AGILITY AND DIGITALIZATION COMPETENCY IN LOGISTICS 4.0 IN MILITARY SETTING: THE CHALLENGE, RISKS AND OPPORTUNITIES

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ABSTRACT

This paper attempt to integrate Resource Based View (RBV) and Social Exchange Theory (SET) in identifying and analysed the importance of logistics 4.0 through links between logistics 4.0 competency, logistics responsiveness (agility, positioning, distribution support, and service recovery), digital competency and knowledge management practice in the era of Industry 4.0. Sample of 117 military respondents from the Malaysian Armed Forces throughout Malaysia are studied. This study used path analysis with maximum likelihood estimation that estimates the relationship in a structural equation system using AMOS 22. Path analysis results show that the estimated regression weights are significant based on *p*-value (*p*-value < 0.05), that is the relationship among the criteria are statistically significant except for the relationship of KMP. In brief, the path analysis model is statistically valid and achieved model fit with Chi square test (z^2 (df = 3) = 1.773, *p*-value = 0.000), CFI = 0.821, TLI = 0.809, IFI = 0.824 and RMSEA = 0.082. Three of four of the hypothesis are supported while KMP was not found to partially mediate the relationship between logistics responsiveness and logistic competency 4.0. This study substantially explains theoretically the available resources that can be exploited to achieve higher standards in employing logistics 4.0 thus contribute to extend logistics 4.0 developments in military setting. From a practical perspective, the findings of this study are expected to facilitate the Malaysian Armed Forces in formulating strategies and capitalizing on the internal capabilities which may provide platforms and opportunities for more effective logistics management.

Keyword: Logistics 4.0 Competency, Knowledge Management Practice, Logistics Responsiveness, Agility, Digital Competency, Military

INTRODUCTION

In boarding Logistics 4.0, there are challenge, risks and barriers that needed to be deliberated before capitalizing by investing large sum of money. Though, a thorough financial analysis and firm capability has been conducted, a firm still need to decide whether the risk of adopting such massive changes to its company is worthwhile. However, the circumstances may change, if the firm is forced to survive when ultimatum made that Logistics 4.0 is the only solution (Strandhagen, Vallandingham, Fragapane, Strandhagen, Stangeland & Sharma, 2017). A step towards changing its risk appetite because of environment volatility is a necessity. In line for Logistics 4.0 fast progress, the changing aspects of logistics automation has developed faster than expected (Domingo, 2016). The rapid economy development was never anticipated few years back whereby Logistics 4.0 assessments on potential and associated risks were few

predetermined in the past (Roblek, Meško & Krapež, 2016). The Malaysian Armed Forces (MAF) is facing great challenges in its effort to achieve superior logistics performance. More recently, the interests in organisational learning capability has also increased in parallel with the modernisation of assets, resources and processes within the organisation.

In digitalization of military force, the concept of revolution military affair and digitalization of knowledge management system are among predominantly among factors that contribute to future soldiers of the Malaysian Armed Forces. At military strategic level, with digitalization, real time information can be garnered which lead to accurate decision making. Having information at the hand, military action planning can be executed successfully thus limiting off-tangent from the mission objective. However, before a military organization adopted total digitization in its operation, education and training as well as the human capital development must be considered to attain organizational digital competence. In civilian organization digitalization, there are many concepts of digital competence, digital literacy, media literacy, ICT literacy, 21st century skills, digital skills, computer skills and Internet skills. The development of digitalization in term of policies in education and innovation is more prominent in European whereas in Asia, China spearheads digitalization both in commercial and military. Nonetheless, the readiness of human capital to be educated and train, so that, the intellectual capital would be a common, thus it become a structural capital, that turn the knowledge into standard operating procedures of an organization are essential in achieving digital competencies of a military force.

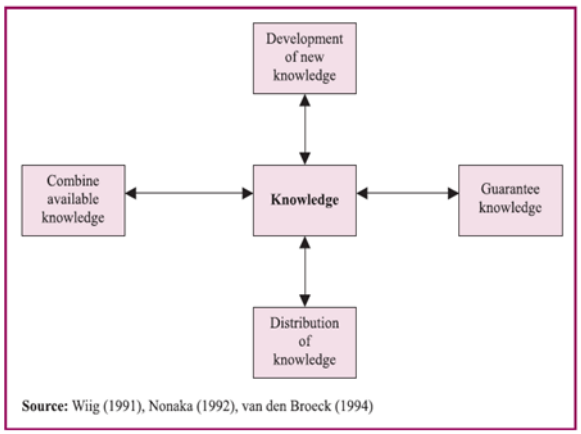

Figure 1: *The Four Basic Processes of Knowledge Management*

Inevitably, the challenge, risks and opportunities of implementing KMP in Logistics 4.0 environment can be extracted from **Figure 1**. Though there are barriers to recognize and implement KM throughout military services, KM initiatives are acknowledged to be vital to increase efficiency of their command and control and intelligence superiority This KM effort is essential since other military super powers of the world are currently practicing network centric when disseminating information-knowledge-wisdom from top to down level when implementing any strategic decisions as evidence shown in US and Australian Defence System military initiatives. As for Malaysia, though this research is conducted in military setting, other organizations such as government or non-government organization can benefits the lesson learnt retrieved from this KM effort. In a nutshell, KM research in military setting is must be robust, reliable and timely according to the demand of operational pace which is different from corporate company considerations and it must in accordance to situation and requirement to revolutionize the military affairs in Malaysian environment.

With the advantage of implementation of Logistics 4.0 in military setting, the platform of Internet with Internet of Things (IoT) or Internetwork Operating System (IoS) the communication between logistics processes is digitally and physically efficient to identify and monitoring the supply chain in real time (Wang & Ranjan, 2015). So, with that augmented reality Logistics 4.0 workers will receive real-time instructions and because of that, it is proposes that cyber security in Logistics 4.0 management must be enhanced since all systems is connected digitally and physically. Therefore, the cyber-crime threats on supply chain in Industry 4.0 will dramatically increase, creating a need to develop more sophisticated cyber security systems. Likewise, with the cloud computing with multi-layered firewall capability, it can reduce cyber threat in Logistics 4.0. For example, Nowicka (2014) coined that manage the traffic lights of a smart city is secured with cloud computing system. Yet if digital interruption is unavoidable like cyber-theft, it gives indication that cyber security of firm embracing Logistics 4.0 must have high integrity with layered firewalled able to sustain to such cyber-attack (Schlegel & Trent, 2015).

With logistics 4.0 and risk management, a physical supply chain dimension is conducted through autonomous and self-controlled logistics sub systems like transport using autonomous robotics trucks, turnover handlings via trailer unloading using artificial intelligence picking robots (Domingo, 2016). So, these logistics processes can be protected with massive firewall such as protection on order logistics procurement. This is enabling with smart contracts using blockchain technology that security criteria are guaranteed between supplier, supplier customers and customers in secured digital supply chain (Hofmann & Rusch, 2017). Other characteristic of blockchain technology is the ability to reduce financial fraud and bureaucracy in such digital supply chain which is inevitable in traditional supply chain. Moreover, a digital data may add value to the digital supply chain dimension. This value added service the intelligence machinery and sensory data able supply chain to harness data physically and digitally through the entire physical end-to-end supply chain. In summing the digitalization process, Logistics 4.0 communication is viable via a connectivity of layers of gathered data in data analytics such as cloud computing signifies that a Logistics 4.0 firm is having value-added business services as compare to traditional firm (Hofmann & Rusch, 2017).

With the pace changes, a traditional sequential process structures in logistics automation is being substituted by autonomous parallel processes. On that account, the paradigm shift of logistics providers and logistics operators had to make fundamental structural changes. The emerging economic countries like China and India are grooving fast in embracing the culture of Industry 4.0 IT culture (Huang, Ouyang, Pan & Chou, 2012) with education and information sharing (Hsiu & Fen Lin, Gwo & Guang Lee, 2005) as enablers. Thus, it also shows that the attitude of the logisticians and its supply chain of new emerging economics countries adapt well to Logistics 4.0 through education of networking and socio-technical skills (Lee & Chen, 2015).

