A Review on Industrial Revolution 4.0 (IR4.0) Readiness Among Industry Players

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Abstract. The Fourth Industrial Revolution (IR4.0) is a digital revolution that not only focuses on the manufacturing industry, but also involves all sectors including the service industry. The readiness of the industry players and their implementations of these technologies will be able to boost productivity growth through creating, adopting, and integrating technological solutions into the workforce and industries. A review of the literature reveals that industry readiness for IR4.0 particularly in Malaysia is still at a low to medium level. The objective of this paper is to review the understanding of IR4.0 readiness models discussed in the literature, the factors driving and inhibiting IR4.0 readiness, and the use of a evaluation tools for industry players to assess their IR4.0 readiness level. The study found that readiness models are commonly discussed and framed around several theories and their theoretical constructs such as Acceptance Theory, Information System (IS) Success Models, and relevant readiness and maturity theories. There are a few factors either driving or inhibiting IR4.0 readiness and these factors are funding, infrastructure, regulatory, skills and competency, technology, and commitment from the leadership. Based on the synthesized literature, this paper proposes the IR4.0 Readiness and Implementation Framework for industry. The framework aims to guide industry players to take a stage approach in implementing IR4.0 and move up their IR4.0 readiness levels progressively.

Keywords: Industrial Revolution 4.0 · Readiness · Driving factors · Inhibiting factors · Self-evaluation

1 Introduction

In 2022, the world's population reach 7.9 billion with 29 billion connected devices were predicted interacting with each other, of which around 18 billion will be related to the Internet of Things (IoT) [1]. The Fourth Industrial Revolution (IR4.0) widely began in 2016 and focused on improving the automation and integration of cyber-physical and biological systems. IR4.0 saw many new innovations such as artificial intelligence, big data analytics, simulation, systems integration, robotics, cloud systems, IoT, augmented reality and others [2].

Arguably, Malaysia is not well equipped to get into the Industry 4.0 in the aspects of people and facilities in which the readiness level is at average level. Due to this, a lot of

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efforts are put into assisting Small and Medium Enterprises (SMEs) to understand and start investing in Industry 4.0 [3]. According to Ortt et al. [4], there are two terms used interchangeably in describing IR4.0 readiness, namely 'readiness' itself and 'maturity'. These two terms refer to the ability of a firm to apply a concept or technology in a complete, perfect, or ready state [5]. Tetlay and John [6] state that maturity is part of readiness.

1.1 The Readiness Concept and Readiness Assessment

Readiness in the context of an organisation is a multi- level construct and can be observed at either an individual, group, or organisational level. In particular, organizational technology readiness is about understanding the preparedness of organization to embrace new innovations so as to keep it informed of market demands in its environment [7]. Hence, any change management process to be effective within an organization, there is a need to have collective readiness at the individual and organizational levels [8, 9].

Towards measuring readiness, an assessment process needs to be performed. Readiness assessment aims to identify risks, opportunities and potential challenges that may arise during the change process [10]. To assess readiness, systems or tools can be developed and it is able to provide a systematic framework that allows benchmarking and performance improvement to be measured discretely. Carolis et al. [5] develop the Digital REadiness Assessment MaturitY (DREAMY) model and the related questionnaire based on modular and scalable architecture.

IR4.0 readiness assessment has been established and implemented in some countries such as Germany, Canada, United Kingdom, and Malaysia. In the Malaysian context, the Ministry of International Trade and Industry (MITI) have introduced The National Policy on Industry 4.0 (Industry4WRD) which is a proactive measure to transform the Malaysian manufacturing industry and its related services to be smarter, more systematic, and resilient.

Towards measuring the IR4.0 readiness among Malaysian manufacturers, a readiness assessment instrument was developed. However, such readiness assessment process takes time to be completed due to the numerous steps and processes before the readiness level is obtained. These include the process of assessment application by the requesting firm, appointment of a panel of assessors to review the IR4.0 readiness, actual conduct of the assessment at site, and convening of a meeting among assessors before the level of readiness is known to the requester. The time taken to complete the entire readiness assessment have resulted in some organizations not keen to be involved in such IR4.0 readiness assessment exercise.

