Energy capture, storage and transmission	This technology allows energy distribution through smart grid systems such as wireless energy transfer and more.
New computing technologies	New architectures for computing hardware, such as quantum computing, biological computing or neural network processing and upgraded current computing technologies.
Biotechnologies	Innovations in genetic engineering, sequencing and therapeutics, as well as biological computational interfaces and synthetic biology.
Geoengineering	Technological intervention in planetary systems, typically to mitigate effects of climate change by removing carbon dioxide or managing solar radiation.
Neurotechnology	Innovations such as smart drugs, neuroimaging and bioelectronic interfaces that can perform such functions as reading, communicating and influencing human brain activity.
Space technologies	Space-exploration technologies like microsatellites, advanced telescopes, reusable rockets and integrated rocket-jet engines.

Table 1 Twelve key emerging technologies (World Economic Forum, 2018)

In some cases, adopting the technologies in production systems could lead to a decline in middle-skill jobs and growth in low-skill and high-skill jobs. Transforming to Industry 4.0 could highly impact a company's economic fortune and slowdown the company instead of boosting productivity and growth. Hence, if a company takes the option of leapfrogging to Industry 4.0, it should be carefully managed because this could come with both risks and possibilities.

3 Challenges Toward Digital Transformation

Despite the promising benefits and potentials, there are significant challenges inherent in any transformation of any industry in response to this new wave of innovations. There is no such opportunity coming without a risk and obviously the Fourth Industrial Revolution is no exception. It could result in increased inequality and social unrest since automation has led to job loss and technology could eventually become a substitute rather than a complement to human productivity. Additionally, the adoption of emerging technologies sometimes involves high upfront costs and can pose prominent threats such as data leaks and security breaches. These risks need to be anticipated, mitigated and monitored.

Transforming to Industry 4.0 without tackling these risks and challenges can lead the society to downfall. New technologies or new sets of digital skills are rarely developed, applied and implemented in a whole organization without being ready to utilize its full potential (Machado et al., 2019). Hence companies need to tackle several challenges and obstacles first before adopting the technology.

3.1 Scarcity of resources

The availability of financial capital and digital-educated employees is an important condition on the way to Industry 4.0. Adopting the technologies can cost companies fortunes because they need to redesign their IT systems and machinery. Furthermore, the lack of in-house talent to support the development and implementation of I4.0 initiatives can be a very tough challenge especially to small and medium sized enterprises (SMEs) because these companies usually have the limited number of staff. Besides, if a company's workforce is comprised of staff with different ages, it requires the company to spend more efforts both physically and financial to generate varied strategic approaches in order to develop and re-train their employees. Another challenge is the lack of digital knowledge such as technologies, vendors and IT outsourcing partners that help execute the core initiatives.

3.2 Lack of digital strategy

Consistent flow of data is a significant factor to implement Industry 4.0. Information needs to be constantly available both vertically and horizontally along the value creation chain (Schröder, 2017). It is sometimes difficult for companies, in particular SMEs to integrate data and processes from various sources because of insufficient know-how staff in the companies. Besides, there are other challenges companies may face in implementing i4.0 technologies such as:

- Distributed decision-making systems
- Some companies need to reengineer existing business models in order to fully benefit from i4.0

- Choosing the right technology for the business can be critical and it requires a lot of considerations including the goal and competitive situation of the company
- There are potentially difficulties in balancing between tactical, strategic, operational and financial KPIs, used to anticipate the future.

3.3 Poor data security

In regards with switching to new i4.0 technologies and moving forward with integration of various IT systems, data security as well as secure standards and norms are also an important attribute. The lack of data security can suspend companies from becoming digital because without tight data security, adopting technologies like cloud or big-data analytics can do more harm than good for the company. Data security investment needs to be considered and developing secure standards and norms can help companies achieve a high number of network partners, which therefore lead to unfolding the economic potential of Industry 4.0.

To sum up, the implementation of the i4.0 requires a multi-year transformation process for most companies, leading to significant changes in their organizational structure, workforce, and their value chains. However, the ways to achieve the successful transformation will not be the same for every company. It is very necessary for companies to evaluate the required competences based their own competitive situations, willingness to invest, and most importantly their people.

4 Human Capital

Human capital is an intangible asset or quality embedded in companies and organizations. It also can be defined as a set of skills, knowledge as well as abilities used to perform activities, processes and services which contribute and increase economic growth (Neeliah et al., 2016). Human capital can be considered simply as the economic value of an employee's experience and skills. This includes assets like education, training, intelligence, skills, health, loyalty and punctuality. Human capital is considered to be a critical key to success for companies in becoming Industry 4.0. Particularly, the characteristics such as education, experience and knowledge are the essential aspects that companies or organizations need to tap into in order to achieve success in the competitive world.

4.1 Competencies for Industry 4.0

Throughout all previous industrial revolutions, human capital has generated innovative solutions to problems of mankind. During the Industry 4.0, where Internet and supporting technologies serve as the backbone of the integration human-machine interface, human capital is not only creative but also marvelous (Petrillo et al., 2018). There is a new set of personal competencies, skills and abilities needed to fit in Smart Company.

- Personal competencies:

During this tremendous wave of emerging technologies, competencies such as the ability to learn, to develop an own attitude and ethic value system are very significant (Agolla, 2018). Today's employees have to face the fact that their current tasks may no longer exist in the future as the tasks keep on changing quickly. Workers have to keep up with such changes because the technologies and Networked Systems have eliminated some or most of the tasks (Agolla, 2018).

Furthermore, personal development and commitment to lifelong learning has become the responsibility for both individual and the company. It is important to invest in staff development and develop a learning and open culture in organization in order for the company to sustain digital advancement. Hence, curiosity and willingness to learn have become more important employees' competencies which companies need to look for.

In terms of personal attributes, flexibility with respect to work time, work contents and workplace are fundamental competencies for an agile production in organization. Flexibility is the key to fast-changing market need and environmental situations. Since teams in companies have become more diverse in terms of culture, education and geographical location, it is essential for managers to transform their management and leadership style from power-driven to value-driven (Agolla, 2018)

- Social/interpersonal competencies:

People as well as organization require the ability to communicate, cooperate and create social connections with other individuals, groups or entities because organizations are basically social systems where interaction takes place between different players such as humans to machines or humans to humans. With the increase of complexity and scope of i4.0, workers require broader capability to comprehend the relations between processes, information, flows, possible conflicts and potential solutions (Agolla, 2018). Due to impacts of i4.0 technologies, human work now concentrates more on flexibility in problem solving and creativity. Hence, it requires the ability to communicate complex problems in different languages to allow innovative activities to be performed in distributed social backgrounds involving different disciplines and inter-organizational teams. Thanks to social media, managers, engineers and employees now can show literacy, skills, knowledge and abilities with different types of communication systems.

- Action-related competencies:

The ability to take individual ideas or socially constructed ideas to action is considered as one of main action-related competencies to make Industry 4.0 become reality. Additionally, strong analytical skills and ability to find domain-specific and practicable solutions without losing sight on the overall goal is another necessary competency for human capital during this revolution (Agolla, 2018). Since adopting the new technologies is not a straightforward methodology or practice, managers and employees need to be encouraged to experiment but also take into account the risks of failures (Erol et al., 2016).

Moreover, to fully benefit from Industry 4.0, companies need to exploit data and thus employees need to be trained and equipped with digital knowledge and data analytical skills. Employees need to have the capability to analyze complex system through specialized software (Lanza et al., 2015). Additionally, statistical methods and data mining techniques are also significant competences for future human capital, especially production engineers (Agolla, 2018).

5 Five Performance Objectives

To accomplish goals, a company needs to outline its strategy. To successfully carry out the strategy, the company needs to pinpoint its operation performance objectives, which serve as the tools to evaluate and keep track on its journey toward the goal. Five performance objective focuses on five principles the company uses to set up the background for its operation to identify its efficiency. The five principles are: quality, speed, dependability, flexibility and cost (Slack, Brandon-Jones, & Johnston, 2013). This chapter will elaborate the theoretical aspects of each of the five principles, which will be applied in the methodology of this research paper.

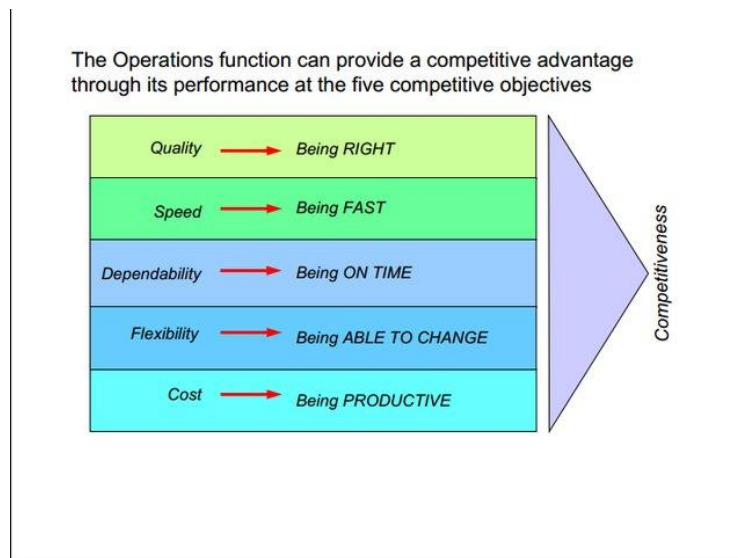


Figure 2 Five Performance Objectives (Ayodele, 2013)

1. Quality

Among the five principles, quality is considered to be the most important objectives in operation performance. Quality is defined as the degree to which a set of inherent characteristics fulfills requirements (ISO 9000, 2015). Simply put, quality determines the ability of the organization to deliver the “right product or service” which meets customers’ requirements. It has an external effect on the perception of customers on the business. However, quality even plays a more essential role in organization in the long run for it also influences the internal environment of the company. It ensures the production of error-free goods. On top of that, it sets up the stability of management control which consumes less time and minimize conflicts and risks in carrying out business activities.

