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Top-Down Orientation on Fourth Industrial Revolution: A Literature Review

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ABSTRACT

Fourth Industrial Revolution (IR 4.0) through convergence of technologies is blurring the lines between physical and virtual world. It has not only redefined the operations for companies and policy making for countries but has led to new possibilities for human life. With this broad and significant impact, this paper uniquely contributes to share a wide-spectrum view from macro/country to micro/organization level (top-down approach) on IR 4.0. Bibliometric and thematic analysis methodology has been used to review 255 journal articles from 1964 to mid-2019. The findings of this review reveal four distinct orientation (Country, Industry, Functional and Organizational Orientation) on IR 4.0. The study further identifies five sub-orientation of functional orientation (Risk Management, Customer Service Management, Operations Management, Value Chain Management and Supply Chain Management) and three sub-orientation of organizational orientation (People, Process and Product-Service). The future studies can consider this top-down approach orientation for comprehensive viewpoint on IR 4.0, which at present is largely understudied, and is also uncommon in most of the existing literature reviews on IR 4.0.

Keywords: Fourth Industrial Revolution, IR 4.0, Industry 4.0, Literature Review

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INTRODUCTION

Fourth Industrial Revolution (IR 4.0) is indeed 'The New Normal' as it is fuelled by the advancement of digital technologies in almost all areas of business operations (Riemann 2016; Sony 2019). The speed of change is so neck-breaking that there has never been a time of greater promise or potential peril. Schwab (2016) considers two factors to believe that IR 4.0 has arrived: First being 'velocity', which reaffirms that IR 4.0 is designed for exponential pace. Second being 'breadth and depth' through which IR 4.0 is impacting businesses and society both.

Our world has witnessed various revolutions in the global history (Schwab 2016). The first revolution was from foraging to farming, and it occurred around 10,000 years ago. This period was also known as agrarian revolution. This was then followed by a series of industrial revolutions. Mechanical power took the center stage as the first industrial revolution from 1760 to 1840, in which steam engine was invented. The second industrial revolution started in the late 19th century and into the early 20th century that made mass production possible. The third industrial revolution started in the 1960s, which was dubbed as computer or digital revolution. Now, we are in fourth industrial revolution which is focused on digital revolution. It encompasses mobile internet, artificial intelligence and machine learning. Massachusetts Institute of Technology (MIT) Professors Erik Brynjolfsson and Andrew McAfee refer to fourth industrial revolution as 'the second machine age'. There are various connotations to IR 4.0, which leads to a variety of definitions (Müller et al. 2018). To start with this review, some of the widely accepted definitions are listed in Table 1.

Table 1. IR 4.0 Definitions

IR 4.0 Definitions	Reference
Integration of complex machinery and devices, with sensor and software, used to predict and control business results	Haber et al. 2015
A smart manufacturing concept where machines and products interact with each other without human control	Ivanov et al. 2016
It is convergence of technologies for optimized decision making	Kang et al. 2016
The interaction of digital and physical processes in cross geographic and organization setting	Adler et al. 2015
A holistic system of people and machines for flow of goods, services and data with a high degree of autonomy in decision making	Hermann et al. 2016

There are various economic, cultural and business challenges in adopting IR 4.0. From the economic perspective, IR 4.0 will lead to reskilling of jobs, which will affect the labor market in a considerable manner (Davis 2017). From the cultural perspective, IR 4.0 will further increase inequality in society (Bankole et al. 2015). From business angle, it will change the future of work and workplaces (Pfeiffer 2017). Martin Nowak, a Harvard University professor quotes that the Fourth Industrial Revolution will raise questions on what it means to be human (World Economic Forum 2018). The main motivation of this review is to contribute a new theme to the existing review papers on IR 4.0.

METHODOLOGY

Review Approach

This literature review involves scanning of existing literature on the topics related to IR 4.0, which led to a total of 255 articles, with timeline spanning from 1964 to mid 2019. These articles include review papers, conceptual papers and empirical studies (covering history, trajectory, maturity, models, frameworks, challenges and benefits of IR 4.0). The extraction of data points was done from 95 scientific journals and publications. In synopsis, the review methodology is shown in Table 2.