Yet, the readiness assessment is beneficial as organizations can gauge their readiness level and plan forward on how best to exploit and derive benefits from Industry 4.0 technologies [11]. According to Tortora et al. [12], due to lack of studies providing empirical evidence on how manufacturing in the digital transformation such as for smaller industrial realities, a web-based survey and interviews with industry players were preferred. Open-source web application can also be used as a platform to develop an IR4.0 readiness self-assessment by creating simple and effective questionnaires where unlimited number of users can participate.

Apart of that, Technology Readiness Index (TRI) is also a recognized metric for studying readiness to adopt and use cutting-edge technology [13]. Technology readiness can be viewed as a belief resulting from four personality dimensions: optimism, innovativeness, discomfort, and insecurity [14]. According to Turcu et al. [13], these personality characteristics affect people's propensity to embrace and use new technologies.

1.1.1 IR4.0 in Economy

The potential of IR 4.0 includes faster decision making, better monitoring and control of the shop floor, more efficient use of resources, and better forecasting of demands [15]. Therefore, to realize the potential, industry players need to follow the pace by being high in the IR4.0 readiness level. Several research have been conducted in this context with focus on studying the driving factors, the barriers, and the impacts of IR4.0 technologies to business operations.

IR4.0 Skills and Competencies In 2020, analysts predict that in the next 10 years, 3.5 million people will be needed to fulfil specific manufacturing vacancies with high competencies on emerging technologies such as IoT, digital twin, and smart factory [15]. However, fewer positions will be filled because of the lack of professionals trained in the required competencies [13]. The competencies needed in the IR4.0 era is said to range from managing complex manufacturing systems to having more creativity, strategic thinking, and coordination skills [16].

Lassen and Waehrens [17] summarized the competences needed in IR4.0 adoption are: (1) CPS skills to aid operational working level, (2) higher de-centralization in decision-making and planning processes, (3) skills in process integration and cross-functional perspectives, (4) automation skills for quality and maintenance, (5) high complexity and dexterity to integrate and manage the automation, (6) flexible in working life and partner networks.

For engineers, a deep understanding of the connections between the electrical, mechanical and computer components will be a vital ability to develop innovative products and processes [18]. There are industry players responded in the interview conducted by Lassen and Waehrens [17] that they have no time to change their company.

IR4.0 Funding Investors have a crucial role in selecting and funding the most promising technological solution, while most start-ups are expected to move faster than established companies [19]. Funding is considered for the most benefit and relevant to them such that if the IR4.0 technologies plays closely with the people and environment. For example, Filieri et al. [19] found that booking and preparation and destination services are frequently received most of the funding.

Further, some investors perceive women industry players as less competent entrepreneurs because of their childcare obligations [20]. Meanwhile, Thébaud [20] also suggested that the declination of investment among the European start-ups is because of the expectations of high growth and industry disruption.

2 Methodology

Literature review study is a transparent search conducted over multiple databases that can be replicated and reproduced by other researchers. The review consists of five discrete activities such as define, searching, extraction, assess, and analyze and combine. Later the activities are categorized into three main phases: planning the review, conducting the review, and reporting the review.

2.1 Planning the Review

2.1.1 Defining Research Questions

This paper study the readiness model with the factors driving and inhibiting the IR4.0 adoption. Therefore, four research questions (RQ) were developed to assist the literature review process: RQ1-What are the different readiness models of IR4.0 that are in existence today?; RQ2-What are the factors driving IR4.0 readiness?; RQ3-What are the factors inhibiting IR4.0 readiness?, and RQ4-How are the self-evaluation instruments be developed for IR4.0 readiness?

2.1.2 Searching for Relevant Data Sources

To satisfy the research questions, six scientific databases (Emerald Insight, IEEE, Science Direct, Scopus, Springer, and Web of Science) have been selected to source relevant journals only which not includes proceeding paper or books. The Institute for Scientific Information's (ISI, now Thomson Scientific, Philadelphia, PA) citation databases have been used for decades as a starting point and often as the only tools for locating citations and/or conducting citation analyses [21]. As in one, the most relevant and related databases to the topic have been chose with the Fig. 1 shows summary of literature review process in this research.

