





Sustainable competitive advantage through technology and innovation systems in the local government authorities



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Background: Managers in companies often do not know about modern techniques and design tools for creating technological and innovation processes, and about the possibility of their usage for effective management and decision-making.

Aim: This study seeks to establish if there are eminent gaps in managing sustainable competitive advantage (SCA) through technology and innovation systems, and its impacts on service delivery in influencing business survival in an unprecedented and unavoidable competitive business world environment, and to build up the impact of these gaps on business performance.

Setting: It is essential to have a realistic vision and practical approaches to the management of technology and innovation for SCA and goal-oriented objectives for city governments.

Methods: This study examines applicable and accessible literature whilst using a secondary research analysis methodology to examine the objectives and research issues of the investigation.

Results: It is concluded that managing technology and innovation for SCA is not a means to an end, but a set of tools and strategies to ensure proper service delivery to the people and communities.

Conclusion: This research study endeavours to provide a significant positive impact to business success and additionally, for the improvement of technology and innovation of an organisation. A fundamental issue for industrialisation and governments is the need to support innovation and change amongst industry individuals with a specific end goal to build efficiency and upgrade the business' competitive position.

Keywords: sustainable competitive advantage; gaps; metropolitan cities; municipalities; Taiwan; technological innovation capabilities.

Introduction

The concept of competitive advantage has changed over time as a result of the technological innovations and modernisation. The organisation's innovation capability is presently being contemplated as a standout amongst the most significant tool towards development and sustainable competitive advantage (SCA) (Leonidou et al. 2020; Yoon et al. 2018). Utilisation of technology and developing this strategy will help the organisation to adapt itself to the dynamic condition and improve its competitive position (Li et al. 2020b; Santoro et al. 2018). Furthermore, it enables the organisation to enhance business reputation, particularly that it would be less demanding for them (organisations) to offer quality merchandise and improve business undertakings or activities, while increasing efficiency and amplifying benefits (Knudsen et al. 2021; Wei, Fen & Zhang 2017).

Although technological development is a procedure, overhauling innovation capacities is a ceaseless assignment for the organisation (Foss & Saebi 2018). It involves a dynamic evolution of planning and research in improving capabilities or increasing utilities. Its concentration is for the usage and improvement of technology, product, process, knowledge, experiences and organisation (Ferreira, Mueller & Papa 2020; Knudsen et al. 2021). These factors will eventually determine whether the clients/customers are satisfied with the organisations services. Innovation is irreplaceable to modern-day organisations. An organisation's technology invention and its capacity to recognise, distribute and use information specifically influence its competitive

advantage (Alavi & Leidner 2001; Hoosain, Paul & Ramakrishna 2020). Organisations are frequently thought to be a critical building-block in the modern knowledge-based economy (Cummings 2004). In that capacity, organisations have made critical investments in actualising an information management ability that is particularly intended to help the sharing of information management amongst individuals within an organisation (Rodrigues & Fanco 2021).

As an end result of this research study, the management of organisations ought to have a superior comprehension of the conceivable outcomes and impediments of overseeing or managing technology and innovation that would affect business survival in a fierce situation (Ghezzi & Cavallo 2018). Experiences will be picked up by concentrating on the predominant strategies for managing SCA through technology and innovation in the context of local government authorities or metropolitan cities and municipalities (Laihonen & Mäntylä 2018). Furthermore, procedures and specifications can be originated from the outcomes of the research study. Local government authorities or metropolitan cities and municipalities may benefit from this research project, by discovering suggestions and the way forward for the forthcoming studies in the more extensive scope of managing the competitive sustainable advantage through technology and innovation deliberated in this study. The lack of demonstrated knowledge in managing SCA through technology and innovation could be an ideal opportunity to business competitors who have progressively turned off in their respective businesses due to business intensity and competitiveness (Del Vecchio, Secundo & Passiante 2018). This research study endeavours to act on these oversights and provide further bits of knowledge into the handiness and potential outcomes of managing SCA through technology and innovation that would impact on commercial existence in a tempestuous economy.

Technological innovation activities involve the following:

- Obtaining and producing important information new to the organisation (Ferreira et al. 2020; Zhao et al. 2019a).
 - Research and exploratory improvement (Rodrigues & Franco 2021).
 - Acquisition of disembodied technology and expertise (Sousa & Rocha 2019b).
 - Acquisition of embodied technology (Sousa & Rocha 2019a).
- Different arrangements for new procedures or for creating new products, that is, activities for tooling up (i.e. to provide (a factory) with machines and tools for producing something) and industrial engineering, industrial plan, and creation startup. This may also include other consumption for pilot plants and models not effectively incorporated into research and development (R&D) (Chatfield & Reddick 2017; Klette & Møen 2012; Santoro et al. 2018).
- Promoting new or enhanced products. Activities regarding the launching of a technologically and innovatively new or enhanced product (Li et al. 2020a). These might incorporate

starter statistical surveying, showcase tests and dispatch publicising, yet will prohibit the working of circulation systems to promote innovations (MOST 2018; NSTS 2018).

Confronted with a spate of unpredictable competitions threatening business survival, local government authorities or metropolitan cities and municipalities suffer indescribable strain to resolve this issue by concocting plans of action that in any event guarantee ensured excellent management of technology and innovation for sustainable competition, in the wake of significant financial difficulties (Chatfield & Reddick 2017; Hussain 2021; Safarov 2021).

This research seeks to establish if there are eminent gaps in managing SCA through technology and innovation systems and its impacts on service delivery in influencing business survival in an unprecedented and unavoidable competitive business world environment, and to build up the impact of these gaps on business performance. There are unreciprocated inquiries, tending to estimation issues. An exploratory field research is expected to address the gap between applied issues and viable arrangements, distinguishing and depicting usually utilised methods for managing SCA through technology and innovation systems and their effect on business survival in an unprecedented and unavoidable competitive business world environment.

Related literature review

Technological innovation: The concept

The concept of technological innovation stems from the scholarship of innovation studies and it explains the processes of technological change and its implications thereof. Initially, Freeman (1995) and Hoosain et al. (2020) maintained that this concept was introduced under the scholarship of Innovation System Approach (ISA) which maintains that the broad technological innovations are rooted in societal structures where the firms are based as opposed to niche firms or research institutions as the foundations of technological innovation. Freeman (1995) also noted through societal studies, that the society has significantly been influential in bringing about technological change which positively impacts on economic development and change. However, although this is seen as an important aspect for development, scholars such as Suurs (2009) noted that it is equally important to consider that knowledge flows through R&D are not really sufficient to induce technological change as well as the development of an economy; hence it is also important to consider niche research areas as stimulators for innovation (Bansal et al. 2019). Overall, technological innovation, when focussed in terms of system dynamics, is broadly seen as a vital element in the competitive status of an organisation, and is seen in the organisational structures, processes, goods and services in an organisation (Bolger & Doyon 2019; Guan et al. 2006; Zhao et al. 2019b). In light of these research studies, technological innovation is said to be related to the

management of the components of the organisation through knowledge management, techniques and skills improvement with the whole intention of increasing the competitiveness of the business entity (Guan et al. 2006; Mikalef et al. 2019).

In another study, Walsh and Linton (2002) maintained that technological innovation refers to the manufacturing process whereby a company allows itself to quickly react to any changes in the operations. On this end, the reaction of an organisation to an environmental shift must be swift and efficient such that the lead times of the organisation will remain unchanged and that should also be done at as little cost as possible (Kumar & Bhatia 2021). Scholars such as Burgelman, Christensen and Wheelwright (2004) argued that technological innovation does not simply mean a swift change as a result of changes in the operating environment of a business, but is actually a continuous process where an organisation must choose, diffuse and improve its technology on a daily basis (Sousa & Rocha 2019a). Thus, the process involves the accumulation of experience relating to the use of technology in the business entity and the application of important improvements (either through internal or external knowledge) in the process of using the existing technology (Burgelman et al. 2004; Warner & Wager 2019). This description is echoed by Archibugi and Coco (2005) who opined that the aspect of technological innovation refers to the ability of an organisation to access, acquire and make use of relevant external knowledge uniquely for the benefit of the organisation. This can be done in a way to improve the organisational products line or developing and launching new products into the market (Archibugi & Coco 2005). Whilst the discussion is continuing, scholars such as Yam et al. (2004) maintained that there are seven dimensions that are essential in technological innovation and they include: technology learning, R&D, resource distribution, manufacturing capacity, marketing skills, organisational skill/stratagem, and scale correlated capability.