Table 2. Highlights of Literature Review

Total Articles Reviewed	255
Timeline	1964 to mid 2019
Language	English
Context	Global (Eastern and Western, including Asian and Non-Asian)
Data Extraction	95 Scientific Journals
Keywords	Fourth Industrial Revolution, Industry 4.0, IR 4.0, IR 4.0
Sources	Google Scholar, UKM Library Portal, Literary Databases, Emerald, JSTOR, Sage, Research Gate, Science Direct, Wiley, Springer Link, EBSCO Host, Journal Citation Reports (JCR), Taylor & Francis, Wiley

BIBLIOMETRIC ANALYSIS

There are two bibliometric results which are of key importance in this review: (a) distribution of papers by year, (b) distribution of papers by orientation. The first year-wise bibliometric analysis helps to understand research growth on the topic of IR 4.0. Out of the 255 articles reviewed, 59 articles were published in 2018 which is the highest as compared to 35 and 20 articles in 2017 and 2016 respectively. In terms of timeline, publications/ articles on IR 4.0 have been gaining momentum recently. This is shown in Figure 1:

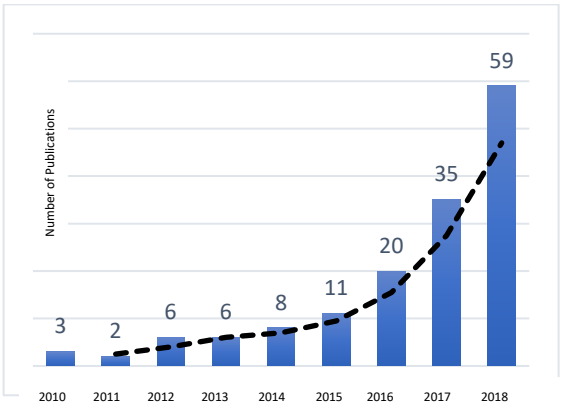

Figure 1. Distribution of papers by year (Source: Researchers' Own Illustration)

The second orientation-wise bibliometric analysis helps to understand the scope of existing literature on each orientation theme. The total papers (TP) on each orientation have been pooled, and it signifies that most of the work has been done on Organizational Orientation with 93 available studies, and lowest on Industry Orientation with 15 available studies. Here, the assumption is that same study can be cited under more than one orientation. This analysis is extracted from Appendix B that shows a detailed tabulation of the literature review. Figure 2 below illustrate the second bibliometric analysis:

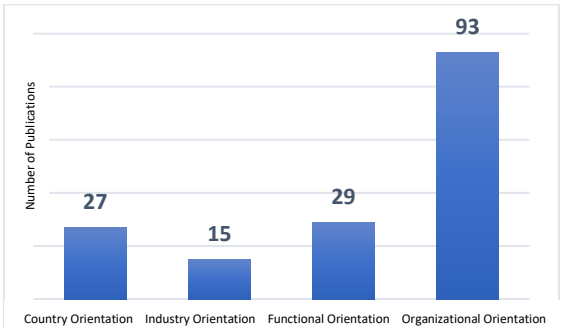

Figure 2. Distribution of papers by orientation (Source: Researchers' Own Illustration)

LITERATURE REVIEW

The top-down approach was first coined by IBM in 1970 with software development protocol which focused on steps ranging from wider to narrower perspective (Stewart et al. 2015). Later, this approach got popular in many other fields including psychology and business. In reviewing the literature, this paper identifies a total of 61 major terms, trends or keywords as recurring in connection with the topic of IR 4.0, as sketched in the form of mind map in Appendix A. These terms in this paper have been carefully pooled to represent four distinct themes, hereon to be referred as IR 4.0 Orientation in this article: Organizational Orientation, Industry Orientation, Country Orientation and Functional Orientation. In terms of stakeholders of IR 4.0, the topic is of importance to governments, regulators, businesses, producers, competitors, customers, consumers and employees. As top-down approach seeks to identify the big picture first and then lead to its components (Stewart et al. 2015), the identified four orientation can be rearranged in a top-down manner (Country Orientation, Industry Orientation, Functional Orientation, and Organizational Orientation), reproduced in that order in Figure 3. The first two types of orientation can be considered as Macro Orientation (outside the firm perspective) and the last two types of orientation can be considered as Micro Orientation (inside the firm perspective). The remaining part of this article makes the case by sharing insights on each of this orientation, starting from Country Orientation.