2.2 Conducting the Review

To clarify and validate the eligibility of the literature review process, the review is conducted by involving data inclusion and exclusion criteria, quality assessment, collection of the data and data analysis.

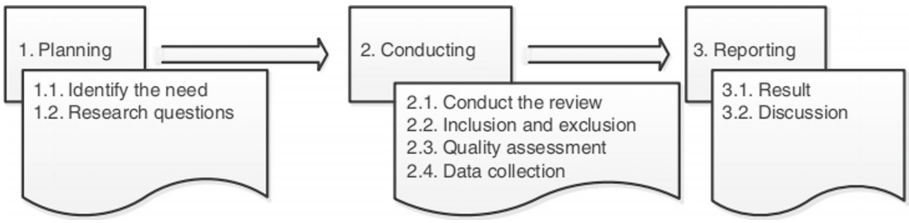

Fig. 1. Activities in systematic literature review adopted from Esfahani et al. [22]

Table 1. Inclusion/exclusion criteria [23]

Inclusion criteria	Indirectly or directly answer any one or more research question. Focus on the role of social media in information seeking behaviour and problems of international students Published in years: 2000–2015
Exclusion criteria	Exclude irrelevant books or overhead presentations. Exclude which is not related to the research field. Papers when only abstract and no full text were available Articles that did not match the inclusion criteria

2.2.1 Assess the Eligibility of Data-Inclusion and Exclusion Criteria

The inclusion and exclusion criteria were used to ensure that only the relevant articles were included in the literature review process [23]. The aim for this selection is to assess the eligibility of the journals which to match the objectives of the literature review. As the keywords are not expected to return the papers with the related topic, inclusion and exclusion criteria are needed to refine the result through the databases. The inclusion and exclusion criteria were used to ensure that only the relevant articles were included in the literature review process, as per Table 1.

2.2.2 Quality Assessment

In the quality assessment, all the papers resulted through the databases till the final selection of papers, are shown in Fig. 2.

2.2.3 Data Analysis

A data collection form was designed to collect the most relevant information from the selected papers to facilitate the process of analyzing the compiled data [23]. Table 2 shows categories of information and specific information needs during the data analysis.

2.3 Reporting the Review

In this phase, analysis and combination of data is conducted which then be furthered in the next section of results and discussion.

3 Results

The findings are discussed based on the research questions highlighted in Sect. 2.1.1.

3.1 Readiness Model

There are various IR4.0 readiness models in existence today. For one, readiness model on Hungary industrial area was conducted by Nick et al. [25] are based on 99 questions which were divided into three sources of questions; 16% from NTP Workgroups which introduced aspects of education, training, employment, and access to financial resources,