At the end, the customer benefited by having choices since with technology 4.0 in logistics, it offers customers with an appropriate decision and strategy tool before purchasing is made (Marolt, Pucihar, & Zimmermann, 2015; Roblek, Bach, Meško, & Bertoncelj, 2013; Rodriguez & Trainor, 2016). The responsiveness toward customer demand and product life cycle is reducing, customers' demands are changing fast, and lead time for response is decreasing. In such

scenario, ability of firms to quickly respond to changes in their external environment is a primary determinant of firm's performance (Singh, 2015). Yet, the agility of the software in securing the supply chain nodes is essential to evade unnecessary risks.

RESOURCE BASED VIEW (RBV)

Many studies have used RBV theory to investigate supply chain performance. RBV is used because of its strategic context, resources and capability is important for sustained competitive advantage and superior performance (Janney & Dess, 2006; Runyan *et al.*, 2006). Moreover, the source competitive advantage comes from both internal and external resources in the supply chain network (Arya & Lin, 2007). Porter (1985) and Grant (1991) adopted RBV because with RBV, the resources and capabilities are competencies for strategy formulation.

LOGISTICS 4.0 COMPETENCY AND SUPPLY CHAIN PERFORMANCE

Supply chain refers to a network's ability to integrate, build, reconfigure internal as well as external competencies to address rapidly changing environment (Tecce, 2007). Day (1994) classifies supply chain into outside-in process, inside-out processes and spanning processes that primarily mean integrating the outside-in and inside-out capabilities. Meanwhile, Logistics 4.0 is a wider term is summarized as logistics and supply chain processes in Industry 4.0 that operations are supported by intelligent sensors such as RFID systems, embedded smart software and intelligence databases from which relevant product and service information in supply chain is provided and shared over IoT (Dutton, 2014). To differentiate from previous industry revolution, the reliance on a major automation degree and logistics as a network is the eminent character of Logistics 4.0 (Domingo, 2016) that such operation should enhanced operational agility capability in this digitalization era (Akhtar, Khan, Tarba & Jayawickrama, 2017). There are also other areas in Industry 4.0 that Logistics 4.0 able to integrate which are big data and analytics that logistics processes of warehousing and transportations can be supply chain visibility is transparent through networked visible end to end supply nodes with all stakeholders has share of information in its supply chain. Moreover, with the cloud-based software in Logistics 4.0, it allows for information sharing across both internal and external sites in milliseconds, including the systems that monitor and control industrial processes (Chai, Miao, Sun, Zheng & Li, 2017). All of these are opportunities for adopters of Logistics 4.0.

SOCIAL EXCHANGE THEORY (SET)

Social exchange theory was developed by Homans (1961) in the field of psychology. The theory specifically focuses on voluntary exchange of value by other people or organisations with the aim to maximise their gains in a social system. Social exchange theory has been adapted in supply chain research to examine alliance performance (Yang, Wang, Wong & Lai, 2008), coordination (Holweg & Pil, 2008) and relationship management (Glogor & Holcomb, 2013). Reaping the potential benefits of process capabilities may possess great challenges to an organisation, since a comprehensive framework for logistics performance goes beyond the physical movement of supplies and materials along the entities involved (Spillane, Cahill, Oyedele, Von Meding & Konanahalli, 2013). Based on the social exchange theory, this study will integrate strategic logistics alliances.

Strategic logistics alliances denote as collaboration in the operationalization of this study. Strategic logistic alliance could be defined as the cooperative and exclusive relationships exist between organisations in the supply chain network formed to improve logistics performance (Gunasekaran, Patel, & McGaughey, 2004). In this study, strategic logistics alliances will be examined in terms of logistics coordination and information sharing (Gunasekaran & Ngai, 2004). Logistics coordination refers to the close integration of logistics processes (Simchi-Levi & Zhao, 2003). Given that the military operations are associated with larger geographical distance, the logistics units may face higher degree of uncertainties (Hesse & Rodrigue, 2004). Coordination between the units may produce a seamless connection, which facilitate in reducing various problems including supply chain disruption (Prajogo & Olhager, 2016). It would also permit an organisation to adopt pull based system which are associated with timely delivery and reduced inventory costs.

In an effort to coordinate and integrate the logistics processes effectively, information sharing is vital (Wu, 2008). In a commercial logistics, information sharing deals with the mutual sharing of business and market information between supply chain partners. This information include inventory status, sales and forecast data and production delivery schedules. Information sharing enables other members in the supply chain network to view accurate and timely data at different levels in the chain, allowing them to avoid any risks of delays in delivery and the need to keep safety inventory, which is associated with higher costs.

Information sharing refers to mutual sharing of business and market information between supply chain partners (Wu, 2008). The information include inventory status, sales and forecast data, order status, production, delivery schedules, capacity and performance metrics (Lee & Wang, 2008). Previous study also define information sharing in supply chain as information sharing support technology, information content and information quality (Zhou & Benton (2007). With information sharing in supply chain it increases visibility and flexibility (Sajadieh, 2008). Moreover, information sharing between business processes and supply chain partners creates a virtual supply chain (Knapp, Marshal, Rainen & Ford, 2006).

Meanwhile, previous literature (Jansen, Tempelaar, Van den Bosch, & Volberda, 2009; Kamasak, Yavuz & Altuntas, 2016) highlights environmental dynamism as the rate of change, unpredictability and instability in external environment. In a highly dynamic environment, organisations may face challenges in responding to the customers' demands and exploring new alternatives. Yet, on the same time, a dynamic environment may also force organisations to strengthen their existing capabilities and develop new ones to enable them to compete. If an environment is perceived to be uncertain, organisations may use their existing knowledge repositories more effectively and enhance their capabilities through learning capabilities. For example, Ramamurti (2012) and Uner, Kocak, Cavusgil & Cavusgil (2013) found that the success of emerging market businesses did not emanate from their low cost advantages, yet through their skills of screening the market's needs.

Hence, it is expected that military organisations may utilise and enhance their capabilities to overcome specific competitive challenges in an ambiguous environment. In the Malaysian Armed Forces environment, the logistics service providers for the unit may face difficulties to engage and sustain their logistics performance due to the problems such as operational

deadlock and technology obsolescence. Hence, they need to enhance their dynamic capability to ensure delivery speed, agility and service responsiveness. Past military operation in Malaysian theatre represent operational uncertainty, which require enormous logistics and supply chain support. This would necessitate the logistics units to reconfigure their processes of benchmarking, flexibility and innovation to meet the operational demand. In order to train, prepare and perform well in the combat operations, it is necessary to understand the environment and its impact on performance and logistics capabilities. Similar phenomenon is also expected to happen in the military organisations.

AGILITY, LOGISTICS RESPONSIVENESS AND LOGISTICS 4.0 COMPETENCY

Since development of technology is rapid the environment is volatile, uncertainty, complexity and ambiguity in this digitalization era. To mitigate such environment, with logistics 4.0, it requires technology of robust and continuous innovation. The pace and breadth of technological changes is rapid. Keeping up with technological advancements recognizes the enhanced role organizations can play in the responsible use of disruptive technologies. Therefore, with blockchains technology, secured ICT physical infrastructure, protected software and middleware, and controlled virtual enterprise, a logistics firm may attain agility as Logistics 4.0 adopters (Samdantsoodol, Cang, Yu, Eardley & Buyantsogt, 2017).

With movement of material flow in globally monitored network, the location of globalization of logistics hub ports in different countries need digital supply chain processes to absorb bureaucracy policies (Yang & Chen, 2015). Therefore, with IT capabilities, the flexibility of IT infrastructure and IT assimilation may enhance the firm performance through absorptive capacity and supply chain agility in the supply chain context (Liu, Ke, Wei & Hua, 2013). So, the link between supply chain agility and IT capability to firm performance is prominent (Liu, Ke, Wei & Hua, 2013). Whilst there are promising links between the Internet of Things (IoTs), dynamic data and information processing capabilities (DDIPCs), and operational agility (Akhtara, Khanb, Tarbac, & Jayawickramad, 2017). Therefore with information system capabilities is as antecedent to organizational agility (Felipe, Roldán, Leal-Rodríguez, 2016).