High-quality products and services undoubtedly lead to less costs, spent in redesigning or returning products. It also fulfills customer satisfaction and provides a unique added value to customers. Providing the high-quality can build good reputation for companies and eventually it will boost brand advocacy by the words-of-mouth.

For financial service providers such as DBS Bank, quality is built around several characteristics – reliability, flexibility, availability, competence, empathy and communication. Reliability refers to the ability to perform or provide the promised services accurately, confidentially and dependably.

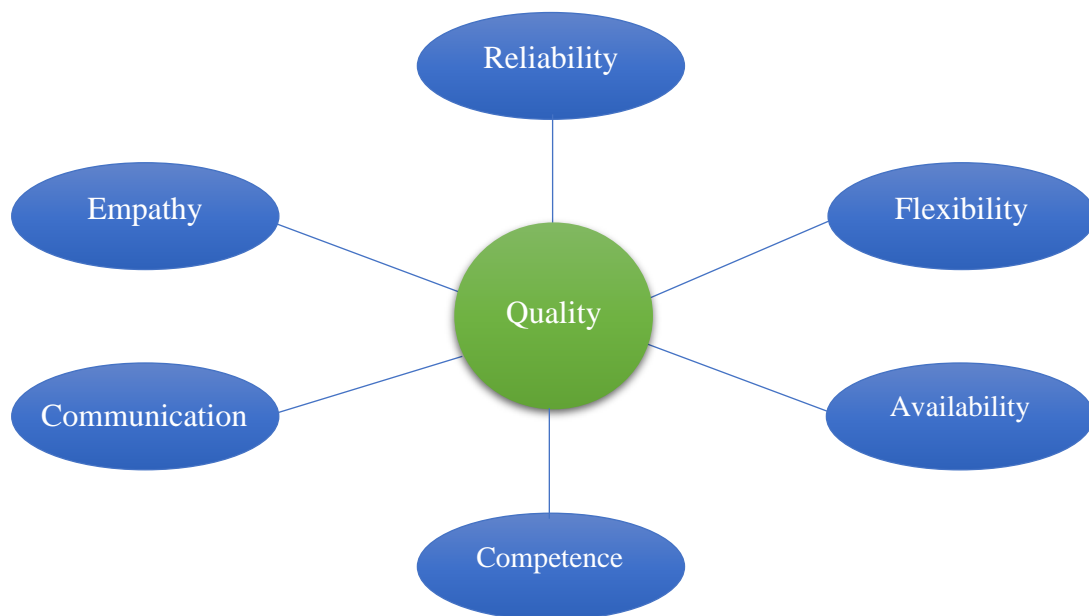


Figure 3 Financial Service Quality (Author, 2020)

Flexibility refers to organization's ability to cope with changes in creative ways. Availability of services itself can serve as one quality parameter for the company and competence is a key set of knowledge and skills to provide high-quality services. Empathy and communication with customers can sustain the company's quality.

2. Speed

Speed is defined as the elapsed time between receiving customers' requests and successfully delivering the customers the requested products and services (Slack, Brandon-Jones, & Johnston, 2013). Speed is important because externally it accounts for customer satisfaction and internally speed reduces internal throughput time and risks by delaying the commitment of resources.

When it comes to organization, speed cannot be achieved by one or two departments. Due to interdependency of all functions and processes, diverse organizational units need to work in unison. Speed is considered a part of the business culture. In most organizations, Human Resource department is directly or indirectly given the responsibility of managing corporate culture. It implies that HR is the main driver in increasing speed in organization and people are the most impactful enabler of speed.

Firms with speed within their culture have the ability to maneuver quickly in their industry and market. By reducing time and flow of information and materials throughout the organization, the company can make swift decisions and provide rapid responses to customers.

3. Dependability

This concept emphasizes on the ability to schedule the entire organization to deliver goods or services to customers exactly when they are needed or at any rate when they were promised (Slack, Brandon-Jones, & Johnston, 2013). Dependability does not indicate the speed of the service but the reliability of the service. This objective plays an important role in promoting customer loyalty and operation stability. Dependability can be achieved through mitigating and lowering threats – faults, errors and failures (Aviz et al., 2001). There are four main ways to attain dependability in an organization:

Fault prevention: to prevent the occurrence of faults

Fault tolerance: to deliver correct service in the incidence of errors

Fault removal: to lessen severity of faults or number of errors

Fault forecasting: to predict future occurrence of failures and the possible consequences.

Dependability can save time, money and most importantly it gives the organization the stability in its operations, which in the long run boosts the level of trust between internal diverse organizational units (Slack, Brandon-Jones, & Johnston, 2013). Taken for example, if everything in an operation is perfectly reliable, the quality of the operation increases and the level of trust. In this situation, each part of the organization can concentrate on developing its own area of expertise.

4. Flexibility

In term of performance, this terminology refers to organization's ability to change or adapt in response to changes in the business environment (Christopher, 2016). Flexibility is a significant factor for every organization in any industry, especially in the era of digitization as a result of market volatility and changing customer behaviors. Financial service providers are strongly dependent on their flexibility to take necessary initiatives in response of rapid change in customers' needs and instability of the market.

The principle concentrates on ability to provide a high variety of products or services to various customers within different delivery time frames and volumes. Mass customization approach is a great example of being flexible because this approach allows customers to personally customize their own products. Flexibility can be in many forms, but these are the main variables:

1. Product or service – new or modified services and products
2. Combination of products or service – mix and diversity of products
3. Volume – flexibility in output or activity to produce different quantities of products
4. Delivery – flexibility in delivery time

5. Cost

Cost is at all times a significant objective even if the organization does not compete directly on price. Low cost of producing goods and services is an attractive objective for every company. Keeping it low is always the priority and it is a win-win situation for both company and its customers because as the cost of production decreases, the price of the product becomes lower.

Cost structure varies in different industries and businesses. It mainly depends on where the operation costs are incurred. However, there are types of costs that are observable and simply measurable. Those are the costs with direct relationship with the inputs and the quantity of output. Other types of costs cannot be quantifiable and must be estimated or allocated.

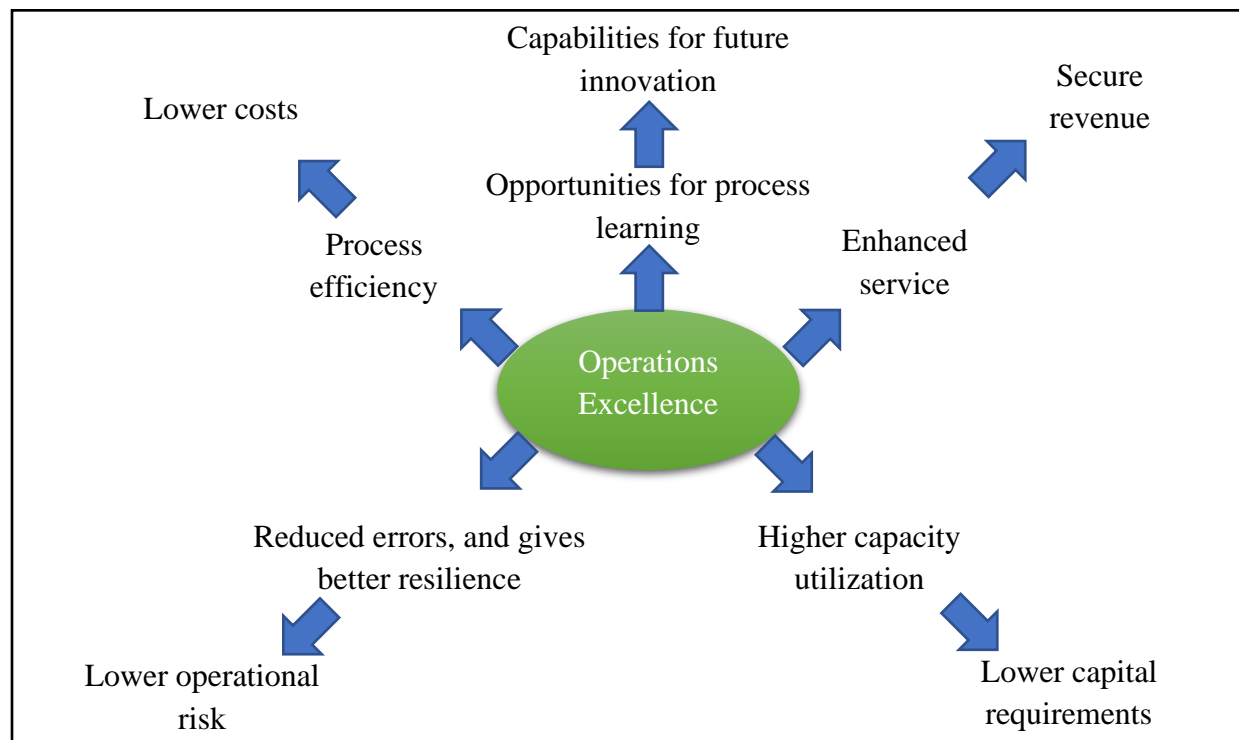


Figure 4 Operation Excellence Advantages, (Author based on Slack, Chambers, & Johnston, 2009)

In conclusion, costs are directly associated with the efficiency of the other four performance objectives. Organizations have a keen interest in maintaining their costs as low as is compatible with the levels of quality, speed, dependability, and flexibility. **Figure 4** illustrates the benefits of achieving operation excellence. Operations can contribute to competitiveness through low costs, lower operational risk, lower capital requirements and strengthen competitive advantages by providing enhanced services, efficiency and capabilities to innovate.