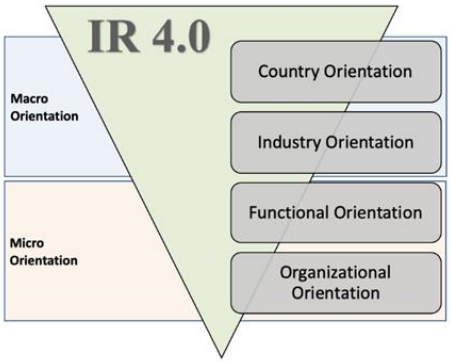

Figure 3. Top-Down Orientation on IR 4.0 (Source: Researchers' Own Illustration)

IR 4.0 and Country Orientation

The top-most orientation with a macro economy view to study IR 4.0 literature is country orientation. IR 4.0 studies are mostly cited with reference to 17 countries, as narrated in this section. The term of Industry 4.0 (I4.0) or German Industrie 4.0 or Fourth Industrial Revolution (IR 4.0) was first used in 2011 at the Hanover Trade Fair in

Germany (Müller et al. 2018; Slusarczyk 2018). This was then taken as part of German government initiatives, and became synonymous for the phrase "High-Tech Strategy 2020 for Germany" (de Sousa Jabbour et al. 2018; Slusarczyk 2018;Westjohn et al. 2009). In Germany, another notion of Smart Industry or Smart Manufacturing became common, which essentially meant the same as IR 4.0. The momentum got picked up, and the world started using their own variants of IR 4.0. Starting from Europe, Germany (Industrie 4.0), France (the Nouvelle France Industrielle), Sweden (Produktion 2030), Italy (Fabbrica Intelligente), Belgium/Holland (Made Different), Spain (Industria Conectada 4.0) and Austria (Produktion der Zukunft) took the stage by the storm (Slusarczyk 2018).

Liao et al. (2017) studied the relevance and progress of IR 4.0 from a global perspective, and identified some good insights. In 2011, the United States (US) started 'Advanced Manufacturing Partnership (AMP)' which is IR 4.0 version of manufacturing. In 2012, the German government crafted 'Industrie 4.0' for the manufacturing sector. In 2013, the French government started 'La Nouvelle France Industrielle'. In the same year 2013, the United Kingdom (UK) government presented 'Future of Manufacturing' for 2050. In 2014, the European Commission launched 'Factories of the Future (FOF)'. In 2014, the South Korea government publicized 'Innovation in Manufacturing 3.0' that has strategies for Korean manufacturing (Kang et al. 2016). In 2015, the Chinese government issued the 'Made in China 2025' to accelerate the informatization and industrialization in China. In the same year 2015, the Japanese government revealed 'Super Smart Society'.

Overall, IR 4.0 presents a great opportunity for countries with sizable manufacturing base like India (Sharma & Gandhi 2018). Russia was late as compared to other developed countries on implementing IR 4.0, but it showed determination and commitment since the time they started (Popkova 2019). C. Jones et al. (2017) studied the innovations under Thailand 4.0, and realized that majority of Thai citizens fail to understand and use it. In 2016, the Singapore government revealed 'Smart Readiness Index' to capture IR 4.0 opportunities. In 2018, the Malaysian government launched 'Industry4WRD' to take benefit of IR 4.0 initiatives. On a country level, each country has a different understanding of economic development, demographic situation, growth of global trade and resource availability which has led to diversity in the adoption practices of IR 4.0 in different countries (Popkova 2019).

IR 4.0 and Industry Orientation

In terms of industry orientation, there are six industries that have been cited in literature relating to IR 4.0: Construction, Logistics, Automotive, Healthcare, Defence and Chemical Industry. The two major industries that have been categorically compared with IR 4.0 are construction industry and logistics industry. The construction industry is internationally expanding, and Information Technology (IT) is of great assistance (Jaafar et al. 2007). IT has been perceived as a driver for many construction ventures. Innovation in construction procurement requires contractors to equip themselves with new knowledge on technologies. The amount of investments in construction has increased with the advent of IR 4.0 practices. In Europe, Germany is at leading market, followed by France, the UK and Spain (Oesterreich & Teuteberg 2016).