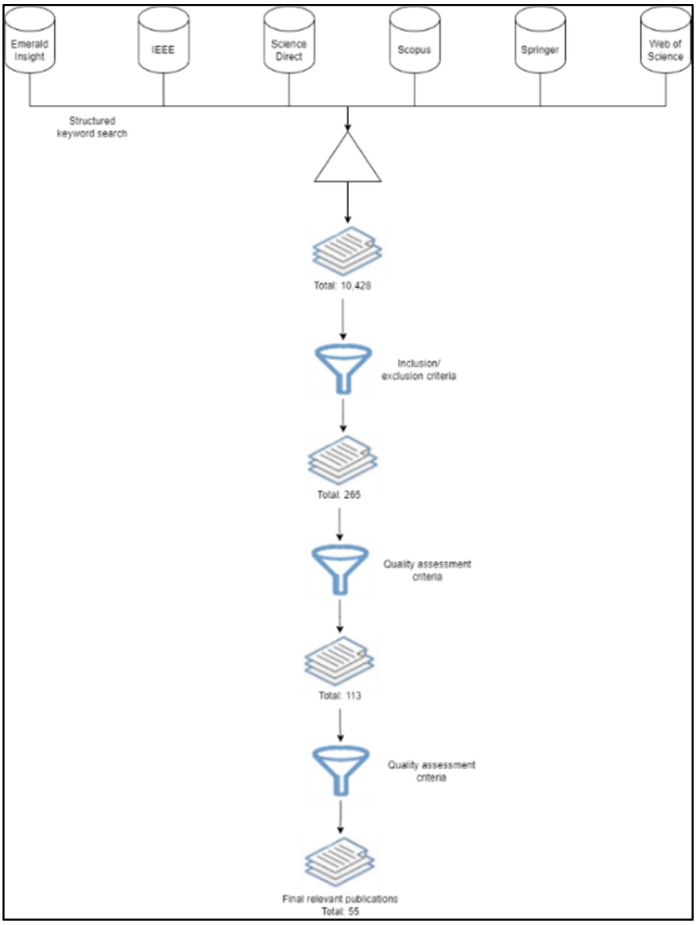

Fig. 2. Publication collection method flow

Table 2. Information needs of IR4.0 readiness

Categories of information needs	Specific information needs	Author/s
IR4.0 readiness model related	Empirical data, method, readiness insight, factors	[24, 25]
Training related	Demand skills, benefit, barrier	[12, 15, 17, 26]
Self-assessment related	Reason, method, benefit	[27, 28]
Funding related	Reason, method, benefit	[19, 29, 30]

18% from VDMA framework comprises of company level, and 66% from the author's interviews on the industrial people. Readiness model built by Lucato et al. [29] is based on a basis structure by Society of Automotive Engineers (SAE) J4000, and the author

Table 3. Industry 4.0 maturity and readiness assessment models [11]

Name	Target	Output	Analyzed dimensions
Industry 4.0 Maturity Model (I40MM)	Manufacturing firms	Spider diagram of 9 analyzed dimensions	Strategy, leadership, customers, products, operations, culture, people, governance, technology
Forrester Digital Maturity Model 4.0 (FDMM40)	Firms	Index to assign to maturity segments (differentiators, collaborators, adopters and sceptics)	Culture, technology, organization, insights
System Integration Maturity Model Industry 4.0 (SIMMI 4.0)	Firms	Positioning of 4 dimensions in 5 maturity levels	Horizontal, vertical integration, digital product development, cross-sectional technology criteria
Industry 4.0 Readiness Online Self-Check for Businesses (IMPULS)	SMEs	Positioning in six readiness levels	Strategy and organization, smart factory, smart operations, smart products, data-driven services, employees
The Acatech Industrie 4.0 Maturity Index	Firms	Positioning of the 4 dimensions in 6 levels	Resource, information systems, organizational structure, culture
Industry 4.0-MM	Firms	Positioning in 6 maturity levels	Asset management, data governance, application management, process transformation, organizational alignment
Industry 4.0 Maturity Model	Firms	Positioning of 3 dimensions in 4 maturity levels	Smart products and services, smart business processes, strategy and organization

assumed the model to be like a linear parameter. Alcácer et al. [27] applied IMPULS maturity assessment model and six dimensions were chosen as their research model of IR4.0 digital transformation. Table 3 summarizes the IR4.0 readiness assessment models studied by previous researchers.

3.2 Factors Driving IR4.0

The literature discussed the factors driving IR4.0 readiness into several factors such as funding, infrastructure, regulatory, skills and competency, technology, and leadership.

A small company's difficulty in entering the long- term capital market could affect working capital strategies, financial structure policies, and the decision to retain profits within the firm for reinvestment purposes [31]. Meanwhile, technology giants such as Google are in the forefront of big data analytics and artificial intelligence in putting forward their search engine. Except, with respect to profitability, small firms are more profitable than large corporations, because of higher profit margins and more efficient management of fixed assets [31]. Therefore, small firms need to understand their worth and be resilient in requiring fundings from resources either a government or non-government.