From all these studies, one can come up with a conclusion that technological innovation is a multi-faceted aspect and it tackles the acquisition of new products or processes, or broadly speaking, change management – through the use of technology (Yang 2019). Through technological innovation processes, organisations acquire commercial benefits through a strategic selection, implementing and utilisation of the available technologies employing a benchmark of their competitors in the market (Shin 2019). Considering these contemporary explanations on technological innovations and its implications on competitiveness, early scholarly articles also raised similar arguments. In fact, current scholarly articles on technological innovation build upon the early works on this subject (Zhang et al. 2018). Seminal works by Schumpeter (1934) and Kastranekes (2019) talked about innovation as involving new products and services, new methods of producing and distributing goods, new sources of customers and suppliers, exploration of new markets as well as new organisation of businesses.

Theoretical frameworks on technology, innovation and competitive advantage

Considering the literature reviewed thus far on the impact of technology and innovation on competitive advantage, two underpinning theories are proposed for this study namely, knowledge management theory and Porter's Five Forces Model.

Knowledge management theory

Knowledge management theory consists of the methods, practices and technologies that are used in an organisation in the course of fulfilling their goals (Krogh 1998). The review of literature shows that there are several paradigms that are put across to explain the implication of knowledge management in the organisation and its impact on the performance of enterprises (Lamberts & Shanks 1997). By definition, knowledge management is a field that looks to enhance the accomplishment of people and organisations by keeping up and utilising the present and future value of knowledge assets. Knowledge management systems (KMS) incorporate both human and automated activities and their accompanied items (Heisig et al. 2016). Considering this definition, knowledge management attempts to balance the organisational activities and the technological innovations available in a way to create value to the organisation and the customers (Yoon et al. 2018). Thus, knowledge management theory explains the extent to which knowledge flows, that is, how knowledge is transformed from one form to another using the available resources (Ferreira et al. 2020).

The knowledge management theory specifies that knowledge is divided into four activities which include: knowledge creation, retention, transfer and utilisation. In terms of knowledge creation, Moss (1995) noted that it includes every one of those activities and procedures that are utilised in the organisation to present new information, disclosure of vital techniques and the act of capturing them into the overall framework. Knowledge creation in this study can be explained by technological innovation in the organisation and how it is introduced in the business processes to take advantage of the prevailing market conditions. On the other hand, Moss (1995) stated that knowledge retention incorporates all activities that save information and enable it to stay in the framework once presented. It likewise incorporates those tasks that keep up the feasibility of learning inside the framework. On this note, retention of knowledge can be the application of knowledge data or systems in the organisation that allows the use of experts when they are needed (Carayannis et al. 2016).

In addition, knowledge retention in this study can also be described by the existence of technologies which enable data to be stored and then used for future purposes. Research by IBM (2013) has also identified storage devices as major developments in the current technological era. Knowledge transfer as a factor under KMSs involves the transfer of knowledge from one point in the organisation to the other (Newman 1997; Wehn & Montalvo 2018). This can be

explained by the use of technological devices available in the organisation such as mobile devices, cloud, social media and computer gadgets.

Lastly, knowledge utilisation in the organisation incorporates all of the activities inside the organisation that are associated with the use of information for business practices. Knowledge management theory also states that there are several artefacts and agents that are involved in the process of knowledge acquisition and transference (Laihonen & Mäntylä 2018). Artefacts arrive in an assortment of structures, including archives, records, papers, discussions, pictures, considerations, programmes, databases, email messages, informational indexes, winks and gestures, and whatsoever otherwise can be utilised to speak to significance and comprehension. In other words, information curios stream amongst and frame the relationships amongst the exercises and occasions that contain learning streams (Ranga 2018)

On the other hand, knowledge artefacts do not perform activities and decide. Activities and choices are embraced by operators: individuals, associations, or sometimes, innovation. Specialists complete all of the activities and show each and every one of the practices inside a learning stream (Santoro et al. 2018). What is important in the field of technological management and innovation is the actions of automated agents which consist of human and technological devices that have the capacity to retain, transfer and transform knowledge artefacts (Turner 1994; Wiig 1995).

Porter's five forces theory and competitive advantage

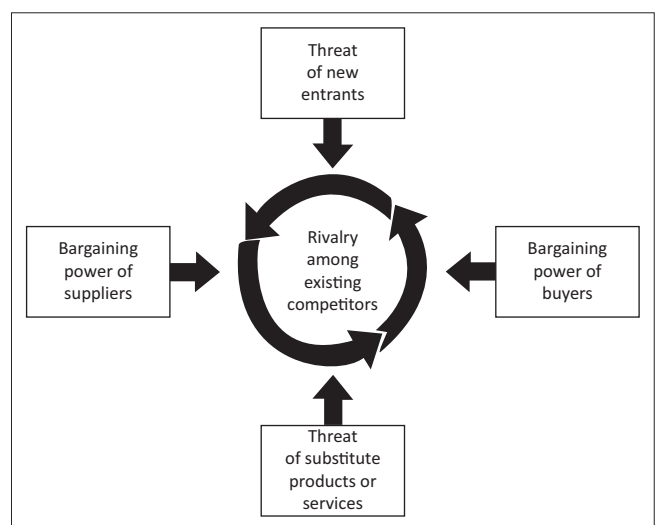
The discussion about technological innovation thus far has shown that organisations can adopt various technologies in order to gain competitive advantage in the industry. Porter's Five Forces theory discussed in this study determines the success and competitive standings of an enterprise if they are taken into consideration for their benefits. The following section discusses how Porter's Five Forces can be conceptualised as literature for this study.

Technological innovations can be used to increase buyer's power for a specific product or service – the preceding discussion has shown that the consumers are always faced with various choices especially in cases where there are many suppliers and substitutes for goods and services (Porter 1996, 2008). In light of this, it is the onus of the business to ensure that they make use of the available technology to influence consumers' choices and propensity to purchase their products in the face of several suppliers. In doing so, technological innovation can be used by a business to attract customers' attention towards available goods and services. The use of digital media such as billboards and television as well as social media such as Facebook, YouTube and other social sites has gained ample attention in the contemporary markets and has led to the development of online businesses where all the business transactions and delivery processes are done virtually (Ellison & Boyd 2013). These digital platforms make it easier for organisations to market their products and therefore more

benefits are obtained if the organisation has positive reviews and also in cases where there are high number of referrals through electronic word-of-mouth (Ghezzi & Cavallo 2018; Kohtamaki et al. 2019; Zhu & Zhang 2010). Therefore, technological innovation, if effectively implemented, enables an organisation to attract more customers online and face competition in the industry in which they are operating in (Kauffman & Naldi 2020).

Furthermore, technological innovation can also be used to reduce suppliers' bargaining power – the preceding discussion has shown that suppliers can have a bargaining power if they are sole players in the industry and if there is an absence of close substitutes (Porter 2008) as indicated in Figure 1. In light of this, they can influence the prices, supply as well as the overall profitability of the industry. However, with the use of technological innovation, it is possible to reduce the suppliers' bargaining powers over prices and supply. Technological infrastructure in business organisations enables it to decrease suppliers' power and locate alternative sources of supplies at a limited cost. Several online stores such as Amazon, eBay, Sahara and Bid or Buy, enables businesses to find more suppliers in their niche. In doing so, the businesses will have variety of information at their disposal and they will have wide choice to select from available suppliers, thereby surpassing the bargaining powers of monopolistic suppliers (Ramey 2012).

On the use of technological innovation to create entry barriers, Porter's Five Forces Model has shown that barriers to entrance into a particular market is a challenge facing many firms because it bars them from accessing particular customers. However, as Ramey (2012) stated, an organisation can actually use available technology to create barriers for the competitors to enter the available markets. This is because the easier it is for a business to easily penetrate the existing market the more vulnerable the competitors are to face intensive competition which eventually drive them out of business. Consequently, the available technological innovations should be carefully



Source: Porter, M.E., 2008, 'The five competitive forces that shape strategy', in *Harvard Business Review*, pp. 24–41, Brighton, MA.

FIGURE 1: The five forces that shape industry competition.

implemented by the existing organisations to ensure that they stay ahead of their competition and make it difficult for other competitors to enter into their markets (Broekhuizen et al. 2019; Ramey 2012). At this end, Ramey (2012) noted that some of the best organisations like Google, Facebook, Coca-Cola, Apple, Nike, Amazon, Dell, Microsoft, and Zappos have utilised innovation and technology to persist as a frontrunner of the market. They have found out techniques for obstructing or hindering rivalry, and this has granted them competitive advantage in the market.