In this research, logistics responsiveness is divided into four which are positioning, agility, distribution support and service recovery. Agility refers to an organisation's ability to sense the changes in environment and quickly respond. Agility is important to be incorporated in this context of research since the Army engulf in operation routines that are dynamic based on various locations in Peninsular and East Malaysia. Hence, agility is needed to respond to the operational demand in a timely manner (Stank & Lackey, 1997; Swafford et al., 2006). In a commercial logistics, service recovery refers to an organisation's ability to convert a previously dissatisfied customer into a loyal customer. It is an action taken by a service provider in response to service failure. The logistics unit in the Malaysian Armed Forces has already been facing this challenge for years. It can therefore be seen as a valid logistics capability measure.

The advantage of digital and autonomous supply chain is the ability to monitor its competitor disruption within its marketplace. Previous literature stated that organizational inertia occurs when logistics firm fixated on its past accomplishments to protect its current state, unlike firm who adopt digital and autonomous supply chain have more control on their operation and business process to their business cycle. With Logistics 4.0, the digitalization such as big data and analytics, service oriented architectures and enterprise systems (ES) offer digital options leading to greater organizational agility and sustainability (Kharabe & Lyytinen, 2012; Trinh,

2015). Thus, it is suggested that Logistics 4.0 able to expedite the logistics responsiveness and its logistics capability in supporting its overall military operation.

Extant researches defined logistics capability as the ability to consistently deliver requested products within the requested delivery time frame at an acceptable cost, is highly important in achieving overall performance (Stank, Goldsby, Vickery & Savitskie 2003). In the military, efficient logistics performance appears to be the most crucial factors contributing to the military success. An efficient logistics operation will facilitate in increasing the fighting power of a military organisation as soldiers not only needed weapons, but food and ammunition to carry out their duties well. In an increasingly challenging environment which is reflected by uncertain demands and rapid technology development, cost pressures remain high (Do & Kambhampati, 2002).

Meanwhile, with the holistic view of Industry 4.0, transfer of autonomy, intelligence and autonomous decisions to machines is eminent whereby Logistics 4.0 is as the extension that mirrors in term of applications, technologies, human and business elements of Industry 4.0 (Hofmann & Rüsch, 2017). For Logistics 4.0, smart supply chain management may increase the potential for firm performance in using information technology. With IT flexibility, it increases the supply chain transparency with quality of information in the supply chain. With Logistics 4.0 is as part of the concept of Industry 4.0, it raises new requirements regarding its organization structure (Barreto, Amaral & Pereira, 2017). Todays centralized organizational structures have to be changed in order to be able to decide effectively locally, globally, flexible and agile with ICT infrastructure (Samdantsoodol, Cang, Yu, Eardley & Buyantsogt, 2017). Decentralization of organizational structure or any structural changes because of Logistics 4.0 may contribute to new areas of non-traditional risks. In sum, any possible changes on adoption of Logistics 4.0 on organizational structure and its implications on the opportunities and risks of logistics and supply chain in Industry 4.0 have not been analysed sufficiently.

In military setting, the military organisation is also facing complexities owing to the considerable distance that the materials and supplies must traverse between the different nodes along the supply chain. In the military context, it was traditionally thought that having abundance of supplies ensured that logistics service providers would be able to provide everything needed to achieve the desired performance. Yet, responsiveness needs to be integrated in the logistics system to attain a good logistics performance. With an increased focus on the trade-off between inventory reduction and higher delivery frequencies, the number of materials delivered by just-in-time processes is also rising. At all times, on time availability of the supplies needed especially at the battlefield is essential. Hence, in this study, responsiveness is incorporated as one of the measures used to assess the logistics performance beside cost.

The demands on the automatic identification and localization as also the condition monitoring of logistics objects as sources of data for a secure supply chain's documentation and control are increasing. By using such technologies Smart Logistics Zones are created for logistics and production processes (Kirch, Poenicke & Richter, 2016). With E-commerce, logistics driven under the background has been largely influenced. With worldwide implementations on E-commerce logistics companies is able to improve supply chain digitalization (Yu, Wang, Zhong & Huang, 2016). With seamless supply chain and the active support of the decision support system exploiting the automatic pipeline inventory and order based production control system algorithm (Towill, 2005). Based on this argument, this study postulates that:

H1: The reference of challenge, risks and opportunities of agility and logistics responsiveness towards Logistics 4.0 competency in digital ecosystem can successfully develop and sustain logistics and supply chain competency in Logistics 4.0 environment.

DIGITALIZATION COMPETENCY AND LOGISTICS 4.0 COMPETENCY

The emergence of digital employees, digital work and digital employee management are among concepts to be dwell as digital competencies in an organization like Malaysian Armed Forces. The concept of digital employees is the larger changes in the core subject matter of the HR profession: which is also known as digital natives (Prensky, 2001), millennial (Deal et al., 2010) or net generation (Tapscott, 2008) which involve interaction with digital technologies that has shaped a new generation of people with distinctively different attitudes, qualifications, behaviours and expectations.

Meanwhile, with Logistics 4.0, the automation and digitalization process take the low skill human workforce off the grid. The operation of Logistics 4.0 alleviate the human limitation capability whereby automated robotics able to multiplied work time force more than human and in term of monitoring the interaction between logistics process in supply chain is in real time. This is made possible through system integration of data networks in supply chain in Industry 4.0 (Cooper & James, 2009). But, if IT system is down, taking orders, making products, shipping product is unavailable that makes structure on cyber insurance for supply chain stakeholders of supplier, supplier customers and customer as better structure of risk management (Schlegel & Trent, 2015). Therefore, structuring the risks in Logistics 4.0 is a must, since the dual atmospheres of cyber and physical environments are the Logistics 4.0 environments.

With digital technologies, this new cohort of people is generally characterized by marked digital qualifications, multitasking capabilities (in particular fast and parallel information processing, affinity for networking, learning by doing and preference of instant gratifications and frequent rewards (Prensky, 2001). It refers to the knowledge, skills and behaviour, which enable a person to read and write the media and to make active and conscious use of them (Buckingham, 2003; Celot & Tornero, 2008; Jacquinot, 2009). With the spread of digital technologies in the last thirty years terms such as computer literacy or IT literacy have prevailed, with a strong focus on technical aspects (Bruce & Peyton, 1999; Davies, Szabo, & Montgomerie, 2002; Swan, Bangert - Drowns, Moore-Cox, & Dugan, 2002). These authors point out that "digital literacy has become a "survival skill" in the technological era da key that helps users to work intuitively in executing complex digital tasks" (Eshet-Alkalai & Amichai-Hamburger, 2004).

The potential usage of information technology in increasing transparency and quality of information in the supply chain is inevitable. With that, the management of supply chains has new requirements that changes management is able to decide locally, fast and flexible. Yet, the organizational risk and implications of Logistics 4.0 with regard to cyber and information risk from external that later may affected the process risk have currently not been analysed adequately. This is especially prevailing in software related security (Masoudi & Ghaffari, 2016)

In order to predetermine the challenges associated with Logistics 4.0 to the customer effectively, the identification of the specific segment of Logistics 4.0 impact. Next, the market

strategy makes the most sense when embarking Logistics 4.0 (Kagermann, 2015; Yu, Subramanian, Ning, & Edwards, 2015). Then, the decision point that prevail the decision criteria and the risks involved when embarking Logistics 4.0. All in all, the important of gauging the prioritization between the essentials steps to not so important crave when embarking Logistics 4.0. Lastly, in strategizing which strategy push the market best when embarking Logistics 4.0.The opportunity and risk may rest on the appropriate system providers system providers, component manufacturers, software houses and planner when a firm consider it readiness in embarking 4.0 (Sommer, 2013).