6 Strategic Analysis Tools

6.1 PEST Analysis

PEST framework provides a comprehensive list of impacts from external environments on the possible success or failure of particular strategies (Johnson et al., 2008). PEST analysis is a study on external factors such as political, economic, social and technological. PEST analysis usually tends to focus on a certain country where the analyzed company provides significant operations.

Political factors:

Political factors strongly influence company's ways of running the business. In the context of the banking and financial services sector, political aspects play a very important role because financial institutions traditionally have held immense power and influence. Hence, they have to highly deal with the government's regulation and policies. There has always been a high level of involvement between banks and the federal, state and local governments.

Political influences of external analysis include political stability, related geopolitical issues, change in regulations and legislation.

Economic factors:

This aspect includes the economic growth, unemployment rate, change of interest rate or inflation and labor costs. Economy has significant impacts on companies, particularly on profitability. Regarding financial industry, banks and economic growth are interrelated and strongly interdependent. A prospering economy is decent for banking sector and a healthy banking sector can be good for the local economy.

Social factors:

The analysis on social impacts on companies are usually attentive to behavior and habits of customers, population growth, age or gender statistics and social or cultural trends in the country. Social factors are important because they identify consumer behavior towards the products or services and at the same time, allow companies to access the possible changes in the society. Organizations and companies need to understand these external influences in order to sustainably satisfy their customers.

Sociocultural forces can have a deep impact on financial services providers. Shifting social trends and people's preferences can affect the business and growth of the banks. Throughout the last decades, consumer demographics and people's attitudes towards the financial services have as well changed a lot.

Technological factors:

Technological trends, rate of technological development, Research and Development (R&D) activities and digital innovations are considered to be a vital force from external environment to companies. Since technologies are evolving and changing rapidly, it is important for companies to consider these aspects and developments within the market in order to discover new opportunities and prepare themselves for the future.

6.2 SWOT Analysis

SWOT analysis is a tool to evaluate the internal capabilities of a company and external factors that might impact the company's performance and strategy. It simply accesses and analyzes four key aspects of the company, namely strengths, weaknesses, opportunities and threats. The tool is used to assist in identifying the relationship between internal factors like strengths and weaknesses and external forces such as opportunities or threats (Johnson, Scholes, & Whittington, 2008). The findings usually imply how the company can exploit its strengths and improve its weaknesses to take advantages of the opportunities by eliminating or tackling the potential threats.

- Strengths: the internal positive capabilities of the company. It consists of the unique potentials of the company that generate the competitive advantage.
- Weaknesses: the internal negative issues that harm or drag the company as well as the aspects the company wish to improve.
- Opportunities: the external possibilities or trends that could contribute to the enhancing the strengths or minimizing the weaknesses of the organization or could probably become advantages for the company.
- Threats: the external negative situations that might worsen the company's performance and negatively affect the business and its operations.

7 Methodology

The aim of this bachelor thesis is to illustrate how human capital contributes in preparing corporations in transforming and becoming digital in the era of Industry 4.0. In order to carry out the purpose, a case study on DBS Bank Singapore is selected as the methodology. DBS Bank is selected for this study because it is a big global company, which have taken absolutely fascinating approaches on its human capital toward digitization. Additionally, it is based in Singapore, small but modern country and one of the busiest commercial hubs in the world.

The analysis is provided in accordance with the secondary approach that involves gathering both qualitative and quantitative data from published and existed resources in order to provide the relevant results to answer the above research question. The practical part consists substantially of data from DBS Bank's annual reports in the last five years from 2014 to 2019, information from the company's official website, articles and other reliable sources.

To evaluate the company's performance and its position on the journey to Industry 4.0, analytical tools such as PEST, SWOT and HR benchmarking are applied along with one of the operation management tools, five performance objectives. For a more comprehensive study, it is relevant to analyze a handful important aspects of Singapore, where the company is based.

The practical part will proceed in following steps:

1. An analysis on Singapore is conducted, in term of the country's economy and human capital. This will provide a summary of the environment where DBS Bank operates.
2. The introduction to the company is made in order to give an overview of the company and its business.
3. To understand the current external environment, PEST analysis is performed by assessing external factors such as politics, economy, society and culture, ang technology.
4. SWOT analysis is carried out to determine key strengths and weaknesses of the company. In addition, prospective opportunities and potential threats are described.
5. In this step, qualitative analysis is used to evaluate the company's strategies and approaches to becoming digital. This includes studying its Human Resource strategies and initiatives for the transformation to Industry 4.0.
6. Analysis on DBS Banks's five performance objectives is created to determine how the implementation of these HR initiatives to the organization influences the company's indicators – quality, speed, dependability, flexibility and cost. To achieve that, it is necessary to compare data before the implementation and current data.
 - a. *Quality*: factors to be analyzed – awards received for its performance and quality, complaints from customers, the standards to manage quality control.
 - b. *Speed*: factors to be analyzed – accessibility of the service
 - c. *Dependability*: factors to be analyzed – security, reliability, risk assessment

- d. *Flexibility*: factors to be analyzed – service and employees’ flexibility.
 - e. *Cost*: costs are analyzed through impacts of implementing the technologies and revenues from digital customers.
7. In this final step of the practical part, the key findings of this study are summarized. Discussion and recommendation are made for the company to keep the competitive advantage in this rapid changing environment under digital transformation.

Considering the limitations, the data collection is not unique, as it is collected from public accessed resources. However, for this bachelor thesis the information is sufficient and provides necessary sources to accomplish the main goal of the paper.

8 Singapore

Singapore has been known as a major financial hub in the Asia Pacific region and also earned a reputation as one of the most advanced economies in the world. Certainly, the Singapore economy is mainly driven by exports in electronics manufacturing and machinery, financial services, and the world's busiest cargo seaport. With its five-million population, this country has been a stable and prosperous global financial hub (see **Appendix 1** for the Singapore's population in the last two decades). In this practical part, a general analysis on Singapore is conducted in order to give an overview of country's position in becoming Industry 4.0.

Economy:

Singapore's economy has benefited from a great inflow of foreign investments due to its attractive investment environment. Despite the tiny size, Singapore has always been a strong economy, whose GDP per capita is one of the highest in the world. This economic success reflects its outward-oriented development strategy, which focuses highly on exports, particularly in electronics and chemicals. Manufacturing is responsible for almost a quarter of total GDP and the industry is dominant by electronics, chemicals and biotechnology industries.

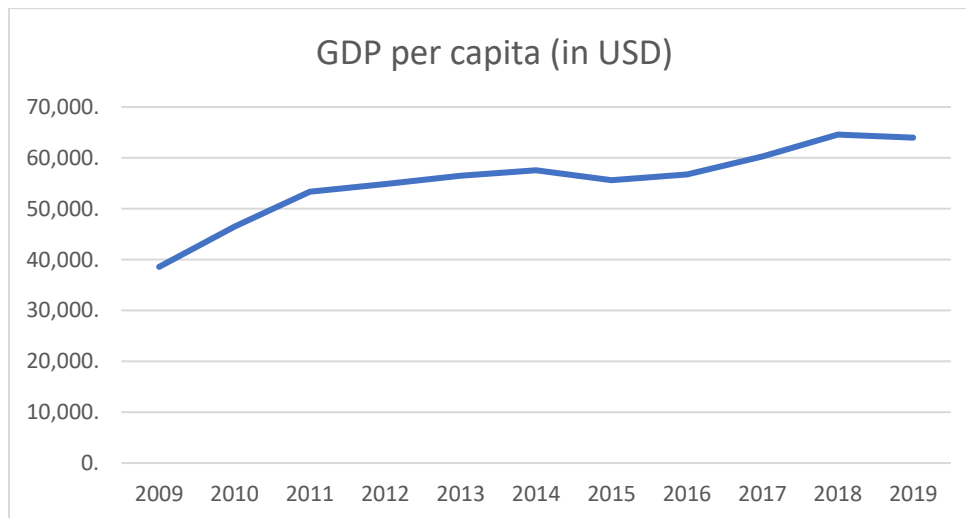


Figure 5 Singapore's GDP per capita (Author based on Statista, 2020)

In 2019, the country with the highest GDP per capita was Luxembourg, and Singapore was ranked 9th after the United States and followed by Denmark (Statista, 2020) As shown in **Figure 5**, the country's GDP per capita has been continuously growing throughout the decade despite the fact that its population has slowly increased during the period.

Research & Development

In line with the government's strategy to become the "Smart Nation", Singapore has significantly spent on Research and Development. Based on the statistics provided by the Department of Statistics Singapore, the total investment had increased quite considerably from approximately 6,200 million dollars in 2007 to more than 9,000 million dollars in 2017. Furthermore, the country has invested on R&D heavily in Engineering and Technology (see *Appendix 2*).