Resources such as investing in IR4.0 is an important consideration for manufacturing firms who strive to remain competitive in this global economy, but the uncertainty and complexity of where to focus technology investments is a problem facing many manufacturing firms [30]. A record of 58% of Indians manufacturers reported the need to invest in machinery, facilities, and associated information technologies [32]. Larger enterprises felt better prepared to adopt IR4.0 compared to smaller enterprises SMEs that had probability to become victims in IR4.0 technology [30].

Infrastructure can become a driving factor for IR4.0 readiness particularly for companies with advanced outlook on technology adoption. For instance, Netflix who is the biggest and fastest growing content hub on the planet. Netflix investment in content for streaming of videos requires dynamic programming and demand from customers, of which data can be extracted from the data analytics of the customers' viewing of their content.

According to Malaysia Industry4WRD Policy, on global trade and investment, Malaysia is already well- integrated into regional value chains and exhibits a very good trade infrastructure. Besides, gaps in deployment of high-speed broadband infrastructure in key industrial and training locations and not always able to support Industry 4.0 technology needs. When it came to a development or a building of something, there must be an infrastructure or a bone structure. In Wikipedia, infrastructure is the set of fundamental facilities and systems that support the sustainable functionality of households and firms.

Skills and competency are one more thriving factor of IR4.0. The crucial part of this factor is that the reality of the world's industries, are immobile in the human along the output process. The conversion of human to a full machine is taking time and yet the little to amend is the human itself which they need to be upgraded. New skills required are based on what to expect to produce the 11 enablers mentioned. For example, machine learning, computer programming, advanced mathematical algorithm, critical thinking, and others.

On the other hand, Galati and Bigliardi [33] stated in their review such that, government's support, training programs and the organizational structures required for Industry 4.0 exploitation, give insights to the IR4.0 success. Ahmad et al. [34] agreed that the staff's hard and soft skills need to be rectified through a program such as training program. Issues related to the skills gap are exponential increased when considering SMEs [30].

Management in the company is one of crucial element in adopting IR4.0. Current employees are still in the last track of the technology due to many reasons and such that, the leader of the team, leader of the company is first to be blame because the null awareness and actions of IR4.0 concept. Indeed, even though there is one leader for example the production manager has the awareness and determination to project the company's technology and productiveness, it is only the hardest when other leaders are not in the same mind. Eventually, the development of the company will be in a static mode which give them a big risk after tomorrow.

3.3 Factors Inhibiting IR4.0

While the literature discussed the factors driving IR4.0 readiness as the covered in Sect. 3.1.2, however, the same factors can be the inhibiting factors for IR4.0 readiness as well.

Funding is needed to operate a business. However, for smaller and mid-sized companies such as the SMEs, budget issue is a constant and critical issue to be addressed. COVID-19 pandemics have proven that many SMEs are not able to survive, let alone invest in IR4.0 technologies. Indeed, government in their actions to adopt IR4.0, has offered few fundings to the SMEs such as the National Digital Network Plan (JENDELA) program is implemented until the end of September 2021 to ensure that 6.4 million premises in the country are covered by fiber optic network with gigabit access, at once intending to achieve 7.5 million premises. Looking into that, yet there are SMEs who feared to stand up with the opportunity in the occasion of lack of knowledge, manpower and time. Commonly, people especially the SMEs need to know that the adoption of IR4.0 begin with the necessitate of internet network.

Next, infrastructure-wise, IR4.0 require a huge investment in new infostructure such as high-speed wired and wireless Internet connectivity. For companies operating in smaller towns or in rural areas where infrastructure is still a major obstacle, it will become a stumbling block for them to be IR4.0 ready. Meanwhile, in the soft infrastructure such as healthcare system minoring the Takaful in Malaysia, is still using the traditional technique to deliver the services. Till today, they use agents for instance insurance staff, to deliver the product. Subtly, it is an unnecessary job that causes the low needed manpower when talking about IR4.0 adoption. Besides, the customer itself can calculate their needs when to choose the right insurance plan. Indeed, the insurance company should offer automatic assistant- bot on the web.