The revolution of human resource workforce in logistics is inevitable when Logistics 4.0 is embarked (Hofmann & Rüsch, 2017). But low level of confidence may be that, as noted above, their strategies continue to focus on traditional near-term business operations. This originates from negative attitude to internet (Al-Hujran, Al-Debei, Chatfield, & Migdadi, 2015). On the contrary, the organization may explore for new technology and lowering the cost, that as challenge to human resource in Logistics 4.0 (D'Netto & Ahmed, 2012). On that note, preferential towards digital competence employee for digital work in Logistics 4.0 is preferred whereby massive job loss for not yet digital competent may be unavoidable. This is possibly because firm is reluctant to invest in retraining and human resource development the ready available employees that are costly to be conducted in house.

With digitalization process, environment like urban traffic incident management can be managed digitally and risk-free from human err which signifies digital society is agile in execution of normal daily routines (Steenbruggen, Nijkamp & van der Vlist, 2013). To enhance such process, business infrastructure need to become digital which affect the scope, scale, speed as well as value creation of business strategy (Bharadwaj, El Sawy, Pavlou & Venkatraman, 2013). With advancement in digital competency in supply chain, it may improve logistics and supply chain flexibility and responsiveness and in turn become competitive through operations strategy medication with IT integration (Gunasekaran & Ngai, 2004). Therefore the digital workforce, it needs to have the ideal ICT competency to be able to be efficient as Logistics 4.0 workforce.

In Logistics 4.0, Information Technology (IT) can be as a leveraging competence in achieving operational agility (Huang, Ouyang, Pan & Chou, 2012). The impact of information technology (IT) on supply chain agility measured by the ability to sense and respond to market changes, and the impact supply chain agility has on firm performance (DeGroote, & Marx, 2013). With IT integration, supply chain is more flexible (Swafford, Ghosh & Murthy, 2008). With XML technology, it enables supply chain information system integration (Ahn, Childerhouseb, Vossenc & Lee, 2011). Other IT integration may involves in the process of evaluating and selecting agile suppliers by measuring the magnitude of bullwhip effect and inventory and mitigates this issue the supplier risk with Fuzzy AHP and Fuzzy TOPSIS in supplier selection (Lee, Cho, & Kim, 2015). On the other hand, virtual enterprise (VE) in sharing resources improves agility in supply chain and evades unnecessary risks such as bullwhipping and exceeds safety stock by the suppliers (Samdantsoodol, Cang, Yu, Eardley, & Buyantsogt, 2017). Therefore, with IT and innovation agility existed in supply chain (Ravichandran, 2015) and IT as platform for value contribution in order fulfilment (Raschke, 2010). Smart city logistics become flexible on transport changing demand sing cloud computing (Nowicka, 2014). All of these digitals tools benefited Logistics 4.0 management systems.

Though lacking information of digital competency studies in Logistics 4.0, the digital competency studies reviewed in this study is taken from education industry. An issue of digitalization of supply chain from education perspective is digital divide of its ready available employees as individual (MacKay, 2017). As a result of the development of internet and ICT (information-centric technology) advances including mobile, cloud, social networking, big data, multimedia and the tendency towards digital society in such workforce (Masoudi & Ghaffari, 2015). If a firm resolve the digital divide, digitalization and creative economy may emerge to create new ICT development (Park, Choi & Hong, 2014). Yet, inter-generational digital divide and different level of self-efficacy signifies technology acceptance and attitudes toward the implementation of digital learning technologies (Salajan, Schönwetter & Cleghorn, 2010). The digital divide and digital competency also depends on family background, language integration as well as cultural capital factors explaining digital inclusion (Hatlevik & Christophersen, 2013). Therefore, digital competency is an issue in Logistics 4.0 as well as risk management in Logistics 4.0.

Henceforth, digital competency is considered as important factor in Logistics 4.0 because of the technology environment that Logistics 4.0 is situated. To have a digital competency workforce, it requires process of academic literacy that develops information and ICT literacies (Guzman-Simon, García-Jimenez & Lopez-Cobo, 2017). In supply chain of health industry, the use of smartphone application depends on acceptance of the users (Cho, 2015) as well as the use of social media in pharmacy practice and education (Benetoli, Chen & Aslani, 2015). In education industry, digital competence, digital literacy, digital technology and national educational program standards are interrelated (Javorský & Horváth, 2014) that the receiving end is virtually Industry 4.0 and Logistics 4.0 workforce.

When, digitalization issues are at hand, innovation practice of the firm may also be in discussion. This is because with digital competency, the innovation behaviours of each individual workforce are important. Innovation management come into play with globalized digital society (Kadar, Moise & Colomba, 2014). Social inequality in information resources and digital use pattern can be overcome with ICT facilities easy access (Yu, Lin, Liao, 2017). Therefore, it is easier to predict internet behaviours to potential active public's internet users (Dozier, Shen, Sweetser & Barker, 2015). On the other hand, with digital competency, a potential workforce able to manage privacy boundaries within individual and group privacy management (De Wolf, Willaert & Pierson, 2015). The use of Information and Communication Technology (ICT) is of immense importance in today's digital knowledge society (Zylka, Christoph, Kroehne, Hartig & Goldhammer, 2015). Techno capital and networking skills are conventionally treated as a form of human capital shaped by individual attributes (Lee & Chen, 2015). Innovation management is focused on the systematic processes that organizations use to develop new and improved products, services and business processes. It involves development of creative ideas within the organization and the networked environment (Kadar, Moise & Colomba, 2014).

With reference to the young generation workforce, their level of digital literacy depends on algorithmic skills, deep and surface-approach metacognitive processes and understanding spread sheet they received during school or university years (Csernoch & Biró, 2015). The traces of their digital competence are mimics of their initial education and pedagogical competences of their teachers or lecturers (Svensson & Baelo, 2015). In Logistics 4.0, with digital competency is a life-long learning in information communication technologies (Ozdamli & Ozdal, 2015). It also involves in active learning, learning strategies supported by the

methodological change in teaching and learning promoted by the process of convergence ICT in virtual learning environments (Vanesa-María & Gámiz-Sánchez, 2017) since knowledge of technology change in milliseconds. In this essential consideration, the learning capability of the firm to absorb new digital knowledge for ready available employees is taken into account in order to become ideal employees of Logistics 4.0 employees.

Likewise, in a human resource in digital competencies in transportation (Čižiūnienė, Vaičiūtė & Batarlienė, 2016) as well as related ideas of digital economy, e-government, and others, and detail implications for business and other organizations, and for society at large are possible if the firm have digital competency (Phillips, Yu, Hameed & El Akhdary, 2017). Previous studies show that by empowering with digital media, literacy skills can be effectively use to raise their quality of life (Suwana & Lily, 2017). So, on improvement of digital competency, self-assessment of digital competency is also available to gauge own digital competency (Maderick, Zhang, Hartley & Gwen Marchand, 2016). At the end digital employees, digital work and digital employee management system are among others supporting digital competencies in Logistics 4.0 human resource management (Strohmeier, Parry & Stefan, 2014). Thus, the following is proposed:

H2: The adoption and practice of Digitalization Competency in digital ecosystem will enhance the performance and collaborative achievement of Logistics 4.0 through characterized human resource development in Logistics 4.0 environment.

KNOWLEDGE MANAGEMENT PRACTICES AND LOGISTICS 4.0 COMPETENCY

As the results of the current worldview of diverse economics and politics landscape, knowledge is recognized as a strategic resource for knowledge exploitation and knowledge making organization of which no exception for military to shift their paradigm from traditional to network centric in information leverage and collective knowledge for decision making (Crawford et al, 2009). This paradigm shift may position any military force that is capable to identify, create distribute, adoptive on insights and experience of individual and organization (Nonaka, 1991) of its own forces and adversaries as having knowledge superior in making appropriate decision making timely and effectively.

Furthermore, with knowledge advantage over adversaries, the military force is able to act or respond or adapt timely to any multiple or complex threat or hostile situation successfully fitting to the level of operational pacing and fighting intensity (McIntyre et al, 2003). Ironically, though most of deliberate strategic planning has the desired returns, there are also war stoppages because of certain factors not considered when deliberating the action plan or unseen circumstances at execution phase, of which not only the product but the process can be captured and transformed into valuable knowledge for future interpretation and implementation (Crawford *et al.*, 2009; McIntyre *et al.*, 2003; Bartzack, 2002).