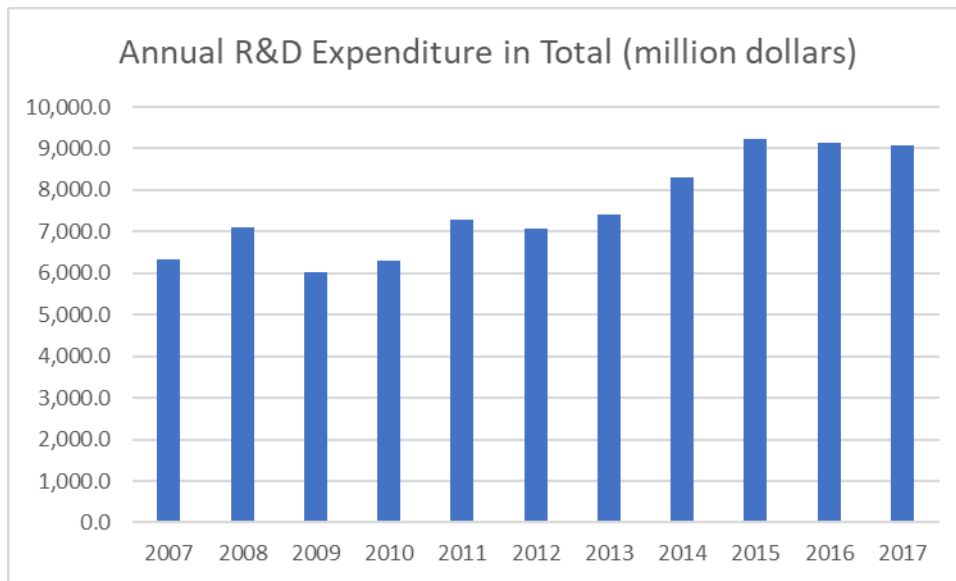


Figure 6 Singapore's R&D Expenditure (Author based on Department of Statistics Singapore, 2020)

Human Capital

As human capital is the vanguard of the Fourth Industrial Revolution, it is significant to the transformation of the country. Since the workforce in Singapore reflects the workforce in the companies, this assessment provides an overview on readiness level in human factor. According to World Economic Forum's readiness assessment report in 2018, Singapore has positioned itself as one of leading countries in the world toward Industry 4.0. Hence, it is necessary to access the country's current and future labor force, as well as the other important determinants.

Current Labor Force	
Manufacturing employment of working population	11.10%
Knowledge-intensive employment of working pop.	54.30%
Female participation in labor force ratio	0.87
Mean years of schooling	11.5

Availability of scientists and engineers (1 - 7 best)	5.2
Digital skills among population (1 - 7 best)	5.8
Future Labor Force	
Migration /100,000 pop.	72.3
Country capacity to attract and retain talent (1 - 7 best)	5.7
Quality of universities	3
Quality of math and science education (1 - 7 best)	6.5
Quality of vocational training (1 - 7 best)	5.4
School life expectancy	15.4
Pupil-to-teacher ratio in primary education	17.4
Critical thinking in teaching (1 - 7 best)	4.4
Active labor policies (1 - 7 best)	5.6
On-the-job training (1 - 7 best)	5.7
Hiring and firing practices (1 - 7 best)	5.6

Table 2 Human Capital Indicators for Industry 4.0 Readiness (Author based on World Economic Forum, 2018)

Table 2 summarizes the results of the report and the most recent position of the country. It also highlights a few key strengths of the country's human capital through the indicators. For instance, high female participation in labor force can result in diversity and innovation in workforce. Singapore has received very high scores for knowledge-intensive employment and digital skills among population, which outstands most countries in the world (World Economic Forum, 2018). Furthermore, it also received incredible assessment on hiring and firing as well as training practices, which relate to talent management in corporation.

9 Case Study: DBS Bank Singapore

Company's Overview

DBS is a Singaporean corporation founded in 1968 and today it is one of Asia's leading banks, operating in the most dynamic region of the world – China, Southeast Asia and South Asia. Its core business is to provide a full range of services in consumer banking, wealth management and institutional banking with a commitment to advance sustainability agenda and facilitate banking experience for customers.

DBS Bank has been globally recognized for their leadership and it is known for its forefront initiatives to embed digitization across the full range of banking, processes and services to shape the future of banking. DBS has made great efforts to modernize itself by investing in technology and its people. The company focuses on leveraging digital technologies such as cloud infrastructure, Application Programming Interfaces (APIs) and digibank platform to reimagine banking and are committed to advancing the sustainability agenda as a purpose-driven bank (DBS Bank Annual Report, 2019). DBS Bank has always been recognized among the top 10 business transformations of the decade for its leadership in digital and its well-known reputation of retaining and developing its people. Diversity in their workforce has always been a core source of strength of the corporation. DBS Bank has been recruiting female talent in technology – an area where is conventionally dominant by male professionals.

Table 3 below summarizes the development of DBS from 2014 to 2019 in term of workforce and customer base.

	2014	2019
Number of Institutional Banking Customers	200,000	240,000
Number of Consumer Banking/Wealth Management customers	6 million	10.8 million
Number of Employee	21,000	28,526
Voluntary attrition rate	13.6%	13%

Table 3 DBS Bank's Overview (Author based on DBS Bank Annual Report, 2015; DBS Bank Annual Report, 2019)

With more than 28,000 on board, DBS is a gigantic organization providing services and satisfying millions of customers. However, the size of it does not seem to be a disadvantage for the company to respond fast in time of need. Furthermore, DBS Bank has won many awards for its quality and security in banking sector. What sets DBS Bank unique and different from the other companies is that it is embraced by the entire organization, not just customer-facing roles but also their support functions. They noticed the change happening behind those roles – marketing, communication, Human Resource (HR) and Audit. This awareness helps the company to understand the requirements and critical aspects for transforming the company to be a smart company.

10 PEST analysis

This analysis evaluates the significant external aspects that can influence the company's operations, activities and strategies.

Political Factors:

The government is capable of regulating and controlling the business activities and behaviors of companies. It has the power to establish new laws, taxes or sections, all of which can impact the market, industries and companies directly and indirectly.

As in the case of DBS Bank, here are the possible political factors that can affect the company:

- Global trade war between US and China: this has put Singapore's economy in bad shape and performance in industries are worsened due to lower wholesale and retail trade (South China Morning Post, 2019). Additionally, new regulations and standard changes have been established due to the dispute, leading to a shift of customer segments. For example, banks are focusing on larger corporate clients and reduce exposure to trade finance.
- High political stability in Singapore
- Low corruption: Singapore is perceived as one of the least corrupted countries in the world. This allows transparency in business environment.
- New digital banking regulation in Singapore: the new act was launched in January 2020 (Singapore Business Review, 2020). It enhanced the old regulation on Payment Service Act (PSA). This new regulatory framework facilitates licensing process for payment service providers; meanwhile, this also proposed risk mitigating measures to better safeguard customer and merchants and ensure adequate controls against money laundering, terrorism financing risks, reduce fragmentation and strengthen technology and cyber standards in payment space. This is good news for DBS as this regulation provides more stability and trust in the economy.
- Governmental support in Industry 4.0: Singapore has developed initiatives and strategies in response to the revolution. The country focuses on Investments in Science and Technology, which promotes and enhances S&T development and the growth of S&T talent base.
- Government's policies in response to Covid-19 pandemic: all service industries expect business activities to deteriorate and are advised to reduce hiring. Furthermore, The Monetary Authority of Singapore (MAS) launched a new facility to lend Singapore dollars at a very low interest rate (Channel New Asia, 2020). Hence, banks are expected to make more loans to Small- and Medium-sized Enterprises (SMEs) at a low interest rate.

Despite the negative impacts from the global trade war between US and China, the situation in Singapore is very supportive and promising for digital transformation. Moreover, there has been political stability in the neighboring countries such as Malaysia, Thailand and Indonesia.

Economic Factors:

Economic factors determine the state of economy and the direction in which economy might move. These determinants obviously have direct impacts on every industry including financial service companies. By analyzing these factors based on the environment, companies can set up strategies in response to the changes.

- **Economy growth:**

After the recession in 2008, Singapore economy managed to recover and grew impressively in 2010 with a growth rate of 15.2%. Since then, its GDP has been growing sustainably. However, according to Bloomberg, Singapore's economic growth plummeted in the last quarter of 2019 due to the impacts of US-China trade war (Bloomberg, 2020). It also causes instability of economy in Southeast Asia, which might lead to recession. This downturn can adversely impact financial services providers.

- **Unemployment rate:**

Singapore has a very low unemployment rate, with an average of approximately 2.1% in the last five years (Ministry of Trade and Industry Singapore, 2020). Unemployment rate in Singapore peaked at 4.08% in 2016 due to a high number of layoffs and shrinking job vacancies; however, it dropped gradually to 3.62% in 2019 (Business Times, 2017; Statista, 2020).

- **Currency Volatility**

The rate of exchange is significantly important for financial sector because it affects the currency strength, spending habit and inflation. Furthermore, DBS Bank's main revenue is from Consumer Banking and Wealth Management (DBS Bank Annual Report, 2019). According to Trading Economics (2020), Singapore dollar has been strong in the last decade. Despite the trade war and Covid-19 pandemic in the last quarter of 2019, Singapore dollar has surprisingly recovered in the second quarter of 2020.

- **Inflation rate:**

Inflation has a major direct influence on banking sector because it affects the currency and its value as well as causes instability in economy. Additionally, it corresponds to investors' behavior and foreign investments. Singapore is known as one of the most attractive nations for foreign investors. However, inflation rate in Singapore hit a record high of 6.63% in 2008 due to the great recession. Then it dropped sharply in 2009 to 0.6% before reaching a peak of 5.25% in 2011. Afterwards, the inflation rate has decreased gradually and maintained at approximate level of 0.58% (Macro Trends, 2020).