Similarly, logistics management gets affected by IR 4.0. As per (Hofmann & Rüsch 2017), there are two dimensions (1) Physical supply chain dimension, which has been affected through autonomous trucks, trailer unloading, piece picking robots and blockchain technology, (2) Digital data value chain dimension, which has been affected by machine and sensor data. (Bujak 2018) coined the development of Logistics 4.0, with added IR 4.0 technologies. Similarly, the projected increase in robotics has change the Automotive Industry Sector (Kannan et al. 2017; Lin et al. 2018). The automation of many processes seems possible now in Defence and Chemical industry sectors (Bibby & Dehe 2018; Reis & Kenett 2018). IR 4.0 has transformed Healthcare industry equally if not more by redrawing the boundaries for what is possible. The use of 3D printing under the ambit of IR 4.0 to create human organs is one of the finest examples in the Healthcare industry (Caison et al. 2008; Melas et al. 2014; University 2016).

IR 4.0 and Functional Orientation

In terms of functional orientation, there are five functions that have been cited in literature relating to IR 4.0: Risk Management, Customer Services Management, Operations Management, Value Chain Management and Supply Chain Management. Of these, the two major functions that have been paralleled with IR 4.0 are Value Chain Management and Supply Chain Management.

Risk Management

IR 4.0 has improved manufacturing processes and have also added more risks. The interaction between humans, systems and objects have become more complicated, and hence calls for integrated data chains and operations (Tupa et al. 2017). It was first projected in Germany with the concept of Internet plus Manufacturing (Zeng et al. 2007). Secondly, a vital principle of management is performance measurement, which is equally a concern in IR 4.0 applications. Precisely, Key Risk Indicator (KRI) is an important indicator in this case, and a good number of researchers have dealt with KRIs to deter risk at an enterprise level. However, there is a gap on the issue of linking KRIs and KPIs in respect to IR 4.0 (Ostrom & Wilhelmsen 2012).

Customer Service Management

Leveraging on IR 4.0, technology combination into service processes has heightened the use of self-service technology (Yieh et al. 2012). This has added to issues relating to customer service as technology-based services are not always user friendly (Lorenz et al. 2018). The study by (Yieh et al. 2012) empirically examines how technology readiness affects customer perceived value in the context of IR 4.0. This customer perceived value then has emerged as a decisive instrument for analyzing service quality, customer satisfaction, and consumer behavior (Mummalaneni et al. 2016). Furthermore, it is also important to understand customers in terms of their attitude, intention, and knowledge as that will have direct consequences on customer service management in businesses (Tsourela & Roumeliotis 2015). IR 4.0 has helped to fetch customer service feedback faster, but it has increased customer expectations multifold (Kim et al. 2017).

Operations Management

IR 4.0 contribute to operations management in multiple ways, as it influences the interaction among systems that requires the interconnection between different technologies (Fettermann et al. 2018). In a manufacturing setting, this might include radio sensors and cyber-

physical systems. Furthermore, the results indicate that IR 4.0 contributions are more relevant in areas such as technology management and just-in-time manufacturing. The advent of IR 4.0 implies new managerial approaches. The application of Programmable Logic Controllers (PLCs) for manufacturing automation has been the most significant contribution so far, but the use of the internet through machines has transformed to a new level called Cyber-Physical Systems (CPS). Tonelli et al. (2016) developed a novel methodology for improving operational performance in the IR 4.0 era through strategic objectives and operational practices.

Value Chain Management

Effective value chain is important for any manufacturer or service provider (Gilchrist 2016). Large size companies that can manage their own value chain. However, in all other cases, large manufacturers partner with other skilful parties to improve the value chain. There are two parts of a value chain—horizontal activities and vertical support activities. Horizontal activities are connected with manufacturing chain. Vertical support activities are more along the after-sales service chain. Value creation is complicated but fundamental to implement strategies in an organization. It helps managers understand the key internal resources and drivers of performance in their organizations. Nagy et al. (2018) discussed the role and impact of IR 4.0 and the Internet of Things (IOT) on the Value Chain. To study this impact of IR 4.0, companies mostly use Porter's value chain model of 1985. Cyber Physical System (CPS), Cyber Physical Production System (CPPS) and Big Data Technologies have also improved the value delivery. Furthermore, the study by Nagy et al. (2018) found that firms having started on the path to digital evolution in line with IR 4.0, and similar investments have gained through the value management process in organizations.