Since, the investment on Logistics 4.0 may be innovative process, the free flow of information, limitless of data requires control measures that function not to hinder the progress of Logistics 4.0 but to ease it expansion. However, with advancement of digital of supply chain era, Logistics 4.0 should be able to absorb the cyber and network risk and competitor disruption that enable more agile systems that can adapt and respond to changes accordingly in real time (Pereira, Barreto, & Amaral, 2017). It is proposes that security of the information and its

privacy shall be emphasized in the data exchange using ICT technologies (Obitko & Jirkovsky, 2015).

With technology as the pillar of Logistics 4.0, the service recovery of logistics mishaps in term of responsiveness is expected to be fast (Brindsmead, 2007, Battaglia et al., 2012; Andrejić, Kilibarda & Popović, 2015). Moreover, with flexible by having two or more able suppliers manufacturers or distributors (Stevenson & Spring, 2007), the disruption is identified early and risk mitigation can be faster because of the information sharing through technology is real time save (Bergström et al., 2015), smart learn to adopt to complex environment (Alsafi & Vyatkin, 2010) and able to sustain with machine forecasting for global uncertainty (Tam, 2018). To the advantage of good practice in governing algorithm in Logistics 4.0, the selection of data through massive information is avoidable yet worthy (Saurwein, Just & Latzer, 2015)

The advantage of IoT is by having high technological changes that bring transparency to supply chain visibility; integrity control on the right products, at the right time, place, quantity condition and at the right cost (Barretoa, Amarala, Pereiraa, 2017). This similar in managing risk in transportation such as air, land and sea freight through simulation (Crainic, Perboli & Rosano, 2017). In Logistics 4.0, logistics mishaps and supply chain disruption can be reduced with integration like transportation disruption through FUZZY, AHP and TOPSIS (Chaghooshi & Hajimaghsoudi, 2014). On top of that, blockchain technology is another alternative to mitigate risk of cyber risk in Logistics 4.0. Blockchain is a distributed, public ledger which is collectively kept up to date according to strict rules and general agreement. With the technology, it enables to reach a consensus in a system with potentially malicious actors and without a central authority and blockchains as security-enabler for industrial IoT-applications (Skwarek, 2017). Though, at the end the human to human relationship would determine the decision making process.

This brings to long life learning to supply chain competence in technological advances and information technologies, which accelerate quickly, affect the continually changing shape of the modern economy. Therefore, Logistics 4.0 need highly skilled workers of which the role of the lifelong learning is essential in the Logistics 4.0 (Wrobel-Lachowska, Wisniewski & Polak-Sopinska, 2017). Logistics 4.0 is able to have instant information exchange; automated solutions and real-time big data analysis are among the features as similar to Industry 4.0 (Strandhagen, Vallandingham, Fragapane, Strandhagen, Stangeland & Sharma, 2017). Logistics and supply chain in Industry 4.0 has brought new communication, transfer information and digital business connection via internet network (Domingo, 2017).

With Industry 4.0, IoT, cloud computing, big data analytics and new web-based operation system are as crowd cyber ecosystem that has interconnected intelligent agents of different stakeholder (Chai, Miao, Sun, Zheng & Li, 2017). It also consists of connection of sensors, monitors, and radio-frequency identification devices through IoT technology that expanded the social and economic implications of doing business (Dutton, 2014). Additionally, the knowledge of algorithms would become as basic knowledge that shape normal business routine. Yet, the benefits of algorithms are accompanied by risks and governance challenges (Saurwein, Just & Latzer, 2015) perhaps from competitor or sabotage to disrupt the supply chain at large.

Moreover, with cyber-physical systems, the big data and IoT in Industry 4.0 need different tools and process (Tamas & Illes, 2017). With IoT, it also opens to innovation to improve business

process (Dong-Il Shin, 2017). However, with the emergence of cloud based system, IOT, Big Data, the vulnerability in security does exist (Pareira, Baretto & Amaral, 2017). Therefore, service failures identification, monitoring and elimination in maintaining logistics services quality, costs reduction scheme, customer satisfaction; loyalty and revenue are still as much imperative similar to traditional business firm. With accurate service identification, service recovery can be conducted to ensure distribution process in warehouse, transport, inventory and other logistics processes is run smoothly (Andrejić, Kilibarda, Popović, 2015).

With smart logistics, it the use of innovation contests as an open innovation initiative for LSPs (von See & Kalogerakis, 2015). Kersten, Blecker and Ri (2015) coined that the impact of Industry 4.0 is from a structural, technological and organizational perspective (Pfohl, Yahsi & Kurnaz, 2015). With Industry 4.0, there are intelligent robots that effecting massive levels of unemployment (Frederick, 2016). Organization is changing structure with management control system because of services/products and resource scarcity (Lechner, 2016). With IOT proximity services, RFID technology as tracking service for better inventory (Ignacio, Segarra, Jammal & Chaouchi, 2017). Whereby implementation of autonomous logistics, with software system and human actors it monitors material flow better than traditional one (Timm & Lorig, 2015). Therefore, with Industry 4.0 and consequently the Internet-connected technologies allows the creation of value added for organizations and society is as influenced to consumer behaviour (Roblek, Meško & Krapež, 2016). Yet any system is not perfect, therefore risk management system must be continuously conducted to guarantee safety from the tail to the other end tail of a supply chain. Thus, as depicted in the Research Framework, the following is proposed:

H3: The adoption of Knowledge Management Practices in digital ecosystem will enable the achievement of Logistics 4.0 competencies that is characterized through Knowledge Management Process as the key strategic priority.

LOGISTICS RESPONSIVENESS, DIGITALIZATION COMPETENCY AND KNOWLEDGE MANAGEMENT PROCESS

Initially, logistics firms need to scan on the social impact of Logistics 4.0 to its firm and society. The fundamental reason to adopt changes to create better business value and the strategy to shift the mind-sets, revolutionize the decision making and business strategies. The next essential is the talent and the workforce of handling talent strategies and workforces when embarking Logistics 4.0. Then, the transfer of technology of which the fundamental of technology usage is as a toolset to improve business as usual, or are they harnessing the full potential of smart technologies to enable digital supply chain-physical integration, holistic decision making and new business models (Arntzen *et al.*, 2013, Bharadwaj *et al.*, 2013). The knowledge absorptive capacities to knowledge assimilate and knowledge transform is feasible though Logistics 4.0 is adopted abruptly by a firm.

The debate on defining digital competence, or literacy, started as early as the 90s, when several authors used it to refer to the ability to read hyperlinked texts and explore multimedia formats (Bawden, 2001). The first influential definition was given in 1997 by Gilster, who took a broader approach in defining it as "the ability to understand and use information in multiple formats from a wide range of sources when it is presented via computers" (Gilster, 1997). However, the fact that Gilster (1997) did not provide a set of competences, as well as the fact that digital literacy can be seen as having its roots on other related literacies as computer and information literacy, kindled a debate that rolls on into our days. While some academics refer

to the ability to use technologies as computer literacy (Simonson, Maurer, Montag-Torardi, & Whitaker, 1987), others take the side of information literacy (Behrens, 1994), or promote the predominance of media literacy (Christ & Potter, 1998), or internet literacy, and so on and so forth. New terms have been created spreading from'new literacies' (Coiro, Knobel, Lankshear, & Leu, 2008) to 'multimodality' (Kress, 2010).

On top of that, there are multiple information management and information system (which is different from knowledge management (Crawford et al, 2009) in a modern military organization that facilitate day to day strategic decision making in getting desired results for operational efficiently, yet one need to be analytic that the very strategic concept of a current technological era military organization needs to be at upper hand in knowledge superiority over its adversaries. (McIntyre et al, 2003). Though transformation from industrial era to knowledge era of which evidently, any information can be reached at one fingertip, there are barriers on issues made on security clearance, hierarchy and bureaucracy obstacles, bandwidth differences, robustness, intensity, reliability (Bartzak, 2002) and internal-external barriers from individual or groups that resist to change which arise to a conclusion that the obstacles are make issues to put aside the idea to implement KM in military context.