Sociocultural Factors:

Social factors have a deep impact on financial industry. Changing cultural and social trends can influence the business growth and growth of banking brands.

- Buying behavior: people nowadays desire great customer service and convenience. For instance, customers want a seamless banking experience which allows them to turn to banks for advice and assistance for loans or specific products. In response to that, banks like DBS, have focused on providing a whole range of services online combined with nonstop customer assistance. This trend pushes creativity and innovations in companies. Human capital combined technology is the key answer to this.
- Rising Social Enterprises (SE) in Singapore: by 2017, the social enterprise sector had surged by around 30 per cent, with 401 registered social enterprises (Channel New Asia, 2017) thanks to the raiSE initiatives to support social entrepreneurship in Singapore. SEs are high-risk client for commercial and investment banks; however, this trend has triggered innovative ways of investment and risk assessment. For instance, many European countries have established social enterprise funds and lending programs, which help improve social enterprises' and SMEs' risk profile and allow banks to lend them on more favorable terms (OECD, 2017).
- Ageing population in Singapore: according to Department of Statistics, by 2030 the number of Singaporeans aged 65 and above is estimated to account for approximately 25% of the population (Statista, 2020). The nation's low total fatality rate hugely contributes to this trend (Population.sg, 2016).
- Education trend: there has been a shift away Science, Technology, Engineering and Mathematics (STEM) subjects towards commerce, humanities and general education in Singapore's higher education (Natarajan, 2016). The decrease of enrolments in STEM disciplines could cause concerns because these subjects are essential to development, innovation and growth, especially during the Industry 4.0.

Technological Factors:

Technology advancement is undoubtedly affecting businesses and it is changing fast. Companies needs to stay updated and connected all the time in order to survive and prosper.

- Smartphones: the rise of smartphone applications allows customers to directly communicate and make transactions without being physically at the branch. It facilitates banking services and make banking more and more convenient.
- QR payment: adoption of this technology enhances the payment experience and makes it simpler for both customers and businesses. There has been a rise in number of registered individuals and businesses using PayNow e-payment service. Since its launch in 2017, the number of users has skyrocketed to more than 3 million (Fintech Singapore, 2019).

- Digitalization: technologies such as Artificial Intelligence, Ecosystem Power Plays and Design for Humans, are very relevant for Singapore. Leveraging on data-analysis technology, for instance IBM Watson helps banking sector analyze big data volumes, product information and customer profiles in order to enhance wealth management advisory services (Singapore Economic Development Board, 2017). Singapore is making huge steps forwards as this tiny nation sets out to become a Smart Nation by 2030.
- Labor platforms and online work management solutions are replacing traditional models and legacy hiring practices with open talent marketplaces. It is one of key future changes for companies. Digital platforms can improve employment experience and talent market by facilitating job fairs for freelancers and prospective employees (McKinsey, 2016).

11 SWOT Analysis

In this section of the practical part, SWOT analysis is conducted based on the company's position in 2019 with the information retrieved from the company's annual report in 2019. This analysis permits us to comprehend the strengths and weakness of the company with regard to digitization. This also provides insights of potential threats and opportunities the company faces through this journey to digital company.

Strengths: <ul style="list-style-type: none"> ➤ Strong market position in East Asia ➤ Diverse workforce in organization ➤ Good relationship with customers ➤ Strong partnerships with academic institutions ➤ Awarded World Best Bank 	Weaknesses: <ul style="list-style-type: none"> ➤ Low market penetration in Europe and Americas ➤ Small market share and limited power in priority markets – Taiwan and China
Opportunities: <ul style="list-style-type: none"> ➤ The need of digital literacy education for the elderly ➤ High opportunity to expand to developing countries in the region ➤ Rapid adoption of technology 	Threats: <ul style="list-style-type: none"> ➤ Prevalent threat of cyber attacks ➤ US-China tension ➤ COVID-19 pandemic

Table 4 SWOT Analysis on DBS Bank (Source: Author, 2020)

Strengths:

- *Strong market position in East Asia:*
DBS Bank has a very strong market position in Singapore, Hong Kong. These sites are ones of the most important commercial hubs in East Asia. DBS has always been the number one bank in Singapore. In 2019, DBS was ranked 9th in Hong Kong, with the total assets of 445,661 million HK\$ (KPMG Hong Kong Banking Report, 2019). By having this strength, DBS acquires the competitive edge in the markets and strong brand identity, which enhances customer loyalty and shared values. This eventually will lead to well-established creditability for the company and ease of purchase for customers.
- *Diverse workforce in organization:*
For several years, DBS has been committed to building healthy, diverse and future-ready workforce. The company focuses on expanding its talent pool by hiring diverse group of people in term of gender, talent, expertise and professional background. By January 2020,

this organization has been named to the Bloomberg Gender-Equality-Index (GEI) for the third time (Bloomberg, 2020).

➤ *Good relationship with customers:*

A longstanding strategy of DBS is to embed themselves into the customer journey through digital innovation. This has been proved to an outstanding success by improving customer experience and creating simple yet new values for customers. For instance, digibank was created to help customers located in underbanked area through smartphones. In 2019, DBS bank was award as Best Bank for customer satisfaction (DBS Bank Annual Report, 2019).

➤ *Strong partnerships with academic institutions:*

The company has formed strong partnerships with major universities and institutions such as Singapore Management University, Institute of Innovation and Entrepreneurship and Lien Center for Innovation.

➤ *Awarded World Best Bank:*

In 2019, DBS became the first bank to concurrently hold three global best bank awards. This was achieved after the company was named “World’s Best Bank” by leading global financial publication, Euromoney. This follows the bank’s wins of Global Finance’s “Best Bank in the World” in August 2018 and The Banker’s “Bank of the Year – Global” in November 2018.

Weakness:

➤ *Low market penetration in Europe and Americas:*

Although prospering in the home region, DBS has not widely covered Europe and Americas. It has merely one office in London, United Kingdom and one in Los Angeles, United States. This suggests company’s limitations and market boundaries.

➤ *Small market share and power in priority markets – Taiwan and China:*

Due to numerous competitors in both markets, DBS is still struggling with its market position and DBS has to compete fiercely with local banks and a handful of other western banks.

Opportunities:

➤ *The need of digital literacy education for elderly people:*

Smart Nation Program is certainly a trend in Singapore. As discussed in the PEST analysis above, Singapore is shaping itself to become digital or “Smart Nation”. Digital literacy education is in high demand especially for senior adults. Therefore, it can be a great opportunity for digital companies like DBS because if they grasp it wisely, they can be the future leader.

➤ *High opportunity to expand to developing countries in the region:*

Entry barrier in countries like Cambodia, Bangladesh, and other developing countries in East and South Asia would not be so high for DBS Bank. There has been good reputation

for Singaporean companies in the region and DBS has built their brand awareness and identity through its successes and fame.

➤ *Rapid adoption of technology:*

This is one of the current megatrends in Asia. Becoming digital is the new fashion for companies and the digitization is disrupting almost every industry fueled by changing customer behaviors.

Threats:

➤ *Prevalent threat of cyber-attacks:*

The increasing number of cyber-attacks in financial service providers has posed a grave concern to the company. As banking sector is progressively driven by technology, the cyber risks have become greater. One study suggests that the fact that the aftermath of such attacks in any financial institution could impact the whole system is much more concerning (Federal Reserve Bank of New York, 2020).

➤ *US-China tension:*

This trade war between these two giant economies has more long-term consequences than short-term ones on DBS Bank for supply chains are not likely to move overnight. The short-term concern is the slowdown of activities in Chinese factories. Heightened economic uncertainty could impact on the company's operations and revenue stream. Meanwhile, this trade war could hit equity markets and weaken Asian currencies.

➤ *Covid-19 pandemic:*

This viral crisis has led to slowdown in economy around the world due to the lockdowns and restricted free movement of people. The pandemic has put a hold on business activities and a majority of business closures. This poses as a dire threat to DBS since its main customers are institutions and Small Business Enterprises (SMEs).

12 Digital Transformation Journey

In pursuing digital transformation, DBS Bank's top priority is to be digital to the core. In recent years, they have invested in cloud infrastructure and rearchitected their technology systems to be cloud ready. The new architecture permits them to leverage Application Programming Interfaces (APIs) to enable simple and high-speed connectivity. This does not just result in better business solutions, but also sustainability through financial inclusion. DBS began their digitization journey by redefining their performance management and developing their human capital.

12.1 Redefining Performance management

1. Project GANDALF

The project "GANDALF" stands for Google, Amazon, Netflix, DBS, Alibaba, LinkedIn and Facebook and has started from 2014 till present. The purpose of this project is set to transform DBS Bank and to compete with the world-class tech companies. This aspiration impressively galvanized people to a whole new level of performance and mindset and at the same, made the journey fun (MITS Loan Management Review, 2019). The project results in a shift in DBS Bank's approach to performance management and eventually drove its transformation to the leader of digital bank.