In adopting IR4.0, skills and competency come at once and now is the time to change the mentality, knowledge and behavior of the employees or change the employees itself. This is because, many of the old employees is aged and they are still in the mind of belief in the old era of technology and wants to be in a comfort zone. Either they are naïve in using the technology or they objected to use it, both are far to be profitable. One of the representatives of low development of IR4.0 is the retention of the aged and old generation of employers followed by employees. Therefore, the awareness and actions to reshape a new and advanced skills and competency is left behind.

The use of Industry 3.0 or even lower, is inhibiting the adoption of IR4.0. SMEs in food and beverages sector are still using cash during the transaction instead of online

payment such as e-wallet or auto debit and credit card. Such that situation, the transactions is slowed which will resulted to lose queued-customer, or in another, the premise's overhead is hiked. In addition, manufacturers who still using the manual record are reducing the productivity. In accordance with the manual report such as via WhatsApp or phone call, the tendency for a problem to be in a cyclic inspection and discussion, is high. This practice of older technology is always referring to the low productivity and low output. Later, the company will be always in high risk of negative number in revenues.

Alcácer et al. [27] in their online self-assessment concluded the survey answers that both small and large companies with a lower readiness level, considered that one of the most important barriers is lack of support from top management. This satisfies that size of company does not affect the IR4.0 readiness but indeed the reaction and action of management department that pave the way. Meanwhile, Lassen et al. [17] stated that one of major inhibitors of IR4.0 is that many companies do not have enough insight into how new technology can contribute to increased growth and productivity.

Vaduva-Sahhanoglu et al. [35] listed main barriers to the adoption of IR4.0 technologies such as high cost of research and development (R&D) innovation, technology cost updates to the latest state of art, cost of training employees, incompatibilities with current practices and operations, challenges in finding the technologies needed, and psychological barriers referring the acceptance of the new technologies. Akinradewo et al. [36] in their study on South African Construction Industry (SACI) agreed that the lack of adoption of standards, training for professionals and skilled labour in using the digital tools at the institutional level as well as its high cost, impede the construction industry in adapting IR4.0 concepts.

Electricity limitations contribute to being a hindrance for the digital change towards the IR4.0 since Weightman et al. [37] documented that the industrialization marked a shift of power, mass production, factories, and special-purpose machineries. Meanwhile, external dependencies frequently become dominant when working with new competences while case study owned the IT manager's statement that they mostly rely on consultants for a help in implementing new solutions and making any necessary changes [17].

Müller et al. [26] discussed on their empirical evidence such that the German SME might claimed that large enterprises are more designed to be in IR4.0 compared to the Chinese SMEs which do not contain any bias. This indicates that the innovation also begins with the talks of people in the industry instead of only the technologies. German SMEs rather see benefits through an operational perspective when referring to "Industrie 4.0", whereas Chinese SMEs emphasize both strategic and operational economic benefits [26].

Insufficient knowledge and skills of employees was one of the main hindrances to digitalization therefore, the employee of the future was therefore expected to meet the following criteria; (1) use, combine and reflect upon at least one set of tools and technologies in the company, (2) imagine and predict the relationship between these different tools and technologies both within and outside of their primary domain, (3) describe the implications for the total company systems, both with respect to finance and IT, (4) identify where technology can improve operations or support innovation [17].