Essentially, knowledge management processes are important in managing Logistics 4.0. This lead to digital supply chain competence when embarking Logistics 4.0: Though, the claim of technology dominance play an important role Logistics 4.0 requires knowledge, skills, and attitudes that are required to deploy these technologies (Dominici, Roblek, Abbate, & Tani, 2016). Digital supply chain competence relates to many aspects of life (work, leisure, communication) and is considered to stretch beyond mere know-how and technical skills, for it refers to confidence and a critical attitude as well (Karkkainen & Holmstrom, 2002). The transmission of the process of digitalization and automation becomes easier if the firm has clear structure of related technology of knowledge management process thus structurally operational risk can be mitigate successfully with the intellectual capability that the firm have. The four basic processes of knowledge management are shown in figure 1.

With Logistics 4.0, technology as an equalizer that provides more access across different geographies and social groups. Yet, this new access requires different skills and impacted jobs competency of the people of the firm that potentially lead to development of knowledge, skills and attitude (Villanueva-Rosales, Cheu, Gates, Rivera, Mondragon, Cabrera, & Larios, 2015). The social development indicates that the cumulative effects of technological advances and demographic changes are the changing preference of customer orientation far beyond previous industrial revolutions (Stock & Seliger 2016). In the near future, customer behaviours that preferred business transaction and digital environment from end-end digital supply chain may dominate the new ways in conducting business reaching out far with customer which before was limited because of geographical distance.

In sum, Logistics 4.0 is revolutionary because it enables organizations to capture data from the physical world, analyse it digital supply chain and drive informed action back in the physical world. This continuous and cyclical flow of information, known as the physical-to-digital supply chain-to physical loop, enables organizations to react in real time to shifts in the ecosystem is the critical success factor of Logistics 4.0 (Lasi, Fettke, Kemper, Feld, & Hoffmann 2014; Ning & Liu, 2015). Technological data analysis is used to improve the efficiency of manufacturing processes and anticipate client demand, as well as to consult clients on the best applications of the organization's solutions can create interconnected digital supply chain enterprises,

ecosystems, supply networks and consumer interactions that communicate, analyse, learn and apply information to drive actions in the physical world in a digital industry ecology like a smart city (Nowicka, 2014). Thus, this study hypothesized that:

H4: Knowledge Management Process and Digitalization Competency centric will enable the development of the Logistics 4.0 digital competencies through Agility and Logistics Responsiveness in Logistics 4.0 Environment.

RESEARCH FRAMEWORK

Drawing upon the literature and the theoretical framework, this study proposes the following research framework (Figure 2). Responsiveness, flexibility and speed in supply chain agility can be achieved with big data management (Giannakis & Louis, 2016).

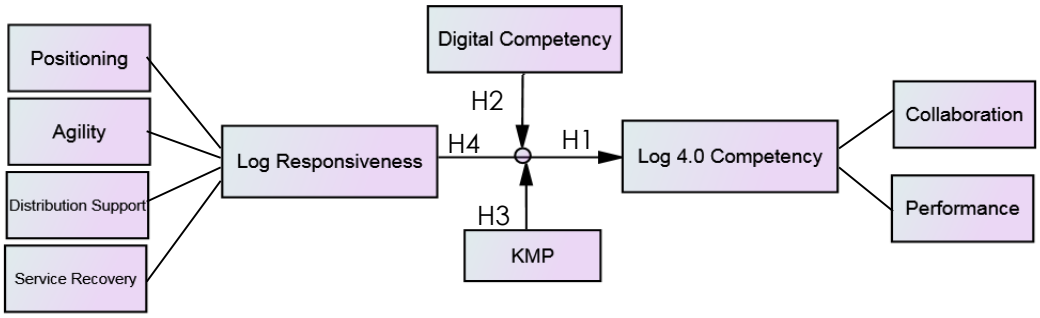

Figure 2. The Research Framework.

METHODOLOGY AND ANALYSIS

Based on previous studies, a research framework is developed to assess relationships that involve the linkages between Logistics Responsiveness, Digitalization Competency and KMP, and Logistics 4.0 Competency. Previous studies have shown that there is a positive relationship that affects every relationship or relationships that are presented. With the four hypotheses have been stated above and follows:

1. **H1**: The reference of challenge, risks and opportunities of agility and logistics responsiveness towards Logistics 4.0 competency in digital ecosystem can successfully develop and sustain logistics and supply chain competency in Logistics 4.0 environment.
2. **H2**: The adoption and practice of Digitalization Competency in digital ecosystem will enhance the performance and collaborative achievement of Logistics 4.0 through characterized human resource development in Logistics 4.0 environment.
3. **H3**: The adoption and practice of Digitalization Competency in digital ecosystem will enhance the performance and collaborative achievement of Logistics 4.0 through characterized human resource development in Logistics 4.0 environment.
4. **H4**: Knowledge Management Process and Digitalization Competency centric will enable the development of the Logistics 4.0 digital competencies through Agility and Logistics Responsiveness in Logistics 4.0 Environment.

This study uses a questionnaire developed through literature study. The population of the study involved three military services throughout Malaysia, namely Malaysian Army (RMA), Royal Malaysian Navy (RMN), and Royal Malaysian Air Force (RMAF). For this study, the combination

of two sampling methods; stratified sampling and random sampling, are easy to use. A total of 700 questionnaires have been distributed to MAF's personnel. Five-scale Likert scales were used to obtain feedback in terms of perceptions of respondents on the testimonials tested. The study involved 8 tools and selected criterions as appropriate from the study of Ding (2011), Manuri (2012) and Morgan (2016). Although there is a predictable variation between the respondents, the researchers try to assist the respondents by providing indicators on the Likert scale used (Ab Hamid *et al.*, 2012). The data collected from the questionnaire were analyzed using SPSS version 22 and AMOS version 22.

The data for the criterion are obtained by using the total score for each item in the criterion. The criterion and items are shown in Table 2. Since scores for each item are collected directly from the survey respondents then these four critics are the observable criteria. Figure 3 shows the CFA path analysis obtained from structural equation modeling techniques which utilizes maximum likelihood estimation on Logistics Responsiveness, Digitalization Competency and KMP, and Logistics Competency developed model. Confirmatory statistics for the evaluation of the hypotheses model are the Chi-squared values (z^2), the p-value > 0.05, the degrees of freedom are positive, the mean square root error value (RMSEA) <0.08, Comparative Fit Index (CFI) Tucker-Lewis Index (TLI) Š 0.9 and Chi Squared Mean (cmin / df) <5.0.

A total of 117 questionnaires were valid and been used in this analysis. The number of questionnaires has gone through the screening process involving incomplete questionnaires and so on. Respondents are from three MAF services. Table 1 shows the breakdown of respondents by rank, service, years of service, education level, units and gender. Percentages according to the accepted organizational logistics core are almost identical to the actual population and coincide with the stratified sampling performed. Fractions according to services size are MA (60.7%), RMN (21.4%) and RMAF, (17.9%). The size of the other criterion and percentages are as tabulated below.

Table 1: Frequency of Respondents Profile

	No of Respondent	%		No of Respondent	%
1. Rank			4. Education Level		
Lieutenant	14	12.0	Master	30	25.6
Captain	19	16.2	Degree	53	45.3
Major	66	56.4	Diploma	24	20.5
Lt Colonel	18	15.4	Others	10	8.5
2. Service			5. Units		
Army	71	60.7	Headquarters	45	38.5
Navy	25	21.4	Operational	43	36.8
Air Force	21	17.9	Training	29	24.8
3. Years of Service			6. Gender		
Below 10 Years	20	17.1	Male	104	88.9
10 to 19 Years	54	46.2	Female	13	11.1
Above 20 Years	43	36.8			

Note: N=117

In the elaboration of the descriptive statistics, the researcher uses the average score. Table 2 shows the mean and standard deviation of each item including the Cronbach alpha. However, the standard deviation values are quite large, but respondents agree that the items are important for each factor being studied (Norzaidi & Intan Salwani 2009; Ab Hamid 2012). The Reliability analysis is done to determine the reliability level of data obtained. Sekaran (2006) defines reliability as a non-error measure that guarantees a consistent measurement across time and across various items in the research instrument. The Cronbach alpha coefficients of the instrument used are 0.853, 0.861, 0.961, 0.948 and according to Hair et al. (2010), alpha values greater than 0.70 indicate good reliability.