Environmental dynamism, industry 4.0 and the role of organisational and technological factors

Organisations are presently undergoing transition with the expected automated, autonomous, and intelligent production systems (Schumacher, Erol & Sihni 2016). Limited resources, market demographic shifts, and globalisation are all driving forces behind this development (Prause & Weigand 2016). Global market competitiveness, shorter product lifecycles, changes in consumer expectations, and other reasons have all contributed to this shift (Fatorachian & Kazemi 2018). Customers' expectations have risen as a result of the digital era, because they desire innovative and customised items at a rapid speed (Gillani et al. 2020). From this perspective, organisations have begun to implement new technologies in this area in order to provide clients with products at cheaper costs, with more personalisation, and in higher volumes (Das Neves et al. 2015). The main goal of implementing these new technologies is to ensure that industrial systems are digitally connected, resulting in streamlined production processes and better decision-making (Bibby & Behe 2018).

To address the afore-mentioned issues, academics and professionals are increasingly considering Industry 4.0 (I4.0), sometimes known as the 'fourth industrial revolution'. (Liao et al. 2017; Ritter & Pedersen 2020). Industry 4.0 is 'a new approach for controlling production processes by providing real time synchronization of flows and by enabling the unitary and customized fabrication of products' (Kohler & Weisz 2016). It includes technologies such as cyber-physical systems (CPS), internet of things (IoT), cloud computing, big data, and so on. (Fatorachian & Kazemi 2018; Luthra et al. 2020). These technologies collect and analyse real-time data, giving systems critical information (Wang et al. 2016). They aid in the real-time dissemination of information, allowing operations to be controlled in response to market demand fluctuations (Moeuf et al. 2018). These new age technologies have the potential to change the way we plan and regulate our production. They can also help with resource allocation efficiency by exchanging real-time data, resulting in more sustainable development (Stock & Seliger 2016), and greater market performance (Li et al. 2020b).

Organisations respond to external and internal contingency factors by taking measures and implementing new strategies (Powell 1992). The environment in which an organisation operates has a big impact on how quickly new technology and processes are adopted (Gillani et al. 2020). Regulations, competitive pressures, changes in customer demand, and

other external events can all have an impact on how organisations implement their goals (Jayaram, Oke & Prajogo 2014). In view of the fact that organisations have a variety of options and may use different techniques to increase performance, it is critical to understand why companies would use I4.0 technology to achieve so. As a result of frequent changes in customer demand, shorter product lifecycles, changes in government rules, increased rate of innovation, and other factors, today's businesses face a high level of market dynamism (Chan et al. 2016; Li et al. 2020a). Environmental dynamism (ED) refers to 'the instability or volatility of a firm's environment' (Li et al. 2020a), and has been considered as one of the most important situational elements in dynamic capabilities theory (Frank, Dalenogare & Ayala 2019). Organisations must modernise in terms of technology to maintain a degree of fit in a dynamic market environment and sustain a competitive advantage (Gunday et al. 2011). Organisations that are knowledgeable about the latest technology and keep a close eye on market changes can stay ahead of the competition (Chan et al. 2016). Industry 4.0 technologies can assist organisations to survive in a changing market environment by reconfiguring and optimising processes, as well as providing customers with personalised, high-quality, and low-cost products whilst also addressing environmental concerns. This can also help marketing managers supply clients with well-balanced solutions for new product offers (Ritter & Pedersen 2020).

Organisational factors

For every business to perform operational responsibilities and offer internal strength, organisational structure is critical. Process standardisation, operational flexibility, technology specialisation, and workflow formalisation are all benefits of a successful organisational structure (Pugh et al. 1968). A proper blend of organisational competencies and resources is required to maintain the balance between operational and economic performance in order to achieve sustainable success for any business (Székely & Knirsch 2005). Market performance, financial performance, and operational performance all have a significant role to play in an organisation's long-term viability. Industrial revolutions necessitate not only the progress of technological skills, but also organisational thought and its associated variables. Organisational factors, together with progressive working procedures or guidelines, can lead to the acquisition of smart and intelligent human resources who can aid in the evolution of an organisation's technical leadership (Gupta et al. 2020).

Technological factors

In organisations, technological factors refer to having an in-depth understanding of a certain technology as well as experience in dealing with it (Gupta et al. 2020). Artificial intelligence (AI), machine learning, blockchain, data science, and a better understanding of programming languages are amongst the technologies involved (Davenport 2014). The majority of organisations are unable to accept and capitalise on a new technology. This is because of the fact that organisations

purchase technology without considering whether or not it would benefit them in their operations. They acquire the technology because one of their competitors has purchased it, or because the technology is a hot topic at the time of adoption. According to studies, it is not only technology that will aid organisations, but it is also the alignment of technology with the business that is most vital for any corporation (Gupta & George 2016). Employees must be taught how to use a specific technology and how to think critically (Prescott 2014). This must be done in conjunction with technology and related technological breakthroughs. Only then can the desired results be attained (Dubey et al. 2019).

Research design and chosen methodology

This study examines applicable and accessible literature whilst using a secondary research analysis methodology to examine the objectives and research issues of the investigation. The primary goal of preferring this technique was to enhance the validation (legitimacy) and accuracy of the investigation by triangulating the data analysis from the investigation methods utilised and limit errors and prejudices (Bonoma 1985; Parkhe 1993). The second objective was to guarantee that the study took after replication rationale, affirm or disconfirm hypothesis through offering a full assortment of substantiation. The third objective was to give a basic point of view in the investigation by acquiring relevant information on managing SCA through technology and innovation systems, and its impacts on service at Kaohsiung City Government (KCG), Taiwan.

A comprehensive secondary data analysis technique was exploited in this research study. The subjective research technique is utilised to assist answering inquiries concerning the nature of phenomena with the motivation behind depicting and understanding them from the secondary data analysis point of views. Denzin and Smith (1998) alluded that 'qualitative research is multi-technique in emphasis, comprising an explanatory, real-life way to deal with its topic'. In other words, the qualitative research methodology helps the analyst to assess things in their natural surroundings, endeavouring to understand, or interpret occurrences concerning the consequences individuals carries to them. Furthermore, this research is not restricted in esteem; rather, it gives a comprehensive investigation of the subject area being considered (Bryman & Bell 2015).

This study collected secondary data through comprehensive analysis of various secondary data sources such as workshops, document analysis and review or desktop study, official statistics, technical reports, scholarly journals, literature review articles, trade journals, reference books, government documents, research institutions, universities, libraries, inter alia, in order to obtain relevant secondary data from management information systems (McCaston 2005) on a convenient basis from the Taiwanese Nationwide

Document Delivery Service (NDDS), through the Science and Technology (S&T) Policy Research and Information Center (STPI) under the Ministry of S&T, that concerns about the KCG, Taiwan. The measuring instrument for this study was determined after a thorough literature review had been carried out.

The compressive and detailed secondary data analysis was critically analysed, scrutinised and evaluated for completeness and consistency. The results from secondary data analysis (of diverse secondary data sources) were organised into themes as a result of their qualitative nature and then compiled appropriately for analysis. The descriptive analytical methods such as frequency (both absolute frequency and relative percentage) were utilised to define the outcomes.

Result and discussions

Taiwan's science and technology development vision and strategies

As per the Fundamental Science and Innovation Act, the government must hold a National Science and Innovation Gathering once at regular intervals to discuss about the nation's future S&T improvement outline in light of national advancement headings, the necessities of society, and a craving to keep up adjusted territorial advancement, and decide a National Science and Innovation Development Strategy, which fills in as a reason for the drafting of S&T strategies and the advancement of logical and mechanical R&D. In like manner, at the tenth National Science and Innovation Meeting, which was held 05–07 December, 2016, people from industry, government, the scholarly world, and the research network together talked about and pounded out the nation's future S&T advancement headings. The tenth National Science and Innovation Gathering had the central subjects of 'knowledge, low carbon, wellbeing, and sustainability', and inclined to the three pivotal topics of the framework condition, ingenious living, and monetary advancement. The consequences of the gathering were consequently used to define four noteworthy S&T advancement destinations, which comprised of 'dependence on development to recapture financial force', 'fortifying smart living S&T and industry', 'developing and drawing in ability and giving assorted channels to headway', and 'sustaining inventive logical research biological communities', and significant procedures and measures were likewise drafted.