It all started with the partnership with the HR regarding redesigning the training and tools as well as the programs the company wanted to run. DBS believes that human capital is the most important and foremost driver in making digital transformation a success. To embark on this journey, DBS took the following steps:

- a. Redefining "performance": instead of resolving and satisfying customers in traditional ways, DBS took it to a next level. They created human-centered design thinking and ran so-called "customer journey projects" to solve customer problems. Employees are welcome and invited to create solutions and pitch them to their senior managers. In 2017, DBS established a method for measuring the financial impact on digitization – digital value capture (DVC). This method allowed DBS to determine importance of migrating customers to digital banking in quantity and figures by comparing traditional and digital customers with their transaction costs and balances such as deposits, loans and investments.
- b. Performance management in digital transformation: DBS uses a balanced scorecard method to assess performance and digital transformation in the company. The scorecard metrics are made up of 40% traditional KPIs, 20% Transform the Bank, 40% Area of Focus – targets that the company wants to achieve (DBS Bank Annual Report, 2019).
- c. Culture change: the project GANDALF focuses on the company's culture to provide unifying sense of purpose to the organization. They have created a process called Culture by Design (MITS Loan Management Review, 2019). With more than 26,000 employees,

DBS has been committed to develop an organizational culture, which is agile, learning organization, customer-obsessed, data-driven and welcome to risks and experiments. DBS continues to reinforce these characteristics throughout its learning and collaboration programs.

2. Improvements to Customer Center

DBS believes that customer centers are a highly KPI-driven environment and those KPIs are aligned to the bank strategy. To improve those KPIs, the key solution is to use technology to engage the staff, improve efficiency and enhance the customer experience. Instead of detecting poor performance, DBS started to implement speech analytics to comprehend both the challenges faced by call center staff and customer pain points (MITS Loan Management Review, 2019). Thanks to real-time data analysis, DBS can monitor and innovate particularly at the customer care center and the data also facilitates real-time management. This leads to a transparent and open culture, where managers can realize which employees are in a good position and which need additional support through an inhouse mobile engagement app.

The app is also used to encourage employees to benchmark their own performance and track their objectives. This promotes self-driven performance management and creates a self-assessing, feedback-seeking and objective-driven culture.

12.2 Developing Human Capital

DBS Bank believes that employees are the spark of the corporation embedding the spirit of imagination, sense of possibility and the courage to make digitization happen. According to the company's chairman, one of the key aspects in its successful digital transformation is the environment and culture of the people that embraces experiments and innovations (DBS Bank Annual Report, 2019). Its culture-enhancing strategies are well implemented through structured flow of information and deep employee engagement. DBS keep on modernizing its work practices with the use of cross-functional teams and agile problem-solving and collaborative approaches (Business times, 2019). It has a complete understanding of what it means to be digital, which includes extensive investments in creating a workforce that is receptive and able to harness technology in everyday uses. The corporation and together with its people set forth toward digital organization. With people at the heart of its digital transformation, DBS is readily on its way to reimagine banking so that customers Live More and Bank Less (Peplematters.in, 2018).

1. Creating Startup Culture

DBS Bank saw the opportunity to transform its workforce into an innovative, digitally-savvy and data-driven 26,000-person organization. They have launched a journey of culture change since early 2014 and it has become one of its key strategies called "Creating Startup Culture". The strategy is to learn how to operate like a startup company because startup companies are more

agile, simpler and better. The organization has tried to become a learning living organization, where people seek to reinvent themselves and are open to experiments. This core value has become the organization's culture and set its root deeply in the mindset of their people.

By the end of 2014, DBS Bank became ready for the next great leap toward digital transformation by re-architecting their systems to be cloud ready in respect of hardware and software.

2. DigiFY program

DigiFY, a mobile learning platform and online course intended to transform the company's bankers into digital bankers equipped with seven digital skills – journey thinking, agile, data-driven, digital business, digital technologies, digital communication and risk & controls (Efma, 2019). The training courses are offered to employees through the company's virtual university and DBS learning Hub. By the time employees achieve mastery in the three-part course, they are qualified to teach its precepts to their coworkers. Once the company decided it required digital bankers, it methodically set about defining, creating, supporting, measuring, and developing them.

3. Data Heroes program

The company has put great emphasize on building digital capabilities and has invested excessively to inculcate a data-driven mindset across the entire organization. According to the company's annual report in 2018, over 10,000 employees including over 900 senior managers were receiving trainings on data-related topics (DBS Bank Annual Report, 2018). In order to implement this strategy successfully, sever programs were created to enhance data-analysis acumen and equip employees with the skills a data translator, capable of translating business problems into analytics and designing digital interventions.

4. Artificial intelligence-powered e-learning

DBS has launched a new cloud-based learning management system called DBS Horizon, which is powered by Saba, a leading cloud-based learning management solution used by many leading organizations in the world. DBS Horizon leverages on artificial intelligence to create personalized course recommendations, and encourage employees to collaborate, create communities of interest, and engage in mobile education anytime, anywhere across the bank. The user-intuitive interface allows DBS employees to search for training or study programs to support their career aspirations and passions with ease.

To prepare the company's labor force for the future, a new digital curriculum was specially designed and built to help them learn about digital disruption and transformation via blended learning solutions, a combination of bite-sized e-learning modules and classroom sessions. Topics

covered include understanding the digital business model, adopting agile methodologies, journey thinking and how to use technology as business enablers.

5. Experiential learning

DBS employees are provided the opportunity to go on paid study leave to work on prototypes and start their own businesses. The bank also launches accelerator programs which give mentorship and funding to help these intrapreneurs develop their concepts into prototypes. By giving staff the chance to personally try building a business from scratch, DBS employees learn to think like digital natives. In addition, more than 2,000 DBS staff have participated in human centered design workshops and hackathons and conducted more than 1,000 experiments since 2015 (DBS Bank, 2020).

6. Grants and scholarships

GANDALF scholarships promote a culture of peer-to-peer learning, where employees can apply for a S\$1,000 grant to acquire a new skill of their choice and in return, they have to teach and share the knowledge to at least 10 people. DBS facilitate learning by creating innovation programs and partnering with schools and start-ups.

Additionally, other scholarship programs have been introduced by DBS in order to support the government's SkillsFuture Initiative (DBS, 2020). Staff are offered credits to learn new skills through customized courses designed by DBS or over 16,000 courses in the government's SkillsFuture Credit Course Directory.

7. Innovative learning spaces

DBS academy and DBS Asia X have been established as the company's latest innovation hub, spanning 40,000 square feet (DBS, 2020). Employees have access to a wide range of courses such as scenario-based leadership development programs and digital master classes.

DBS Asia X is built in a purpose as an innovation facility for its employees to gather, create and develop iconic customer journeys and collaborate with start-ups and wide-ranging FinTech community.

8. Recruitment events

DBS has developed a number of innovative recruitment events such as (DBS Bank Annual Report, 2019):

- Hack2Hire – a global coding challenge designed to recruit coders who are skilled at managing emerging and disruptive technologies across cloud, ML and big data.

- Hacker-in-Her – a recruitment events designed for talented women for tech roles.
- Paradigm Shift – a global virtual event designed for entrepreneurs, developers and students from around the world to sell their ideas and win prizes such as getting a chance to work at DBS, monetary prizes, meeting experts and other rewards (DBS Pshift, 2019)

9. Retaining Strategy

DBS Bank has been following this remuneration strategy to ensure attractiveness and motivation and to retain their employees to deliver long-term values. **Table 5** below shows the elements and the summary of an employee's total compensation.

Total Compensation	Fixed Pay	Variable Pay	Variable Pay
	Salary	Cash Bonus	Deferred shares/cash

Table 5 Compensation Formula (DBS Bank Annual Report, 2018)

Variable pay is performance linked and based on a balanced scorecard. It focuses on employee's achievement of objectives aligning to value creation. Deferred remuneration is paid in restricted shares and/or deferred cash and comprises of two elements – the main award and retention award.

12.3 Important KPIs

DBS Banked used balanced scorecard approach to measure how successful they are. The scorecard is based on the company's strategies and it is used to set objectives, drive behaviors, measure employee's performance and determine remuneration.

The scorecard comprises of traditional KPIs, Making-banking-joyful KPIs and Areas-of-focus KPIs. The table below shows selected KPIs in 2018 because these KPIs explain the position of the company in term of human resource management after implementing its HR strategies.

KPI	Target	Outcome
People engagement	Maintain employee engagement levels	The employee engagement score improved slightly to 83% in 2018 (See Appendix 3) and was ranked at the 87 th percentile in the Kincentric despite the fact that DBS still lacked in area such as rewards, enabling productivity, collaboration and follow-up survey.

People development	Provide people with opportunity for internal mobility to enhance professional and personal growth	Enabled people to broaden their exposure across businesses, functions and markets. 28% of positions were filled by internal candidates in 2018 (See <i>Appendix 4</i>).
Build a developmental and growth mindset	Drive a learning and developmental organization, improve leadership capabilities and employee experience	DBS Bank focused on upskilling its employees with targeted lessons like data analytics, training 7,000 staff across the bank.

Table 6 DBS Bank's Selected KPIs (Author based on DBS Bank Annual Report, 2018)

Additionally, the three selected KPIs above show how the bank monitors its performance and develops in these areas of focus. Priority was seriously given to improve these KPIs, which allow the company to track its efficiency in implementing its HR strategy to become digital.

13 Five Performance Objective Analysis

The analysis of five performance objectives investigates DBS Bank's operational performance and evaluate its performance efficiency. The five fundamental objectives are used to assess DBS Bank's performance after the implementation of its HR strategies for the digital transformation. The purpose of this analysis is to determine the organization's position from the perspective of operation and process in line with its HR strategy toward digitalization. Additionally, this analysis also determines the company's sustainability, its leading role in the industry and its readiness level to industry 4.0.