Table 2: Descriptive & Reliability Statistics

	MEAN	**STD. DEVIATION**	**COMPOSITE RELIABILITY**
Digitalization Competency	3.699	3.347	0.876
KMP	4.384	3.752	0.863
Logistics Responsiveness	3.708	9.642	0.988
Logistics 4.0 Competency	3.657	10.782	0.976

According to Hair *et al.* (2010), path analysis is a way of representing a set of regression equations using a causal relationship diagram. Path analysis is used to determine the effect relationship between independent variable with dependent variable. In this case the path analysis method is based on the determination of the relationship in a series of regression equations which can then be estimated by determining the amount of correlation in each equation simultaneously. Relationship estimation is done using maximum likelihood estimation. Figure 3 shows the analysis of the path analysis of the measurement model of the logistics responsiveness and the digitalization competency and KMP, and the logistics 4.0 competency. Figure 4 portray the modified model as suggested in modification indices according to the literature review.

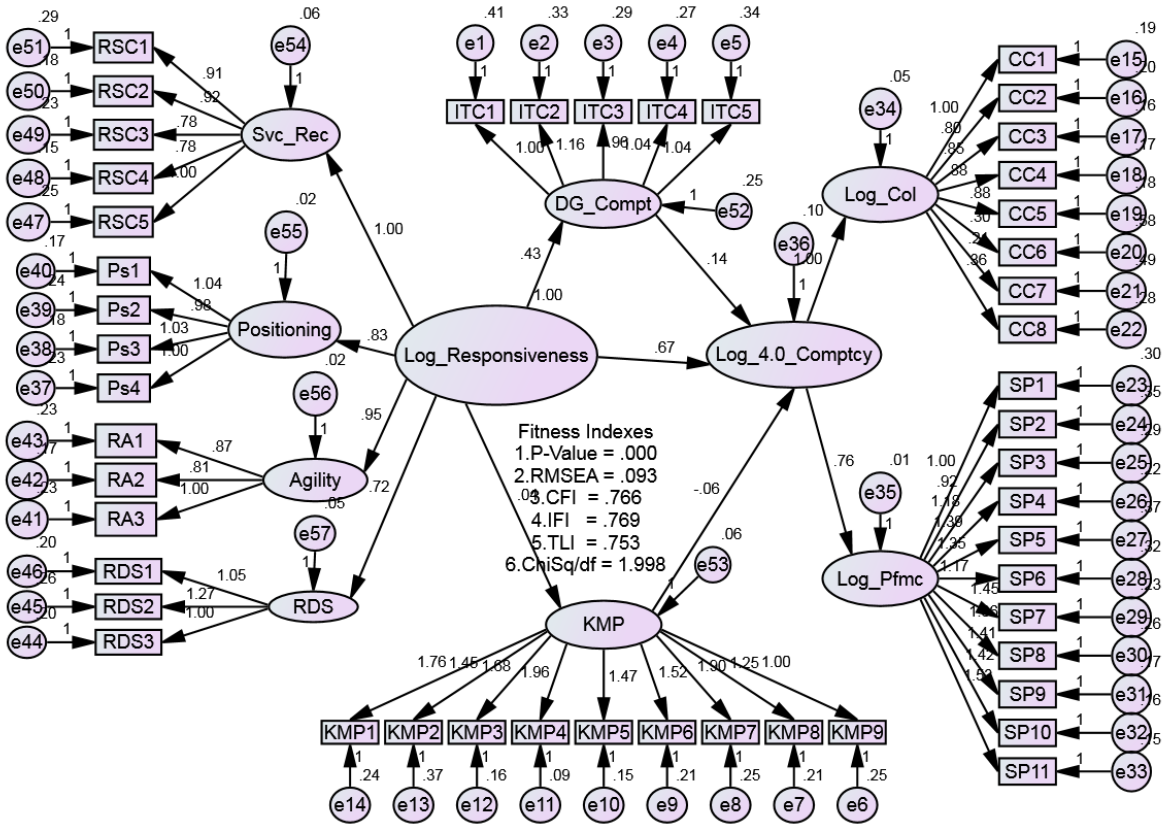

Figure 3: The CFA Path Analysis Model (Before modification)

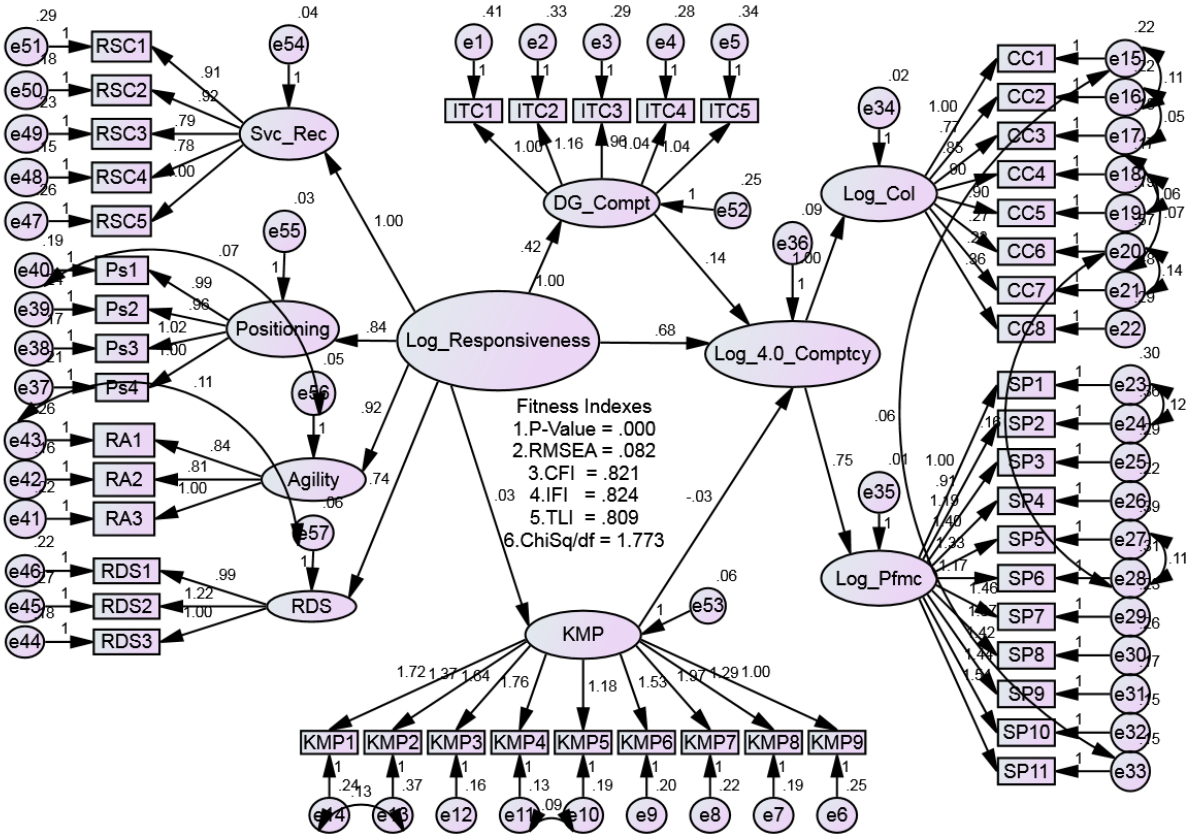

Figure 4: The CFA Path Analysis Model (After modification)

Before testing the fitness statistics for the path analysis, normality assumptions and regression analysis were observed. An assumption of normality finds that all items are in the range for the skewness coefficient and for the kurtosis coefficients of each item as well as the availability of multivariate normality are also complied with (Kline 2011). Subsequent multivariate regressions are identified using the Mahalanobis distance for each isolated case detected. Fitness statistics for the path analysis yields chi-squared values, z^2 = 1.773, df = 3 and p-value = 0.000. Furthermore, fit statistics such as CFI = 0.821, TLI = 0.809, IFI = 0.824 and RMSEA = 0.082 are within the range of proposed matching statistics. Subsequently, based on the results of the study, all track coefficients were tested at a = 0.05, giving a significant result with p <0.05 or critical value> 1.96. Hypothesis testing is based on the path coefficient and the level of understanding that explains the effects of exogenous variables on endogenous variables. Additionally, Moss (2016) posited that Bollen (1989) suggestion in a field in which previous models generate CFI values of .70 only, a CFI value of .85 represents progress and thus should be acceptable (Bollen, 1989).