Mission and vision of the Kaohsiung City Government

Kaohsiung City is regarded as the main leading-edge modern and industrial harbour or city in Taiwan with the world's most imperative loading port. Taiwan made the 'Taiwan Supernatural occurrence' when the island developed as a world pioneer in assembling in the 1960s. Kaohsiung was the business motor behind the wonder. In the 21st century, Kaohsiung is focused on accomplishing a harmony between the economy and environment, amongst industry and

development. The city is currently growing innovative, ecological insurance, low-carbon, efficient power vitality, social and imaginative businesses, and quickening the updating and changing of conventional substantial enterprises. Kaohsiung is currently fabricating its ability for what is to come. Kaohsiung has a huge potential for advancement from all perspectives, and be able to fill in the gap as the best strong harbour for financial specialists to future investigation in both the Asian economy and market (KCG 2018).

The role of organisational structure and duties of city government in supporting technology and innovation

Organisation system and duties: The change of hierarchical affairs of KCG depended on the full-scale vision created in an incredible Kaohsiung region. The City has an all-inclusive deliberation of the social attributes of the province and city organisation, business obligations' disposition, economic and ecological changes, and in addition the requirements of adversity deterrence measures, rebuilding of disaster-hit spots, and redistribution of basic living circle after restructuring (KCG 2015, 2016). The study has also revealed that when it was guaranteed that the rights and benefits of staff individuals were totally secured, organisational alliance was completed, setting up 23 bureaus, namely, Civil Affairs, Finance, Education, Economic Development, Marine, Agriculture, Tourism, Urban Development, Public Works, Hydraulic Engineering, Social Affairs, Labour, Police, Fire, Public Health, Environmental Protection, Mass Rapid Transit, Cultural Affairs, Transportation, Legal Affairs, Military Service, Land Administration, and Information; four offices, namely, Secretariat, Accounting and Statistics, Personnel, and Civil Service Ethics; and three commissions, namely, Research, Development and Evaluation, Indigenous Affairs, and Hakka Affairs, having a total of 30 first-level agencies. In addition, there are 35 regional offices, 3 mountain indigenous regional workplaces, and 145 subordinating offices, with an overall of 213 offices and 357 schools of various levels (comprehensive of open university and kindergartens) (KCG 2015, 2016).

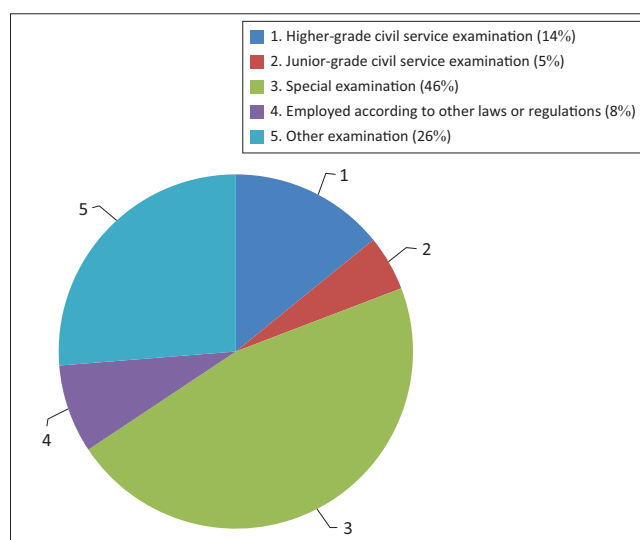
Disposition and number of civil servants in the Kaohsiung City Government: The study revealed that the staffing of every department or school of the City government depended on the observation for the genuine business needs and monetary weight. Under the standards of 'adaptability, insightfulness, efficiency', mindful and rational recruitment was made. The study found out that in 2016, there were 37 staff working in the head office of the City government, 6034 staff working in the first-level departments, 14 984 staff working at the regional offices (excluding mountain indigenous regional offices) and second-level departments, and 23 613 staff working at the schools of various levels, their status in terms of age, their education levels and their civil services examination, with a sum of 44 631 staff hired (KCG 2016).

The study has also revealed that the staff members of different departments of KCG have passed different examinations. Whereas 47% have passed the special examination, with 26% passed other examination and 14% have passed the higher-grade civil service examination. Only 5% have taken or passed junior-grade civil service examination as indicated in Figure 2.

Effect of government, policies and regulations on technology strategy

Government strategies and different guidelines, ideologies and directions may affect the company's technology and innovation systems and its efforts to endeavour towards the advancement of both financing and arrangement as far as rules for improvement are concerned (Bo, Xu & Liu 2017). On a large-scale level, a portion of the basic components are strategies embraced to advance macroeconomic dependability; policies warranting resources allotment as per the most preferred angle; quick gathering of physical and human capital; improvement of horticultural sector and advancing skilful administrations (Dasgupta 2009).

However, in Taiwan there is a need to balance technology and innovation policies that help conventional industry with provisions that better react to issues of rivalry and enterprise development (Huang et al. 2010). Whilst the progression measures taken by the Central government hit hard the small and medium enterprises (SMEs) who thought that it was difficult to survive the aggressive competition, the expenditure plan of the Central government presented an exceptional arrangement for enhancing credit streams to the SMEs (Huang et al. 2010). This is similar to what happened in China, whereby the Government is dedicated to drive various administrative changes and institutional reforms which are essential to improve the Chinese learning creation and innovative capacities. This gets demonstrated in the expansion in R&D funding. Most importantly, the 'open policy strategy' rehearsed by the Government remains the



Source: Based on Kaohsiung City Government (KCG), 2016, *Overview of Kaohsiung City administration (2016): Research, development and evaluation commission (RDEC)*, Kaohsiung City Government, viewed 29 July 2018, from https://rdec.kcg.gov.tw/en/News_Content.aspx?n=251E6D26AA557471&sms=83394B7464FF5D3&s=CB2F90E385FD96CD

FIGURE 2: Kinds of examinations passed by the staff of different departments of Kaohsiung City Government in 2016.

genuine key to the adjustment in development elements and advancement (Huang et al. 2010).

The regulatory boundaries to entry furthermore play a critical part in determining the dominance of companies in certain areas. Thus, strengthening of patent laws, equally assumes a critical part in changing institutions from imitators to pioneers. The expanding significance of ecological issues prompts technological innovation transformation and organisational change to endorse it (Cozzarin, Kim & Koo 2017).

Impact of organisational factors on innovation and technology

A comprehensive literature review on technology and innovation has drawn out the significance of different organisational variables which produce a learning domain that advances innovation and technology of a business. A shift to a new technology or another innovation within the organisation would experience money related hindrances as well as various social and political boundaries. Thus, process technologies are closely connected to the product technologies as well as to organisational components (Rycroft 2006).

The organisational domain and culture have the potential for advancing learning and development of employees through open correspondence channels and learning from clients, providers and even contenders. Thus, an organisation can have a superior position to transform through innovation. It is through discovering that an organisation can build the profundity and decent variety of information. Indeed, higher the learning capacity of an organisation, higher is the level of organisation's competitiveness, inventiveness and product presentation achievement.

Wilson (2007) presented another point of view of learning: learning from and learning with each other. In the preceding, the shareholders learn things that are now known to others from whom they are learning. At the end of the day, this includes a reusing of existing data. Learning with is a collective and dynamic process which includes making of new information. Such joint efforts and systems advance perpetual drift of information as well as advancing trust and equal connections which are important for speedily innovating and developing information intensified technology (Cenamor, Parida & Wincent 2019; Cennamo 2019; Rycroft 2006).

When training and development agendas pertaining to innovation and technology of an organisation are sometimes considered as innovative sources of contributions, this could be, on numerous occasions, unequivocally viewed as one of the principal channels for the promotion of the technological abilities of an organisation (Jacobides et al. 2018).

Yet, the critical thinking capacities of information employees lie in their educational upbringing, proficient training, inventiveness and inspiration. Appropriate and centred training programmes assist creation of new information which prompts creative solutions and management transformation. In addition, because of progress of innovation and technology

from labour-intensive work to a high review of mechanisation because of trend setting innovation there has been a growth in request for profoundly gifted employees.

Training of workers and development of winners empowers cutting-edge tools to end up being inserted in the products and procedures of the organisation. Regardless of organisation's system to create technology and innovation within or to outsource, it ought to give clients adequate and fitting education and training on the innovation and technology to make the implementation practical and appropriate (Ferreira et al. 2020). Change in the attitude of workers from 'Not Invented Here Syndrome' to 'Invented Anywhere Syndrome' furthermore encourages harnessing of exterior technology and innovation for development.