Supply Chain Management

The impact of IR 4.0 and digital technology has a ripple effect on supply chain (Ivanov et al. 2018). It examines transitions expected towards cyber-physical supply chain systems. Manavalan & Jayakrishna (2018) conducted a review of Internet of Things (IoT) embedded sustainable supply chain for IR 4.0. Sustainable supply chain is a pressing need. (Dallasega et al. 2018). There are three important perspectives of supply chain management in connection with IR 4.0, namely Technology Collaboration, Management Strategy and Sustainable Development (Manavalan & Jayakrishna 2018). IR 4.0 and its impact on supply chain sustainability has also been studied by Bag et al. (2018). The evolution of technology from other industrial ages to IR 4.0 has resulted in greater demand for horizontal, vertical and end-to-end digital integration. Bag et al. (2018) and Asdecker & Felch (2018) emphasize on smart manufacturing, smart warehousing, and smart logistics. Mapping digital technologies for supply chain management in IR 4.0 is also highly important (Ardito et al. 2018). The tools that can be considered in this case are Industrial Internet of Things (IIOT), Cloud Computing and Big Data Analytics.

IR 4.0 and Organizational Orientation

The down-most orientation with a micro firm view to study IR 4.0 literature is organizational orientation. IR 4.0 studies in terms of organizational skeleton can be thematically categorised into 3Ps (People, Process and Product-Service).

People

In an organizational setting with a view to adopt IR 4.0, people need to be prepared in the first place. IR 4.0 requires more investment on soft skills, rather than hard skills (Cotet et al. 2017). Soft skills work on a range of personality attributes and personality dimensions. This selection of tactics or skills then is considered mandatory to succeed in IR 4.0. In certain cases, recruitment of candidates based on this is helpful. The problem is that in this 'technological wave', over one-third of skills (35%) that are considered important in current workplace will witness a makeover. Soft skills include a wide array of skills. As per Minulescu (2015) survey, most of these soft skills revolve around these five supra-factors: Extraversion (Optimism, Humor, Interpersonal skill); Maturity (Respect, Adaptability, Friendship); Agreeableness (Altruism, Empathy, Honesty); Conscientiousness (Sensibility, Planning, Auto-discipline); Self-actualization (Thoroughness, Independence, Creativity). This process of identification was conducted with a view to foresee the skills that will be required to excel in IR 4.0.

With the knowledge of these competencies and abilities, people can be prepared for IR 4.0. Thereon, the study by Ras et al. (2017) analyzed skills gaps of workers in IR 4.0. The challenge of improving quality of life and welfare will remain more important than ever. This will include better guidance in manufacturing, grip on performance analytics, new training and learning designs and modules, technology impact assessments. Likewise, the study by Schneider (2018) is solely focused on how future workplace look like in physical structure and how people can be prepared to occupy it. This as per author is the strongest of people and leadership challenges. Insufficiency of subject matter expertise among people is a major IR 4.0 implementation barrier. Also, there is a lack of digital resources for this preparation of workforce (Rentzos et al. 2014). Hence, research in IR 4.0 should have main agenda factor for people enablement (Pfeiffer 2017).

Process

After people, adaptation with respect to processes is needed for IR 4.0. Leonardo Caporarello and Assia Viachka (2006) study of technology readiness is a mix of change management and Enterprise Resource Planning (ERP). The author studied different variables that affect an individual's readiness to adopt digital processes. This leads to process changes with people changing to the new settings, also referred to as realignments. Managers act as change agents in this case. The author suggests that change management will fail if there is no trust on management. In similar setting, some other authors show a negative relationship between readiness for change and individual fear of change, in change of processes. There are people who will resist changes as not being personally beneficial and/or disruptive for their existing job roles. People integration is an unavoidable result of process integration. In other words, more integrated processes, more is cross-functionality, and accordingly higher is the need of interactions and communication.