The results of the chi square test of 1.773 indicate that the hypothesis model suggested by this study are consistent with the data collected from the survey respondents. Fitness statistics values such as CFI and TLI are between 0.821and 0.809 (considered acceptable (Bollen, 1989)). This shows the hypothesis models are worth the study data. The RMSEA value of 0.082 (RMSEA is less than .08 (Browne & Cudeck, 1993)--and ideally less than .05 (Stieger, 1990). Alternatively, the upper confidence interval of the RMSEA should not exceed .08 (Hu & Bentler, 1998)) confirms that in essence, this hypothesis model corresponds to the study data.

Table 3: The weighted regression results for the causal relationship between the variable using maximum likelihood estimation

DESCRIPTION		ESTIMATION PARAMETER	P-VALUE
H1 (Log Responsiveness	**---> Log 4.0 Competency)**	0.678	<0.001
H2 (Digitalization Competency	**---> Log 4.0 Competency)**	0.144	0.088
H3 (KMP	**---> Log 4.0 Competency)**	-0.008	0.010
H4 (Log Responsiveness	**---> Digitalization Competency & KMP)**	0.424,0.028	<0.000, 0.422

Referring to the Table 3, the hypothesis 1 states that the logistics responsiveness is affects the logistics 4.0 competency. The findings show that the relationship between logistics responsiveness and logistics 4.0 competency is significant. This is evidenced by the result of regression weighting equals 0.678 which means (p-value <0.001, a = 0.05). This means that when the logistics responsiveness increases by one standard deviation, logistics 4.0 competency increase will increase by 0.678. The result of hypothesis 2 of the bias weighted regression shows that the value is small i.e. 0.144 and does not mean (p = 0.088, a = 0.05). This means that when the digitalization competency increases by a standard deviation, then the logistics 4.0 competency increases will increase by 0.144 and this increase will not be meaningful. Hence the hypothesis 3 is concerned with the relationship between the KMP and the logistics 4.0 competency and the result of the bias weighted regression shows that the relationship is significant (p = 0.010, a = 0.05) and has a value of -0.008. This means that when the adoption of KMP increases by a standard deviation, the quality increase will increase by -0.008. The result indicates that KMP does not partial mediate the relationship between logistics responsiveness and logistics competency 4.0. It also indicates that KMP is not explaining the relationship as proposed. Extant literatures show that knowledge management awareness not KMP is the alternative construct that may best explain the MV relationship for the awareness of MAF personnel about KMP bottom line (Forcada, Fuertes, Gangolells, Casals & Macarulla, 2013). The KMP towards logistics competency is in existence yet the awareness may be the phenomenon in this 21st century era (Jain, 2009) and education on the knowledge management awareness should be emphasized (Liebowitz, 2003). Then, the hypothesis 4 examined the relationship between logistics responsiveness and digitalization competency and KMP, and found that there was a link between them. This is evidenced by the value of 0.424, 0.028 and is meaning (p-value<0.001, a = 0.05). This means that when logistics responsiveness increase by one standard deviation, the digitalization competency and KMP will increase by 0.424, 0.028.

FUTURE STEPS TAKEN FOR LOGISTICS 4.0 COMPETENCY DEVELOPMENT

In 2011, to the advantage of early adaptors of Logistics 4.0, their expansion of business by finding right distributors, find better strategic alliance for coordination of bigger network, new partner for expansion, control on own distribution, grow distribution channel internationally may be facing uncertain and complexity environment. Yet, with the platform of communication of IoT the transmission speeds up, paving the ground for dissemination of 5G, and communication between logistics providers, operators and customers causing better integration process (Dominici *et al.*, 2016) that lead to better business process because of Logistics 4.0 competency.

In mature knowledge economy environment, Logistics 4.0 expand towards total automation and non-human involvement in operation. In avoiding risk, a firm may adopt non-human or drone types of transportation such as unmanned aircraft or sea vessel (Domingo, 2016) that risk aversive to life threatening situation such as to terrorism risk (Schlegel & Trent, 2015). With Logistics 4.0 as the mirror image to Industry 4.0, warehousing and inventory management can be operationalized with robotics and artificial intelligence. Moreover, this envision of more collaborative jobs between humans who is digitally competent with robots that has artificial intelligence. Yet, the danger of low-skilled jobs being supplanted by technology may not be in the picture thus the reality is that every individual workforce need to have their digital skills level alleviated. With digital competency in Logistics 4.0, this may results to a new value add of the human as the managers that essentials are human skills such as supervision, creativity and emotional intelligence in having artificial intelligence mechanism as a tool to manage operation of Logistics 4.0 (Shamim , Cang, Yu & Li, 2015).

Future of work driven by connectivity, new talent and cognitive tools, work is changing the workforce of Logistics 4.0. With Logistics 4.0, the robotics, artificial intelligence and talent grow and jobs are also being reinvented, creating the new generation workforce (Prensky, 2001). The designed and work to adapt and learn for future growth much more in fostering an IT culture for uncertain nature of Logistics 4.0 workforce. With differentiation of digital workforce, it enables firm explores beyond digital employee efficiency. This type of workforce interacts with pertinently with advanced technology. At the end of the day, the firm need to have different reaction between the traditional and non-traditional employees and in preparing the workforce, training and education of Logistics 4.0 workers is way forward to meet the future workforce (Hecklaua, Galeitzkea, Flachsa & Kohl 2016). The firm workforce is having digital competency by having knowledge application of network-based, data-driven, autonomous and cognitive digital supply chain and physical technologies may take advantage of the process innovation of Logistics 4.0 (Domingo, 2016).

SUGGESTION OF FURTHER STUDIES

Not many studies focus on the aspects of human resource development especially on digital competency of Logistics 4.0 especially in emerging economic countries. The change of organizational culture whereby traditionally the relationship of human and machine is pushed forward by Industry 4.0 and amicably logistics and supply chain risk environment change volatilely globally (Strohmeier *et al.*, 2014). Though, it may appears that operational risk in relation to digital and robotics high maintenance and enduring operation risk, the psychological risk on the human behind Logistics 4.0 may prevail. It is suggested that beside digital competency of the workforce as to engage awareness of logistics and supply chain risk in Logistics 4.0, the psychological risk of the workforce involved directly need also to be emphasized in term of relationship between cyber-physical and multiple realities of supply chain risk management to human workforce (Hecklaua *et al.*, 2016) .

CONCLUSION

Agility and logistics responsiveness are essential capability for Logistics 4.0 performance. Though the risk appetite is changed because of the supply chain environment volatility, it is a necessity to maintain agile when embarking on Logistics 4.0. With rapid development of 4.0, the aspects of logistics automation needed to be scrutinized in order to enhance the business values with Logistics 4.0. Though, scepticism play around Logistics 4.0, late adopters may not seize the opportunity of business as the early adopters of Logistics 4.0. Nowadays logistics providers and operators are forced to change and adopt Logistics 4.0 because of the present and future circumstances (Strohmeier *et al.*, 2014). The continued existence of a logistics firm requires paradigm shift that decide whether the risk of adopting such massive changes like Logistics 4.0 to its company to be as worthy business model change. The changes was never expected few years back whereby Logistics 4.0 was perceived only as a transportation systems in Industry 4.0, that risk assessment were not predetermined in the past. Hence, in boarding Logistics 4.0, there are risks that needed to be measured and it is proposes that aside from security risk on cyber-attack like blockchain technology, psychological risk related to human factors should be given more emphasis before capitalizing by investing large sum of money.

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