Technology disposition in the esteem chain necessitates between practical combinations. In this manner, organisational qualities which support rotation between job and between divisional groups, will guarantee that every one of the workers are flawlessly coordinated in a store network and are always learning with a plan to advance innovation and technology. These groups build up an implicit learning of how to deal with basic circumstances. Shared between its individuals, this implied information may likewise decide the effectiveness of the organisation (Chronéer & Laurell-Stenlund 2006).

Execution of innovation and technology methodology to prompt advancement requires change in the set systems in the organisation. However, this surprises existing conditions and regularly welcomes opposition from the workers. Cross practical communication and collaboration empowers an adjustment in the mindset of workers and rolls out them more adaptable to improvements. It likewise advances cross-disciplinary learning both inside and crosswise over limits of the organisation. Heterogeneity of information, knowledge and accessible skills can expand the inventiveness level of workers. Whereas, communication with shareholders outside the organisation encourages an organisation to build up its dynamic abilities which mirror an organisation's ability to grow new and inventive types of upper hand and synergistic creative capacity (Laihonen & Mäntylä 2018).

Organisation learning happens when information is exchanged throughout the organisation, incorporated with other learning areas, and is connected to an innovative new product or process. Organisational information which is entrenched in the connections between workers of the organisation and furthermore amongst workers and the shareholders are an imperative hotspot for project views that contributes to innovation and technology techniques.

Also, motivation strategies and rewards for sharing learning experience are essential components to urge workers to impart information to each other. It improves the organisations' information base as well as upgrades the essence of cooperation. It additionally causes representatives

to comprehend where they fit into the aggregate measurement of the working environment. Motivating the workforce and execution frameworks that enable rewards for collaborations and aggregate accomplishments, rather than rewarding or motivating singular performance. This will ensure prompt consistent advancement and use of individual know-how. Another critical organisational factor which profoundly affects the innovative activity is the general organisation structure. Notwithstanding the conventional progressive structures and the level group-based structures, which advance formal connections, there is an expanding pattern towards casual connections which extend past the hierarchical limits (Wang & Ahmed 2003).

Formalisation alludes to the degree to which employments inside the organisation are institutionalised. On the off chance that a job is exceptionally formalised, the occupant does not have many options regarding what work is to be done, how it is to be done or when it is to be finished. Earlier research by Grover (1993) demonstrated that the level of centralisation is adversely identified with innovation and technology. High centralisation of basic leadership leaves little self-sufficiency in the hands of the colleagues who consequently oppose any endeavours of innovation and technology by the organisation.

Self-governance then again, persuades the employees to experiment with new strategies and systems for the achievement of any product or process development (as referred to in Barczak, Sultan & Hultink 2007). An agreement driven structure, where even and vertical correspondence is required, hinders execution of hazard taking systems whilst a various levelled structure where basic leadership and procedure detailing power is gathered in a couple of hands promote a risk-taking society. It additionally advances the appropriation of radical process innovations.

The choices identifying with innovation and technology stratagem are generally in the scope of the top management. It is the top management which plays a significant role in establishing the ethos of learning and innovation within an organisation. The state of mind, foundations and characters of the CEO and the gathering of senior managers who are encircling him or her decide the way of life, customs and identity of the enterprise. When the top-tiered administration is inflexible, traditional, driven by the numbers and the returns for money invested, one is probably not going to see the level of risk-taking that a creative organisation requires (Dasgupta, Gupta & Sahay 2011).

Innovation and technology management entails a ton of correspondence and persuading until the point that the vision has been assimilated all through the organisation. The nearness of bosses of specific technologies additionally decides the critical selection of radical innovation forms (Ettlie, Bridges & O'Keefe 1984). Powerful innovators likewise play a critical part in urging the organisation to embrace the outsourcing approach of innovation and

technology into the simple texture of the organisation. They express visionary objectives of supplementing inner sources with outer sources to accomplish innovation and development. These pioneers compensate workers for successful utilisation of outer sources. This suggests that 'culture', on a delicate side, should be produced alongside formal methodologies and structures within an organisation (Ettlie et al. 1984). Whereas the transformative process system for innovation procedure speaks to methodology making as a social learning process wherein innovation technique is intrinsically a component of the amount and nature of organisational abilities.

Reviewing, controlling, and evaluating government science and technology development programmes

As per the Organization Act of the Ministry of S&T, the ministry is entrusted with revising into the Central government's S&T expenditure plan and developing, planning, and evaluating S&T progression plans led by Central government establishments. In the commencement of these projects, the ministry audits key enactment themes, financing, and past programme outcomes, supporting incorporation and connections amongst related projects and creates a total database of all the assessment data (KCG 2016).

Factors influencing technology and innovation

Challenges faced by science and technology development in Kaohsiung City Government, Taiwan

Research and development and innovation: Because technical research innovation necessitates a sound domain, comprising a powerful legal and administrative framework, as the nation builds up a 'creative driven' development prototypical, the legal and governing framework must react to S&T development and fast economic and social change through adaptable, appropriate adaptation. Specifically, the amendment of the Fundamental Science, Technology and Innovation Act is a pressing need. Moreover, linkage amongst industry, the scholarly world, and the research community network must be reinvigorated. It needs a focused innovative R&D and industry-academic joint effort, keeping in mind that the end goal is to combine R&D capacities with industrial applications, and in this manner will boost the foundation of new technological companies and will drive the modern industrial advancement and transformation (Broström & Karlsson 2017; KCG 2017).

Manpower training and recruiting: Predominant HR are a key reason for innovative scientific research in any organisation. Reacting to the rapid advancement of the high-tech economy, Ministry of Science and Technology (MOST) has effectively drafted interdisciplinary HR development methodologies through recruitment of S&T personnel from 2007 to 2016 (see Table 1) following funding and person-times that are stimulating useful industrial labour training strategies and widening the possibilities of S&T research labour, which will do much to merge Taiwan's S&T research establishment (Ho 2011; Huang et al. 2010). Keeping in mind

TABLE 1: Recruitment of science and technology personnel, 2007–2016.

Year	Funding (NT\$1000)	Person-times
2007	1 121 926	1242
2008	1 169 286	1491
2009	1 660 752	2630
2010	1 978 388	2755
2011	1 854 242	2479
2012	1 797 841	2422
2013	1 867 358	2393
2014	1 832 694	2435
2015	1 943 565	2488
2016	2 121 115	2660

Source: Ministry of Science and Technology (MOST), 2018, *Statistics database*, viewed 09 February 2018, from <https://statistics.most.gov.tw/was2/>

the end goal of recruiting first class global scientific research labour, MOST has to rapidly enhance appropriate policy frameworks, and provide a conducive living and working settings, appropriate for global labour, if the nation is to effectively appeal to global manpower for research and keep up the global standards (Ho 2011; Huang et al. 2010; KCG 2016).

Industrial development and transformation: Numerous new S&T patterns have been developed of late, including the IoT, virtual reality (VR), augmented reality (AR), and AI. These patterns have fortified new rushes of rivalry amongst worldwide businesses, and local industries are thus getting on with a new evolving direction (Huang et al. 2010). Thus, in the current high-tech economy age, benefiting from global S&T patterns whilst utilising indigenous technological points of interest, outlining out a dream for the eventual fate of industry, and keeping up adjusted territorial advancement will be the administration's most critical mission whilst helping the industry to adapt to change (Huang et al. 2010; KCG 2017).

Living condition and the environment: Healthy residents and an eco-friendly environment are the foundation of Taiwan as a country. Nonetheless, therapeutic and well-being requirements have turned out to be progressively appalling despite Taiwan's maturing populace, declining birth rate, and a spate of nourishment wellbeing episodes, and serious land improvement. In relation to the above, the development of information/communication technology is another aspect that have been accompanied by environmental value and information or communication security uncertainties (Huang et al. 2010; KCG 2017). These issues and others profoundly influence natives' lives, and desperately require the dedication of adequate resources for the development of pertinent science, technology and innovation.

With respect to land and environment, since Taiwan has a high recurrence of catastrophic events, besides from utilising disaster moderation science, technology and innovation to support the nation's adaptability notwithstanding cataclysmic events, MOST should likewise promote various types of environmentally friendly energy and effectively build up a cyclic economy on the off chance that it is to empower the

residents to pursue S&T research, development, technology and innovation in a protected, sustainable living environment (Huang et al. 2010; KCG 2015, 2016, 2017).