Since the word IR 4.0 has been coined, convergence of technologies has been the focus area to optimize processes. This convergence is both horizontal integration across the value chain and vertical integration within a company. Hence, the combination of Operational Technology (OT) with Information Technology (IT) is a trending topic in terms of processes. IT has been a

keyword since the last revolution. However, OT has recently got prominence, which is defined as hardware and software that causes a change in physical devices, processes and events in the enterprise. Overall, IT and OT can both add to the efficiency of processes in the context of IR 4.0.

Product-Service

With people and processes being prepared for IR 4.0, the next organizational component requiring adjustment is the organizational offering (product-service). New products are higher in price but are more sustainable. Prause (2015) gives an example of case study of a multiple useable teapot warmers which has a new service-design oriented business model. This showcases the models required in IR 4.0, and tea pot warmer can be taken as a blueprint model for IR 4.0. The tea pot is fully recyclable; hence the idea of sustainability is well captured. As this product has multiple pieces which can be bought and sold separately, design and technology has given it a multiple product lifetime. Smart business model also has a strong brand identity and IR 4.0 can help achieve the two objectives (Kaivo-oja 2012).

Likewise, Rennung et al. (2016) study discussed services in the context of IR 4.0. This study created a model to assess the service sector in terms of their business strategy. The author uses 'Service Engineering' concept that refers to Services for the 21st Century. Here the attributes of the services are listed in detail along with customer requirements. The most critical is to understand organizational, process and qualitative aspects in connection with services. The business landscape is changing, as more technology is being introduced (Roblek et al. 2016). Online sales services, online medical examinations, customizing food from home and the like are already changing the work style of Small and Medium Enterprises (SMEs) (Sommer 2015). Likewise, IOT and the IOS are changing consumer behavior. Products and services are also getting connected. Thereon, organizations must study sociodemographic and psychological factors of products and services, on a relatively faster pace (Rocco & Bush 2016).

CONCLUSION

This literature review proposes four new themes to study IR 4.0: Country Orientation, Industry Orientation, Functional Orientation, and Organizational Orientation. These themes follow a top-down approach, from country level to organizational level. Furthermore, the first two types of orientation (Country Orientation and Industry Orientation) can be classified as Macro Orientation with respect to IR 4.0, as it mostly deals with topic outside the organization on a country level. Thereon, the last two types of orientation (Functional Orientation and Organizational Orientation) can be classified as Micro Orientation with respect to IR 4.0, as it mostly deals with topic inside the organization on a company level. This literature review has two main implications. First, this paper could potentially help managers and organizations to understand the urgency and importance of IR 4.0 on multiple levels, in and outside the organization. Second, this review implies broader need of integration between policy makers, corporates and society at large on IR 4.0 technologies. In terms of future research, this review establishes the need of testing and exploring these four orientation themes, for better and faster adoption of IR 4.0.