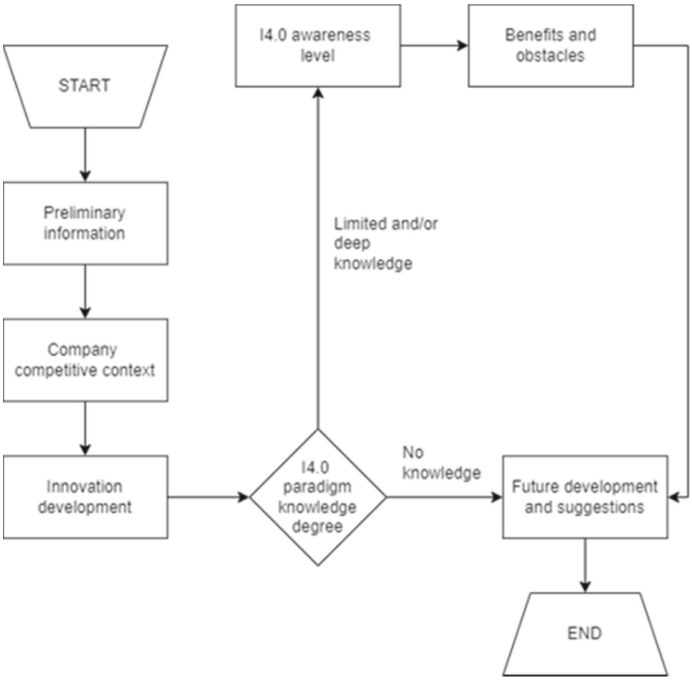

Fig. 3. Structure of survey [27]

3.4 IR4.0 Self-evaluation Instrument

Assessment tools are developed by academia and practitioners aiming the self-assessment within analytical frameworks to evaluate conditions or analyze IR4.0 adoption on an interactive form with the framework developers [38]. The Capability Maturity Model Integration (CMMI) or Software Process Improvement and Capability dEtermination (SPICE) are examples of maturity models, used in software development field [27].

Survey conducted by Tortora et al. [12] were interestingly structured by a web-based, with 77 confirmed respondents from 150 that initially targeted (51%). It consisted of 23 questions comprised the central part of the survey and engaged on the information collection about the readiness level gained by the industrial system in the use of IR4.0 enabling technologies and financial economic aid used.

An analysis on a survey (Fig. 3) conducted by Alcácer et al. [27] via questionnaire aimed to assess the perception of companies on barriers to adopt I4.0 enabling technologies, stated that even if the online survey provides a guideline to assist the respondent, there is still a possibility that the answers do not depict their reality due to lack of knowledge of the IR4.0 thematic, it was necessary to choose more than one case to analyze and consider the available resources to expand the investigation and cover as many cases as possible. One of crucial discussion is that one aspect that may contribute to such a low average readiness level is the fact that almost half of the respondents (46.7%) have no I4.0 strategy implemented or under development [27].

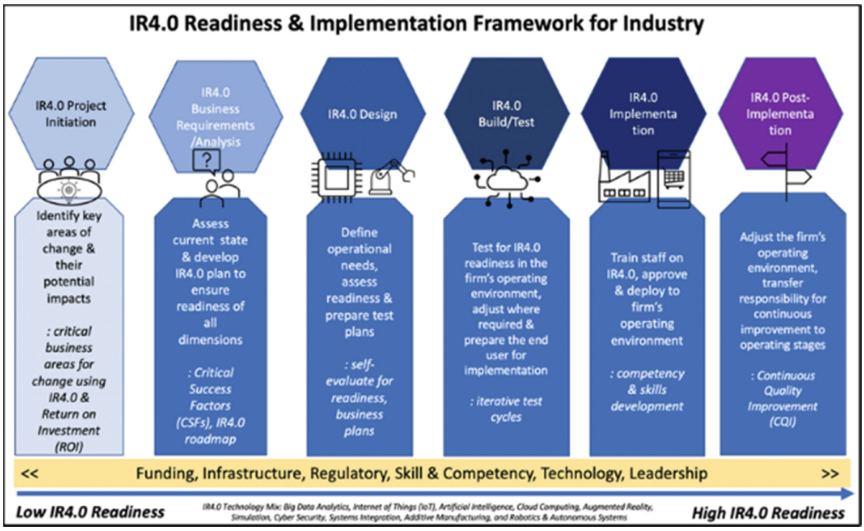

Fig. 4. IR4.0 readiness & implementation framework

4 Discussion

Based on the synthesized literature on conceptualization, this paper proposes the IR4.0 Readiness and Implementation Framework for industry (Fig. 4). The framework aims to guide the investigation and industry players to take a stage approach in implementing IR4.0 and move up their IR4.0 readiness levels progressively.

The proposed framework summarizes the six stages of readiness from low to high which giving insights on the processes of how readiness of IR4.0 can be achieved in firms. The initial stage is generally on the IR4.0 project initiation followed by its business requirements or analysis, design, build or test, implementation, and post-implementation.