Other technological factors affecting organisations and their environment

- Organisational transformation – is typically very wearisome especially when a great number of parties are encompassed as plans will be adjusted. It is recommended to advise workers before of time and stay up with the up-to-date enabling reproach when developing such improvement (Haned, Mothe & Nguyen-Thi 2014).
- Business developments – assimilating the contemporary innovation and technology demands differentiating the business pre-requisites and evaluating the business procedures as per its targets and objectives. These advancements should profit the organisation and the customers (Cozzarin et al. 2017).
- Sustainable Competitive Advantage – looking at innovation and technology from a positive viewpoint fairly than an 'important malevolence'. Customary models are shifting, and points of interest can be achieved by investing resources into contemporary innovation and technology, but solely achieving innovation and technology for having it is not enough; actualising a vital strategic idea is the key to success.
- Costs included – a vital cost in the present rising condition. Be that as it may, it is practical that a few institutions are unwilling to give because of the commonly outdated frameworks; however the ones who see this venture as an opportunity to rise upper and have an outstanding created system connected, could profit immensely.
- Competence – effectiveness, lessening difficult labour costs, economically savvy in general factor as it can streamline, hasten and enhance precision (or e.g. agencies can interrelate or check a certain issue or status of a demand, distribution and benefit from several areas in the value chain (Choy & Park 2016).
- Information security or contingency planning – Innovation and technology provides a great deal of benefits, hitherto we must equally deliberate over the obligations that accompany them. Organisations should also reflect upon the growing information rupturing and various cybercrimes being perpetuated, and must put resources into persuasive methods for anticipating or battling these issues. Organisations must have these alternate courses of action set up keeping in mind the end goal to ensure their significant resources (Choy & Park 2016).

For the most part, innovation and technology is useful and organisations should attempt to counter the negatives to locate the valuable effect in its implementation.

Factors affecting innovation capacity and capability

Several public subdivisions employees, including those involved in native government, will refer to their inspiration for working in the subdivision as the possibility to have an effect on innovation capacity and capability – that is to add to

work that rewards society and enhances (Smith et al. 2011). In any case, for some the truth of working in the public division organisation is that the pace of progress is moderate, the effect frequently backhanded, and endeavours to make change regularly hampered by existing frameworks, procedures or conventions.

The limit and competence of people in these organisations that has an impact on encouraging changes can be improved or restrained by various components. These are not one of a kind to city governments, but rather give a helpful system to seeing how innovative practices are best bolstered inside organisations.

The five elements for an innovation culture introduced in Figure 3 informed the preliminary rational for this. Through guided discussions and meetings, a portion of these components rose emphatically, whilst others were viewed as less essential and extra impacts distinguished. The perceptions presented here speak to those components that rose most firmly from the other research (Goi 2017).

Organisational capacity

The blend of practical technological components with feasible market positioning and the ability to convince esteemed clients is through the expertise of marshalling of a huge range of resources, abilities, and networks (Ojasalo & Kauppinen 2016). The creation of technology and innovation alone is inadequate. An organisation should likewise have a culture that signifies values of innovation, is fit for acclimatising innovations, and can transform new improvements into suitable market contributions (Yoon et al. 2018).

An appealing business sector position without competent item or service innovation is a formula for long haul calamity; however, the perseverance of vapourware, items that are publicised yet never created, contends that there might be some temporary preferred standpoint in the market for a suitable technological solution (Zhang et al. 2018). It is the

mix of a variety of integral resources and competences that makes a genuine and enduring incentive in the commercial centre and the trade. Organisations that do not have this capacity of arranging and dealing with the interconnections between the components of a market, may endure a significant decline in benefit or market share or notoriety/brand image. Organisational capacity is the adhesive that ties most of the organisation's capacities into a lucid framework that can deliver client esteem.

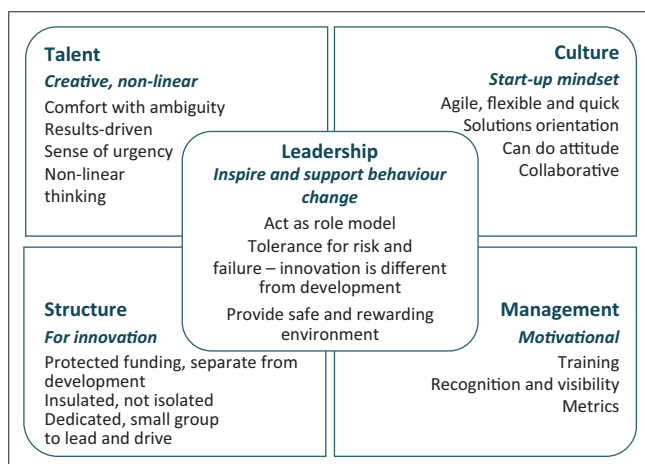
As time goes on, diligent absence of organisational capability results in lost brand notoriety, market share of the overall industry, and profitability. Apple endured such a wearing down of market position in the 1990s as the interest for its items simply reduced, the brand name slid in broad daylight discernment, and corporate outcomes were poor to the point that many market watchers expected liquidation. Some even went so far as to call Apple 'ostensibly one of the most noticeably awful managed organizations in the business' (Choy & Park 2016).

Comparable hypothesis has been made with respect to the possibilities of BlackBerry (the new name taken by Research in Motion after its ongoing close demise encounters). The two organisations endured a disappointment of management that prompted inadequate utilisation of the specialised and showcasing limits they had created (Yuan 2017).

Apple explored its organisational predicament to develop as a market pioneer in the commercialisation of innovation and technology, however, and despite everything it positions well down the rundown of enormous spenders on R&D with respect to size. One of the central parts of Apple's prosperity has been the formation of powerful components for profiting by the manifestations of others to give client esteem. The achievement of Apple's lead items depends as much on iTunes and the Application Store as it does on Apple's item advancements. BlackBerry may deal with a comparative remodel to restore itself, as an innovation pioneer, yet doing as such would require radical change of the general organisational capacity essential for pulling multitude divergent piece of technological and market learning together into an appealing and saleable bundle (Yuan 2017).

Proper technology and innovation management strategies can help an organisation to survive through tough competitions. In order to do so, an organisation should identify what technology and innovation management model it has at its disposal to compete itself with its counterparts in the specific business domain to eliminate the gap existed between them. Additionally, an information system, which is one of the KMS factors support organisational competencies in terms of managing technology and innovation. Inclusively, technology and innovation management and its effects can support organisations to get sustainable advantages against competitors.

The research conceptual framework remains to be further proven by empirical studies. Particularly it is worth examining



Source: Makin, C., 2017, *Adapting for the future: Promoting innovation in city government*, viewed 10 August 2018, from <https://www.wcmt.org.uk/sites/default/files/reportdocuments/Makin%20C%20Report%202017%20Final.pdf>

FIGURE 3: Innovation culture (PricewaterhouseCoopers [PwC] Digital Services).

how the proposed framework can be developed into a model that can be employed for managing technology and innovation for competitive advantage and enhancing organisational performance. Advances in technology, information technology (IT), can also be incorporated into the strategies for managing technology and innovation for competitive advantage which can considerably transform service delivery systems and can expand the boundaries of service interactions. Benefits brought by managing technology and innovation for organisation firms and customers has been well documented in the literature. However, some challenges, such as organisational transformation, organisational development, costs included, competencies, information security, collaborative issues, inter alia, have also received wide discussion. Lack of top management commitment, lack of management motivational training, improper technology use irresponsible to personal need or motivation can be another form of these negative effects or challenges which may impair the strategies for managing technology and innovation for competitive advantage. All these issues remain to be further examined.

The 4th Industrial Revolution (4IR)/Digital economy technological developments and implications on sustainable competitive advantage

Given the rapid application of digital technologies, one of the significant concerns is how increasing digitalisation impacts the long-term viability of SCA for organisational development (Ferreira et al. 2020; Knudsen et al. 2021; Sousa & Rocha 2019b). Will outperformers continue to outperform, or will eras of outstanding performance become increasingly transient and short-lived? One widely held belief is that digitisation will destabilise SCA in an organisation. The heart of this proposition is that digitisation erodes and redefines sources of SCA by dismantling outdated entrance barriers, dissolving industry borders, and erasing and redefining old entry obstacles (D'Aveni, Dagnino & Smith 2010; McGrath 2013). In essence, digitalisation is progressively destroying or diluting previous sources of stability, security, and privilege, and replacing them with transient and temporary benefits formed at the junction of an ever-expanding technology opportunity set and business model innovation (Knudsen et al. 2021). Digital technology, on the other hand, is said to contribute to long-term SCAs. The core of this notion is that essential characteristics of digital technologies produce self-reinforcing 'winner-take-all' dynamics that allow tech-giants like Amazon, Alphabet, and Facebook to establish irrefutable positions in addition to their main industries, but also in expanding their supremacy into a growing number of adjacent markets (Eisenmann, Parker & Van Alstyne 2011; Schilling 2002; Zhao et al. 2019b). According to this viewpoint, digitalisation would eventually result in a level of market influence, concentration, and isolation from adversaries that was previously unheard of in the pre-digital period.