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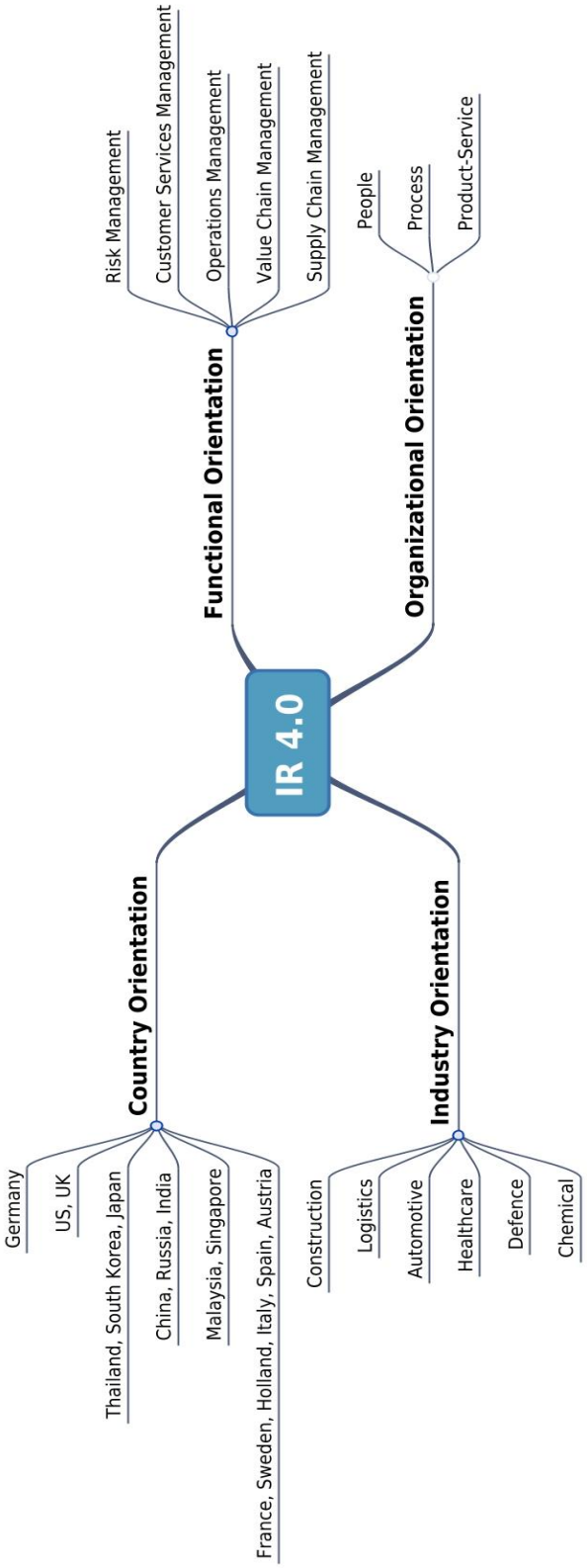
Appendix A: Literature Review Mindmap



(Source: Researchers' Own Illustration)