As a beginning, IR4.0 project initiation is aimed to identify key areas of change and their potential impacts. The top and bottom layer of organization are complementing each other in succeeding this stage. In the most literature, majority of company had done the initial plan to adopt the new technologies but only the top layer of organization is involved and understand the reason of the substitution while the bottom layer is still continuously believed in the routine only. Training must be conducted among the employees and employers in time to time, which begin with the awareness and introduction of the fundamental of IR4.0. Workforce must be properly informed and trained to achieve the strategic objectives predefined by the company itself [12].

Besides, research and development also required in this stage and the next. Aforesaid, based on review, the data show that 63% of medium-sized companies systematically carry out research and development activities with an internal research and development department dedicated to these activities; having specifically dedicated resources indicates an investment by the company in innovation; 50% of the Micro companies, on the other hand, do not carry out R&D activities but the remaining part (32%) occasionally

carries out R&D activities using resources from other areas for participation in innovative projects; the small-size companies picture is no clear: the 32% occasionally carry out R&D activities using dedicated resources, the 25% exploiting resources dedicated to other areas while 43% do not carry out R&D [12].

In the next stage of IR4.0 business requirements or analysis, the purpose is to assess the current state and develop IR4.0 plan. Employees and employers are entailed to know the development and current IR4.0 across the globe, such as delivery robots in the restaurants used in first till the third class of country, vacuum robot by Xiaomi, and one of the biggest inventions of a kinetic energy launch system as a private space to orbit. Despite of the size, companies with a lower readiness level considered that one of the most important barriers is "lack of support from top management" [27]. Business analyst must be opened to learn new skills of analyzing by broaden the perception and awareness. Tortora et al. [12] affirmed that investing only in new technologies does not guarantee the achievement and keeping of competitive advantage by companies in an I4.0 context. Meanwhile, industry players required to adopt the Subject Matter Expert to expand the performance of company. That being the case of the identification of Critical Success Factors (CSFs) and IR4.0 roadmap for the firm.

IR4.0 build, or test pursued to test the IR4.0 readiness in the firm's operating environment, rectify requirements and preparation of the end user for implementation. This stage carried out the IR4.0 design in iterative test cycles. Thereupon, IR4.0 implementation stage is to train the staff on the technologies, approve and deploy to firm's operating environment. Management's propensity to assume risk may have a more significant role than investor attitudes in establishing the working capital policies for the small business. Also, the growth demands placed upon the small company may be important as a cause for small firm illiquidity [31].

In brief, after numbers and continuous training, execution and assessment, competency and skills development aid the company growth such that the productivity and output is proportionally high. Eventually, IR4.0 post-implementation stage that regulate the firm's operating environment and transfer responsibility for continuous improvement to operating stages, is monitored via Continuous Quality Improvement (CQI). In the end, these six stages are expected to be attained when the source such as funding and training is adequate as it complies the element of money and energy.

5 Conclusion

Soomro et al. [24] concluded that, large size service organizations are more advanced in terms of strategy in embracing IR4.0 since the small and medium size organizations often work on the most pressing and immediate business investments, hence the exercise of strategic planning seems a burden for them. Enterprises must consider that employees need to be always acquiring new competencies by having training programs that continuously promote the development of their competencies [15].

In relevance to that, the IR4.0 readiness among industry players require strong advocacy and commitment from the entire organization right from the beginning. Further, the mixture of the right driving factors and minimization of the inhibiting factors would be able to make organizations ready towards IR4.0. While the realization of IR4.0 readiness

is time consuming, however if concerted efforts and actions are taken, IR4.0 readiness could be attained. Two main elements to project and focalized on to adopt IR4.0 are training and funding, which then they will be formed in a self-assessment consists of questionnaires and survey. Hence, industry players can continuously improve and update the needs of IR4.0 in their organization as the readiness level has been well determined through the self-assessment. To succeed in the digital era, companies can use performance assessment mechanisms extracted from their skills and approaches [39].

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Authors' Contributions. Collected the data, performed the analysis and wrote the paper.

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