This section aims to explore when digitisation strengthens SCA and when it weakens it. Knudsen et al. (2021) contended that the result will be largely determined by two factors, the

degree to which the leading business model in a market depend on: (1) the compilation and use of Big Data, and (2) the creation of network effects and their application. The stronger an organisation is in these two dimensions in comparison to competitors, and the better the complementarity between Big Data and network effects, the more digitalisation will tend to provide a big and long-term SCA. In the absence of these factors, digitisation will have a negative impact on the long-term viability of SCA of an organisation (Knudsen et al. 2021).

Sustainable competitive advantage and digitalisation

The sanctified treasure of an organisation's success is to gain a long-term SCA, in which an organisation outperforms its competitors and does not destroy that advantage soon. Understanding the reasons of performance disparities amongst organisations, as well as their stability, is an essential subject in business study. The introduction of digital technologies was primarily viewed as a means of fostering the competence of existing business models and processes by lowering costs, enhancing product quality, boosting convenience, and shortening delivery times, amongst other things (Brynjolfsson & Hitt 2000; Knudsen et al. 2021).

Digital technologies have progressed to the point where their implications for competition and competitive results have become far more significant. Increased digitalisation has the potential to fundamentally modify market structures, such as changing the height of entry and mobility barriers, altering the key competitive factors in a market, and allowing for the emergence of new rivals and substitutes (Ferreira et al. 2020). In addition, digitalisation allows for the development of more complex (digital) ecosystems (Weill & Woerner, 2015). In such ecosystems, value is generated in such ecosystems by merging various heterogeneous and complementary digital technologies held by various enterprises (and other types of actors). The resources and capacities associated with these digital technologies determine the position that enterprises play in such an ecosystem (Iansiti & Levien 2004; Jacobides, Cennamo & Gawer 2018), which can range from keystone to easily replaceable complementor. How rising digitisation affects the competitive value of resources and capabilities determines the position and function an organisation adopts in such developing market structures and ecosystems. Digitalisation reduces the importance of some resources and competencies, whilst increasing the competitiveness of others (Sousa & Rocha 2019a).

Organisations in the digital economy

Understanding how digitalisation affects the value of current resources and capabilities, as well as how it promotes the production of new and potentially valuable resources and skills, is critical to understanding how it affects competitive outcomes. As previously said, one of the defining characteristics of many of today's digital technologies is that they are broad, standardised, and offered as a service to anybody. This basically means that the more broadly such technologies are used, the more similar enterprises become, and the complementary assets firms deploy in conjunction with these new technologies will dictate competitive

outcomes to a greater extent (Teece 1986). Big Data and network effects are two complementary assets classes that have seen a rapid rise in competitive value as a result of growing digitisation (Andrew McAfee & Brynjolfsson 2013; Broekhuizen et al. 2019; McIntyre & Srinivasan 2017; Mikalef et al. 2019; Wamba et al. 2017).

Access to Big Data or Big Data capabilities that are superior may provide a number of competitive advantages. It can benefit businesses by allowing them to innovate more quickly and precisely. For example, when Netflix creates successful series based on analysis of viewing trends, it can help a company enhance the targeting of its existing products and services, as Amazon's recommendation engine does.

It can result into more effective new customer targeting, such as when Google and Facebook target adverts and information to those prospects who are most likely to buy a product or service. Alternatively, Big Data can also be utilised to minimise risk, like when the lending platform Welend offered consumers lower-interest loans in exchange for access to their social media profiles.

Although each of these Big Data applications can generate value in their own right, Big Data has the ability to create a self-reinforcing procedure of improved advantage (Andrew McAfee & Brynjolfsson 2017; Brynjolfsson & McAfee 2012; Erevelles et al. 2016). A company with more and better data on clients' preferences, behaviour, and other attributes, as well as the ability to examine that data, might gain an advantage in the struggle for new clients and the battle for existing customers' 'share of wallet'. Additionally, having an exclusive Big Data edge may boost the value of utilising and analysing publicly available data. Spotify, for example, uses private data on users' listening habits, as well as analyses of public data such as blog posts, reviews, and talk about songs and artists, along with analysis of the songs themselves, to recommend weekly playlists of new music to individual users (Boyd 2019). Spotify's unique data on listening habits therefore acts as a good supplement to other publicly available data sources, increasing its value (Pitelis & Teece 2010; Teece 1986). In essence, more data leads to an advantage, and this advantage leads to additional data, which strengthens the previous advantage even more. To put it another way, the benefits of Big Data can lead to self-reinforcing supply-side economies of scale.

When the demand for a product or service is influenced by the number of people who use it, this is known as network effects (Katz & Shapiro 1985). When the value of a product or service is directly proportional to the number of users, as is the situation with social media platforms such as Twitter and WhatsApp, direct (or same-side) network effects arise. When the value of a product is indirectly dependent on the number of other users of that product, such as enhanced compatibility or increased access to complements, this is known as indirect (or cross-side) network effects (Farrell & Klemperer 2007; Katz & Shapiro 1985; McIntyre & Srinivasan 2017; Rochet & Tirole 2003). Multisided platforms like Airbnb, WeChat, and Amazon are examples of companies

that benefit from large indirect network effects. The more guests that use the Airbnb network, the more profitable it becomes for home owners, and the more properties on the platform, the more desirable it becomes for potential guests. In a nutshell, benefits derived from effective network effects can lead to self-reinforcing demand-side economies of scale.

Conclusions and recommendations

The research explored various gaps, which exist within and between managing SCA through technology and innovation systems and its effects on service delivery in influencing business survival in an unprecedented and unavoidable competition in the business world environment, in the local government authorities or metropolitan cities' and municipalities context. These gaps are as follows:

- There is a gap within and between managing SCA through technology and innovation systems and its impacts on service delivery in influencing business survival in an unprecedented and unavoidable competitive business world environment, in the local government authorities or metropolitan cities' and municipalities; particularly the issues with policy makers at national level, as far as the responsibility of national leaders to the significance of research, technology and innovation is concerned.
- There is a gap in designing evidence-based research, technology and innovation policies effect on business performance (Olsson & Meek 2013).
- There are gaps in knowledge and skills at an organisational level effect on business performance.
- There is a gap in enhancing innovation and technology abilities through technological partnership effort.
- There is a gap in developing adequately funded city governments' research agencies.

To a great extent, managing technology and innovation can be essentially determined by a collection of numerous primary and secondary drivers (economic downturn and unpredictability of the technology and innovation) both internal and external to the organisation. The outcomes of this research study demonstrated that technological factors positively impact the organisation's performance including technology transforming the business operations, promotion of the inter-agency public services informational platform, promotion of smart city development, business developments, organisational transformation, improving the living conditions and the environment of the City government's residents, industrial development and transformation, infrastructure and information security management and organising information security reporting drills. Finally, the results of the research study also reveal that organisations, particularly city governments are facing different significant challenges that influence the management of technology and innovation, thus impacting the business performances and prompted the conclusions that five (5) research gaps within and between managing SCA through technology and innovation systems and its impacts on service delivery in influencing business survival in an unprecedented and unavoidable competitive business world environment, in the local government

authorities or metropolitan cities' and municipalities, were identified for the City government's management consideration. Everything taken together, it is established that managing technology and innovation has positive effects on organisation's performance and is greatly impacted by diverse technological factors as well as organisational factors.

The outcomes of this research study provide several key contributions. One of the fundamental contributions of this investigation and the secondary analysis in particular, has been the development of a pool of valuable data in relation to managing technology and innovation for SCA in the City government as public sector by ways and methods of reviewing a bundle of literature, particularly in the area of managing SCA through technology and innovation in local authorities governments and the central government of Taiwan.