Appendix B: Literature Review Tabulations

No.	Sub-Theme	Main Theme	Selected References	Total Papers (TP)
1	People	Organizational Orientation	(Chinachoti 2018), (Kelly 2018), (Schneider 2018), (Kazancoglu & Ozkan-Ozen 2018), (Cotet et al. 2017), (Shamim et al. 2016), (Lai J.-Y.a Ong 2008), (Jaafar et al. 2007), (Nankervis et al. 2019), (Hecklau et al. 2016), (Mashelkar 2018), (Promsit 2019), (Arntz et al. 2017), (Pedron 2018), (Bordel & Alcarria 2017), (Ras et al. 2017), (Muller 2018), (Oosthuizen 2016), (Yagiz Akdil et al. 2018), (Erol et al. 2016), (Tarokh & Pazari 2008), (Nagy et al. 2018), (Erdogan et al. 2018), (Peña-lópez 2014), (Lezzi et al. 2018), (Basl 2018), (Aleksandra Bradić-Martinović; Branislav Miletić 2017), (Flatt et al. 2016), (Milenkovic et al. 2016), (Leyh et al. 2016), (Degerli 2015), (Haddara & Elragal 2015), (Parasuraman 2015), (Kirshin et al. 2015), (Ogunyemi & Johnston 2012), (Leonardo Caporarello and Assia Viachka 2006)	37
2	Process	Organizational Orientation	(Hong & Kim 2018), (Canetta et al. 2018), (Ariani et al. 2018), (Bertola & Teunissen 2018), (Ustundag & Cevikcan 2018), (Sarvari et al. 2018), (Petko et al. 2018), (Ghassani & Amani 2018), (Samaranayake et al. 2018), (Ertan 2018), (Ng et al. 2018), (Závadská & Závadský 2018), (Cisneros-Cabrera 2017), (Schaupp et al. 2017), (Rojas-Méndez et al. 2017), (Wang et al. 2017), (Bogner et al. 2016), (Parasuraman & Colby 2015), (Cleland-Huang et al. 2014), (Chen et al. 2013), (Ratchford & Barnhart 2012), (Pires et al. 2011), (Andaleeb et al. 2010), (Meng et al. 2010), (C.-H. Lin 2007), (Sauser 2006), (Yi et al. 2003), (Heslop et al. 2001), (Shun Yin Lam, Jeongwen Chiang 2014), (Han et al. 2013), (Sun et al. 2018), (Hammer 2019), (Fleming & Artis 2010)	33
3	Product-Service	Organizational Orientation	(Santos et al. 2017), (Marilungo et al. 2017), (Mourtzis et al. 2017), (Tukker 2004), (Rennung et al. 2016), (Thomas et al. 2016), (Lee et al. 2014), (Weking et al. 2018), (Müller et al. 2018), (Man & Strandhagen 2017), (Montanus 2016), (Prause 2015), (Gerlitz 2016), (Sheen & Yang 2018), (Weking et al. 2018), (Müller et al. 2018), (Lokuge et al. 2018), (Javahernia & Sunmola 2017), (C. Jones et al. 2017), (Thomas et al. 2016), (Shum 2015), (Verbano et al. 2015), (van de Vrande et al. 2009)	23
4	Construction Industry	Industry Orientation	(Dallasega et al. 2018), (Oesterreich & Teuteberg 2016), (Kuo 2013), (Zeng et al. 2007), (Jaafar, Abdul Aziz, et al. 2007)	5
5	Logistics Industry	Industry Orientation	(Hofmann & Rüsch 2017), (Richey et al. 2007), (Bujak 2018)	3
6	Automotive Industry	Industry Orientation	(Lin et al. 2018), (Kannan et al. 2017)	2
7	Healthcare Industry	Industry Orientation	(University 2016), (Melas et al. 2014), (Caison et al. 2008)	3
8	Defence Industry	Industry Orientation	(Bibby & Dehe 2018)	1
9	Chemical Industry	Industry Orientation	(Reis & Kenett 2018)	1
10	Germany	Country Orientation	(Kaltenbach et al. 2018), (Bogner et al. 2016), (Sommer 2015), (Fuchs 2018)	4
11	UK, US	Country Orientation	(Jones et al. 2017)	1
12	Thailand, South Korea, Japan	Country Orientation	(Chinachoti 2018), (Kraisuth & Panjakajornsak 2018), (C. Jones et al. 2017), (Sheen & Yang 2018), (Sangki 2018)	5
13	China, Russia, India	Country Orientation	(Kamble et al. 2018), (Lin et al. 2018), (Lee et al. 2011), (Tourk & Marsh 2016), (Li 2018)	5
14	Malaysia, Singapore	Country Orientation	(Tan et al. 2015), (Ooi et al. 2018), (Cheng et al. 2009), (Jaafar, Abdul Aziz, et al. 2007), (Lai Ming Ling & Muhammad 2006), (Dahlan et al. 2002), (Saleh & Ndubisi 2006), (Katan et al. 2018), (Jaafar et al. 2007)	9
15	France, Sweden, Holland,	Country Orientation	(Ertan 2018), (Verbano et al. 2015), (Melas et al. 2014)	3

	Greece, Italy, Spain, Austria			
16	Risk Management	Functional Orientation	(Tupa et al. 2017), (Ostrom & Wilhelmsen 2012), (Zeng et al. 2007)	3
17	Customer Services Management	Functional Orientation	(Lorenz et al. 2018), (Kim et al. 2017), (Mummalaneni et al. 2016), (Tsourela & RoumelIoTis 2015), (Victorino et al. 2009), (Sharma 2008), (Lai 2007), (Verma 2007), (Rojas-Méndez 2007), (Tsikriktsis 2004), (S. Chen & Li 2010), (Yieh et al. 2012)	12
18	Operations Management	Functional Orientation	(Tonelli et al. 2016), (Fettermann et al. 2018)	2
19	Value Chain Management	Functional Orientation	(Nagy et al. 2018)	1
20	Supply Chain Management	Functional Orientation	(Dallasega et al. 2018), (Ivanov et al. 2018), (Manavalan & Jayakrishna 2018), (Bag et al. 2018), (Wang & Ha-Brookshire 2018), (Asdecker & Felch 2018), (Majeed & Rupasinghe 2017), (Methavitakul & Santiteerakul 2006), (Asdecker & Felch 2018), (Barata et al. 2018), (Ardito et al. 2018)	11