1. Quality:

Quality is considered as one of the most important objectives in performance management, particularly in the long run. In DBS Bank, quality is measured on the services provided to customers – customer satisfaction, security of the service, accessibility of the service and employees' capabilities. **Table 7** below summarizes the quality performance of DBS Bank in 2019.

	2019
Awards	World's Best Bank – Euromoney Bank of the Year (Global) – The Banker Asia's Safest Bank – Global finance Best Transaction Bank, Asia-Pacific – The Asset Global Innovator, Gold – Efma-Accenture Bloomberg Gender-Equality Index – Bloomberg Dow Jones Sustainability Index, Asia-Pacific – S&P Dow Jones Indices Regional Best Employer, Asia-Pacific – Kincentric Special Recognition Award – Excellence in Human Capital Management by Singapore Corporate Awards And many other awards and accolades.
Philosophy	DBS Bank's performance is recognized in the balance scorecard using key indices in terms of shareholders, customers, employees, digital transformation, reimagining customer experiences, other indicators.

Table 7 Quality Performance, (Author based on DBS Bank Annual Report, 2019)

- Customer satisfaction: DBS has achieved broad-based increase in customer satisfaction across markets and segments after improving its customer call centers and implementing the real-time data analysis and management.

Customer engagement measures (1-5 best)	2014	2019
Wealth Management	4.40	4.25
Consumer banking	3.93	4.23

SME Banking	4.09	4.30
Large corporates market penetration ranking (Only Asian bank in top 5)	N/A	4 th

Table 8 Customer Relationship Comparison (Author based on DBS Bank Annual Report, 2014; DBS Bank Annual Report, 2019)

- Digibank: it has become a success by allowing customers to open their accounts using their smartphones and by offering assistance and financial advice in large geographies. This system is very beneficial in markets such as Indonesia and India, where there are many underbanked regions.
- DBS has trained and equipped its employees with digital capabilities enabling them to create seamless journeys and deliver excellence in customer experience.

2. Speed

DBS has adopted a number of emerging technologies such as AI, cloud, big-data analytics, and other applications in the purpose of reducing the lead time of providing services to customers. Speed and accessibility are the essential aspects for the company because it is the company's core mission – customers live more and bank less.

- With the technologies, DBS employees work faster and more efficient. For instance, by using advanced data analytics, DBS is able to anticipate what customers will do next in their journeys and hence what challenges they may encounter. This allows employees to prepare and design products in advance.
- Thanks to smartphone apps and digibank technology, employees can communicate and assist customers online wherever they are. This enables efficient and smooth workflow.
- DBS is on its way to achieve its objectives of equipping all of its employees with digital skills. The more employees are digitally well-educated, the faster they can serve customers using the technologies.

3. Dependability

- Fault tolerance: during Covid-19 pandemic, the lockdowns affected a lot of business operations. However, DBS could still provide their services to customers through online banking. Employees can work from their home and communicate with customers without delays.
- Fault prevention: in 2019, DBS was awarded as the Asia's Safest Bank. With their well-trained employees, DBS can guarantee both finance and cyber security and this minimizes frauds and faults. Additionally, once analytic tools reveal most frequent complaints, the company can specifically train employees to assist customers in that matter.
- Fault forecast: big-data analytics of customer profiles allows DBS to predict possible challenges and issues during the next activities of customers.

- Fault removal: DBS puts customers at the heart of what they do, and this strengthens the relationship with their customers. Hence, whenever there exists any issues or faults, customers are invited to seek assistance from the bank through its customer care centers.

4. Flexibility

For more than five years, DBS have established training program and organizational culture for its employees. Their people have acquired strong fundamental digital knowledge and the adaptability in the ever-changing development of technologies. DBS Bank's human capital is the most important driving force in the journey of digitization full of uncertainty.

- Employees' flexibility: DBS has implemented a real-time management environment so that managers can see which employee needs support during business activities. This allows the company to deal with unexpected customer complaints or issues quickly. It also facilitates the workflow in the company.
- Service flexibility: DBS' strong labor force plays an important role during Covid-19 pandemic because the people are already well-trained for using cloud, data-driven and other technologies. During the lockdowns and social distancing, DBS managed to provide services online in virtual platforms.

5. Cost

The cost structure of DBS Bank mainly comprises of staff expense, interest expense, fee and commission expense, computerization expense and occupancy expense such as rental fees. Although cost is not the first important objective for DBS, it is necessary to maintain costs and at the same time improving quality, speed and dependability in their service.

- By becoming a technology company, DBS has reduced fixed infrastructure costs and has significantly increased energy efficiency, which leads to lower carbon footprint.
- Cost-income ratio in the whole company slightly improved from 45% in 2014 to 43% in 2019. However, the company spent a great deal of capital on its staff, reaching 6,258 million S\$ (DBS Bank Annual Report, 2019).
- Staff training is a one-time investment but yields long-term benefits to the company. Investing in developing digital skills will undoubtedly reduce operational costs and improve efficiency at long run.
- Internal mobility of talents reduces hiring costs and time on recruiting high-skilled people from external sources.

- According annul repot in 2019, digital customers generated twice as much revenue as traditional customers. Digital customers also sustained lower cost-income ratio and higher Return on Equity (ROE). **Figure 7** compares the cost-income ratio between digital and traditional customers from 2015 and 2019.

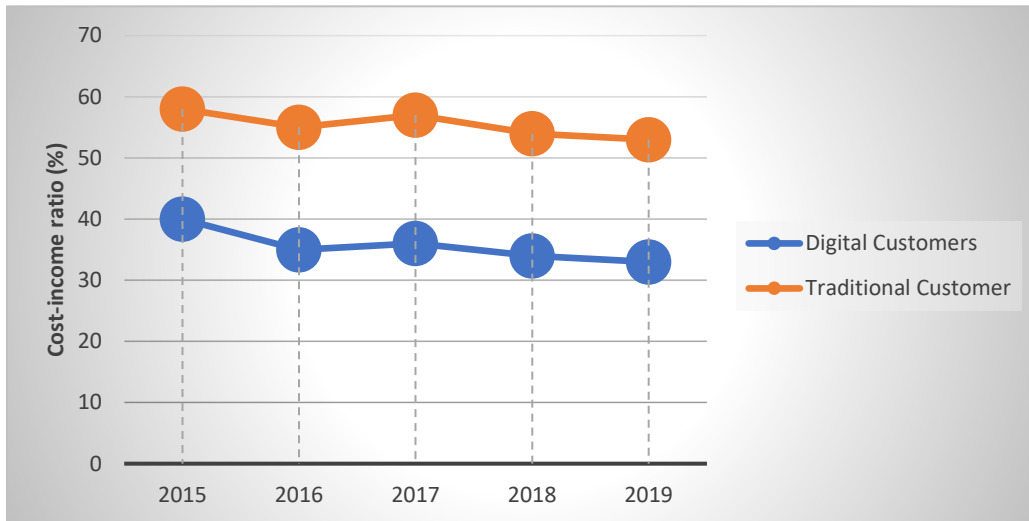


Figure 7 Cost-income ratio in percentage for Consumer and SME banking sectors (Author based on DBS Bank Annual Report, 2019)

14 Key Findings

Emerging technologies brought by the industrial revolution undoubtedly influence the performance of DBS Bank from both perspective of operation objectives and human capital. One of the main discoveries is that there is a deeply strong relationship between technology and human factors. Based on the analysis above, significant improvements in term of technological point of view are recognized and summarized as following:

- Quality
 - Implementing the technologies along with strong capabilities in people can create new business models and bring more added values to customers.
 - Multi-channel network is established to communicate and resolve customer complaints.
 - Technologies can fulfill some weaknesses of the company. For example, Digibank can cover large geographies that are underbanked, which increases accessibility of the service without costing the company.
 - Real-time management has enhanced employees' performance quality through self-assessment and objective orientation.
 - Big-data analytics allows the company to better design products and services by evaluating current trends in the business environment, customer feedbacks, and forecasting trends.
- Speed

Speed is hugely impacted by the industrial revolution. Data analysis, cloud, IoT and mobile applications are used to fasten the data flow and provide wider accessibility. Since the company is expanding, it is important to have efficient flow of such big data volumes.

- Real-time tracking and analytics accelerated real-time decision-making process, shorter lead time.
 - Digibank reduced travel time to branch and allows immediate access to the banking services.
 - Some technologies are not user-friendly, so if the staff are well-trained, they can leverage on the applications without any issues.
- Dependability

In terms of dependability, the industrial revolution contributes to keeping more reliable services and performance by maintaining:

- Transparency of performance
- Low error rate
- Non-physical communication
- High customer satisfaction by allowing wide accessibility anytime

- Accuracy of forecasting – trend forecast, fault predictions or fault repetition.
- Flexibility

This aspect determines the company's ability to adapt to fast-changing environment in a competent way without great losses and risks. The concept of industry 4.0 basically is designed to support and make organizations flexible.

- By adopting those emerging technologies, specifically big-data analytics, companies can make more accurate prediction with the massive amount of data collected.
- Virtual or online platforms help organization achieve adaptability in dealing with unexpected crisis such as Covid-19.
- Companies as well as employees can provide flexible products or services through real-time management and integrated systems.
- Cost

Becoming a digital company is a very long journey for DBS as well as any other companies. It requires a great deal of efforts and investments in terms of money, time and people. Hence, adopting the technologies can both positively and negatively impact the company.