Recommendations

Recommendation 1: Establish an account around the values of innovation and technology, and align to the prevailing priorities within the City government

- Consider how the account of innovation and technology is best told, and how achievement can be characterised and illustrated. This may differ starting with one business entity then onto the next and the account might be particular to a specific organisation. Take for instance The Mayor's Office of New Urban Mechanics (MONUM) who portray their innovation and technology team as 'public sector space cadets' and have established their story and brand around this character (Cohen & Stattman 2018).
- Consider whether measurements are required to determine value and what the proper measurements and procedures may be. It is vital that this is done in a way that does not confine the capacity to give things a go and this is the place outside orders may play a significant role, bringing tools that empower safe experimentation (refer to Recommendation 5).
- For technology and innovation groups or those dealing with technological innovation programmes, accepting tireless agony that focuses on another technique could resolve is a critical advancement in locating technological innovation and clarifying its significance.
- Show how technology and innovation can bolster Mayoral primacies to increase senior level support. Aligning prospects for technology and innovation with the City government and Mayoral priorities gives a chance to show the potential for better approaches for working and how managing technology and innovation can bring benefits to the City Government (Tukiainen, Leminen & Westerlund 2015).

Recommendation 2: Consider structure and the position of technology and innovation teams

- Deliberation ought to be given to the engagement of technology and innovation teams in organisations, in light of the fact that governmental structure affects

groups and the work they can do. For instance, providing an accommodation to a technology and innovation team in the City Government Chairman's Office demonstrates commitment to work crosswise over City Government issues which can be fitting and useful (Sørensen & Torfing 2011).

- Alternatively, this prominent 'spotlight' arrangement can imply that less opportunity and self-rule is granted to these groups, which can confine experimentation and risk-taking, consequently restraining technology and innovation. To be sure, consequently, group arrangement is probably going to differ crosswise over settings, and it could be viewed as suitable for the management of technology and innovation to sit outside of the City government completely (Tukiainen et al. 2015).
- Taking a resident centred view, the City government should appear to be an empowering influence as much as a supplier of services. This requires a step transformation in the role, responsibility and mentality of the City government. City government should think about the following questions:

- How could the City government help to set up or bolster self-maintaining organisation that support society, as opposed to giving these services by themselves?
- Is there a responsibility for the City government as the primary client for such organisation?
- Where suitable, how could the prevailing City government employees be established to be the front-runners of the organisation, outside of City Hall? This may require a change far from a classical of employees retaining, creating individuals to take their thoughts and abilities for positive social change out into the City government communities that they would profit (Tukiainen et al. 2015).

Recommendation 3: Build innovation capacity in multiple teams

- A devoted technology and innovation group can't and ought to not really possess technology and innovation for an organisation or a city. Whilst there is a part for technology and innovation groups to go about as helpers and facilitators, establishing capability and expertise over various groups will be valuable. The attention here ought to be on establishing a cooperative culture in an organisation. Search for approaches to specify silos, establishing networks, and bolster cross departmental operational to build the exchange of information and abilities. This will empower more grounded working connections, accumulate trust, increment efficiencies and empower new plans to thrive all the more promptly in terms of managing technology and innovation.
- The capacity for various groups and divisions to work together is urgent to establishing the value of managing technology and innovation. In some cases, technology and innovation pilots fluctuate with regard to changing effective components of a pilot into the same old thing activities or supply. In order for managing technology

and innovation to be highly esteemed, this is a fundamental step and where the advantages are eventually acknowledged, with accomplishments being replicated and possibly scaled up (Cohen & Stattman 2018). This progress requires the participation of various stakeholders in a local government organisation. In this way, including significant shareholders and groups in the initial establishment of new thoughts and answers is critical to this changing and to a definitive accomplishment of any technology and innovation management technique created through pilot ventures (Taylor et al. 2017).

Recommendation 4: Invest in staff development to attract and nurture talent

- The duty of City government is experiencing a quick change and the talents in the employees need to keep pace with this change to guarantee that City government can deliver in their new obligation. Consequently, it is essential to identify the talents required for the future mandate of the City government and nurture fitting skills pipeline that can give these capabilities (Tukiainen et al. 2015).
- Investment in individual and expert advancement prospects is significant to appealing and development capacity for managing technology and innovation. Skills advancement identified with flexibility, the capacity to identify prospects, grasp vulnerability and vagueness, and react emphatically to change are integral to City government's ability to adjust and keep on innovating. HR and individual's advancement teams should play a significant role in modelling procedures and practices that help suitable enlistment, improvement and maintenance of staff to accomplish this goal (Buck & While 2017; Taylor et al. 2017).
- Employees' incentive to attempt new methodologies and make positive change is probably going to be associated with both top management supporting for managing technology and innovation and a hierarchical culture that advances experimentation, gives input and praises accomplishment and also identifying omissions. Supporting these conditions in the City government departments or agencies can spur staff to improve.
- An expansive scope of points of view, skills and assorted variety of experience is probably going to give the best compensate for a technology and innovation team. In this way, enlistment procedures should try to reach and pull in individuals from an assortment of social and expert credentials

Recommendation 5: Consider the role of disciplines such as design and behavioural insights to provide tools for change

The use of plan standards to the improvement of public services affords a genuine prospect for City government to connect with residents and make appropriate services custom-made to certified requirements. Seeing how benefits are utilised and experienced and applying that understanding to test, perfect and enhance municipal services can help make benefits to the clients more proficient and powerful (Krogh & Torfing 2015).

Establish Council's Design in the Public Sector programme assessment makes proposals for central government, local authorities and different departments to put resources into calculated talents, and in addition joining forces with professional agencies who can offer help and guidance. Any such approach ought to be combined with an aim to establish skills broadly over the organisation, including numerous groups (Design Council 2015).

- The Local Government Association's social experiences programme looks to help City government innovation. For instance, the local governments in the UK could look to the financing, support on offer to upskill, and grasp the potential for conduct bits of knowledge and experimentation in benefit outline and conveyance (Design Council 2015).

Whilst Smart City activities can give a scope of advantages and are efficient and financially worthwhile, they do have challenges. Most of the Smart City ventures or pilots have been 'point solutions' driven by technology and innovation, as opposed to from the perspective of the resident. These have not been feasible nor scalable and may have missed the mark as far as understanding and resolving fundamental issues confronting city government stakeholders (Hunting, Ryan & Robinson 2015).

Subsequently, developing a strategic structure and controlling standards surrounded around a 'citizen-driven' view is an imperative central component of Smart City rationale. Smart Urban communities can be a critical building square of a technology and innovation plan; however, this demands a suitable approach and system (Chen et al. 2018).

In the event that the progressions ahead seem overwhelming, it is important to note that challenges can be transformed into opportunities. As 2020 approach, KCG can take stock, re-assess and get ready. They have each opportunity to lead the way for Taiwan as a country, into a dynamic future (KCG 2018).

Direction and suggestions for future research

This investigation can be replicated to other city governments within Taiwan and even in other emerging economies in developing countries in the world and in Africa in particular. It is equally recommended that this research study be replicated in diverse business sectors in Taiwan and other developing economies, especially in Africa and South East Asia, other than city governments or local authorities. Moreover, this research study can be repeated in various natural settings and environmental contexts, which may give extra experiences and understandings about managing technology and innovation for competitive advantage. In addition, it is fascinating to know whether the discovered results hold for different sectors or industries in Taiwan.

More research is required in the area of managing technology and innovation for competitive advantage in order to close the identified gaps within and between managing technology

and innovation systems for SCA and its impacts on service delivery. This has so much influence on business survival in an unprecedented and unavoidable competition in the business world environment, in the local government authorities or metropolitan cities' and municipalities; particularly the issues with policy makers at national level, as far as the responsibility of national leaders to the significance of research, technology and innovation is concerned. The gap in designing evidence-based research, technology and innovation policies, as well as gap in knowledge and skills at an organisational level affect business performance.

Major relevant business settings to be considered in future studies ought to tap in the knowledge derived from this investigation, particularly on how various business settings affect the management of technology and innovation for competitive advantage, including the following factors: (1) R&D and innovation – manpower training and recruiting; (2) information security or contingency planning; (3) rapidly advancing technologies; (4) ageing technology and under-investment; and (5) the change in residents' expectations, as it additionally play a critical role in managing technology and innovation for competitive advantage and have significance impact on organisation's performances. In a way, future analysts and researchers alike ought to consider that the outcomes of the present study obviously stipulate that managing technology and innovation have impacts on organisation's performance in Taiwan's city governments yet can be obstructed by various technological factors.

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The authors declare that they have no financial or personal relationships that may have inappropriately influenced them in writing this article.

Authors' contributions

K.T.T.A., the first author, was responsible for conducting the overall study, as well as for formal analysis, methodology, writing and correspondence. E.I.E, V.N. and S.P. supervised, revised and edited the manuscript. All authors discussed the results and contributed to the final manuscript.

Ethical considerations

This article followed all ethical standards for research without direct contact with human or animal subjects.

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Data availability

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Disclaimer

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