Advantages	Disadvantages
Improving efficiency	High installment cost
Cost effective in operational activities	Rise in staff wages
Reducing recruitment cost and time	Increase of expense in staff training and development
Reducing lead time in operations	Requirement of long-term investments on human capital

Table 9 Cost advantages and disadvantages of I4.0 (Author, 2020)

Since technologies and human capital are interdependent, DBS Bank took many efforts to develop its people and equip them with the relevant set of digital skills. The philosophy of the company is that human capital is the heart of the transformation. According to the case study of DBS, a list of creative HR approaches is summarized below:

- Creating an open-minded and learning culture in organization
- Establish a friendly learning environment that promotes the flow of knowledge
- Investing in re-training and staff development in digital skills
- Creating innovative programs to support the company's strategies
- Leveraging on new technologies to create new ways to develop people
- Promoting diversity in workforce in terms of skills and genders

- Prioritizing human resource development as a top on the list to prepare for digital transformation

Having first improved and shifted its workforce and organization culture toward digitization, DBS Bank has proved to be a successful digital transformation. The HR strategies and training programs that have been developed have served the company very well in line with its goal to become a smart company and at the same time, they have provided improvements in operations in respects to quality, flexibility, dependability of the services, speed and costs for the company.

15 Recommendations

This chapter provides possible recommendations for future development of DBS Bank toward industry 4.0. Despite the astonishing advantages of Industry 4.0, companies should not overlook the necessary aspects that build around digitalization, especially the human factor.

Technology should not come before human capital

Human and technology are the two main driving forces in Industry 4.0, and they should advance together. Companies with merely high technologies and without capable workforce cannot fully benefit from this industrial revolution. DBS has started out amazing great as it placed its people at the heart of the transformation. Consistent investing in re-training and hiring new talents from various sources and regions are recommended to sustain this leading position.

Digital transformation is journey for both companies and customers

Implementing new technologies can create new values in business and bring new experience for customers. According to the finding in the case study of DBS, Digibank has created a new customer segmentation – digital customers, which can be reached in vast geographies including rural and underbanked areas. With this advantage in hand, DBS should keep on involving its customers in this journey by providing new customer experience and values through technologies like virtual banking and more.

DBS should implement Human Resource Management 4.0 concept by leveraging on the technologies.

This new management in HR focuses more on strategic issues and organizational improvement and at the same time HR becomes more automated. It is necessary to design encouraging and smart working environment, which can greatly influence on retaining and attracting current and prospective employees. Additionally, DBS should adopt innovative virtual solutions to help in people management and talent recruitment with more analytical and less operational performance – for instance, SmartHR and more.

Conclusion

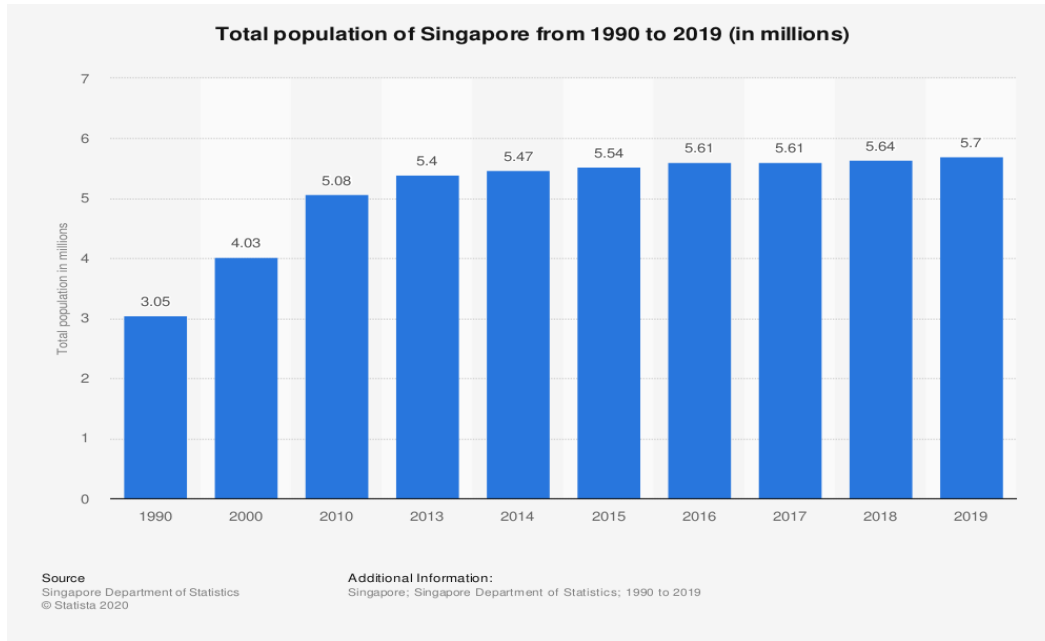
The aim of the bachelor thesis is to determine significance of human capital and its relationship with technology toward Industry 4.0. With the application of PEST, SWOT, analysis of the five performance objectives, the purpose was fulfilled by studying a practical case study of DBS Bank Singaporean, which have successfully become a smart company.

The theoretical backgrounds reveal the concept of the Industry 4.0 and its driving technologies and their applications in various industries. Despite their advantages, adopting such technologies puts companies in the face of many challenges from immense financial requirements to lack of in-house talents. The theoretical part also highlights the importance of human capital as one of the key enablers in the Industry 4.0 transformation. Additionally, for this new era of technological advancement, the new demand of human competencies is also discussed. Furthermore, the paper elaborates on operation management and strategic tools which are relevant to the analysis conducted in the practical part

The practical part is devoted to analysis of DBS Bank, its Human Resource strategies and its performance. It also serves as an overview of how the speed, quality dependability flexibility and costs are affected by the company's HR strategies toward digitization. In addition, the analysis of the macro environment via the PEST is provided to identify the possible external factors that influences the company's decisions. PEST analysis reveals the importance of the consumer shifts, external forces and trends within financial industry. Moreover, the study of the company's HR strategies along with SWOT analysis impressively disclose the successful approaches to be taken in becoming Industry 4.0.

To sum up, technological factor and human capital are deeply interdependent and are the key enablers in Industry 4.0. By improving technology, a company indirectly improve its labor force and their efficiency. Likewise, by developing and training human capital, the company has positioned itself better to adopt new technologies which together with smart and strong human capital can create prosperity and growth for the company.

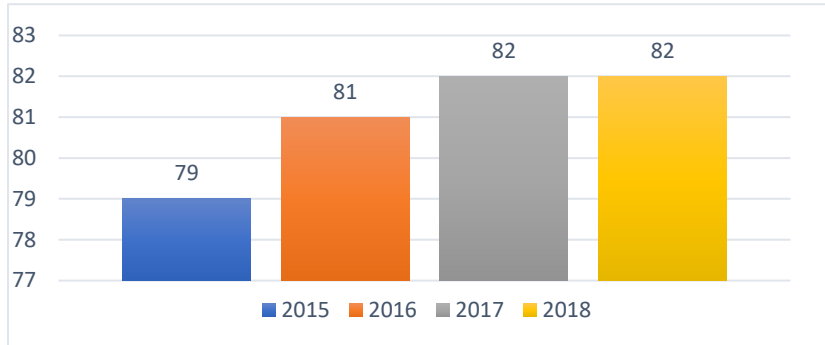
Appendices



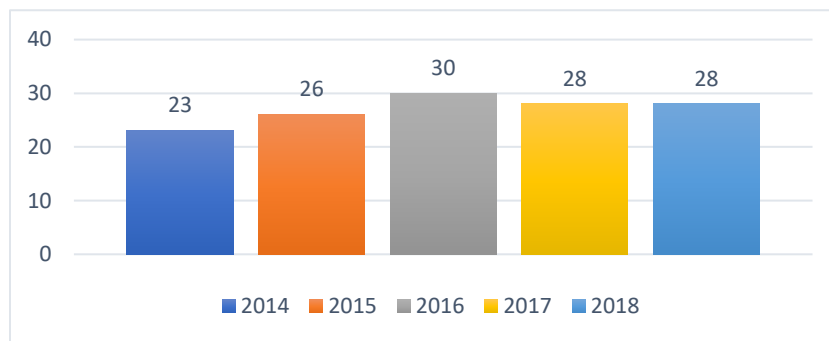
Appendix 1 Singapore's Population

Variables	Total	Agricultural & Food Sciences	Engineering & Technology	Biomedical & Related Sciences	Natural Sciences (Excl Biological Sciences)	Energy	Others
2007	6,326.3	70.1	4,166.5	1,057.6	586.9	na	445.2
2008	7,113.6	95.1	4,872.4	1,062.5	584.2	na	499.4
2009	6,012.9	92.9	3,720.4	1,243.9	649	na	306.8
2010	6,315.2	108.5	3,848.6	1,361.7	738.1	na	258.4
2011	7,275.6	155.1	4,564.1	1,357.8	857.7	81	259.9
2012	7,078.1	200	4,336.3	1,403.6	834.6	101.8	201.8
2013	7,402.4	210.3	4,451.9	1,367.6	927.3	108.1	337.3
2014	8,316.6	262.9	4,843.4	1,578	1,103.2	122.4	406.6
2015	9,239.5	267.6	5,745.6	1,762.3	1,059.1	149.6	255.3
2016	9,140.2	280.8	5,664	1,777.8	950.3	152.3	315
2017	9,085.9	291.9	5,688.5	1,725.2	900	139.4	340.9

Appendix 2 Singapore R&D Expenditure by Area of Research in million dollars (Department of Statistics Singapore, 2020)



Appendix 3 Employee Engagement Score (DBS Bank Annual Report, 2018)



Appendix 4 People Development KPI (DBS Bank Annual Report, 2018)

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