

# READINESS ASPECTS IN EDUCATION SECTOR TO SUCCEED IN INDUSTRY 4.0 (IR 4.0): A REVIEW

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## ABSTRACT

*This paper reviews the readiness aspects in the education sector for engaging a new frontier of IR 4.0 and identifies possible ways of succeeding in IR 4.0. A new wave of IR 4.0 has created a greater impact on the whole industry and the education sector is no exception. IR 4.0 has revealed technological advancements using automated machine systems and the Internet of Things is becoming a priority in human life. This is in tandem with the aims of IR 4.0 of ensuring the effectiveness and flexibility in the operations of the industry. Indeed, IR 4.0 benefits are numerous. However, extensive utilization through the Internet of Things (IoT) and digital systems have caused major changes in the educational landscape, i.e., educational content, delivery/pedagogy, and its management structure. Thus, the education sector is among the sector facing disruptive challenges due to the speed of innovations. Are we ready? This study found that education needs to consider readiness aspects in terms of psychological, environmental, financial, technological skills and curriculum content to meet the changes brought about by IR 4.0.*

**Keywords:** readiness; education; education sector; IR 4.0

## INTRODUCTION

In recent years, the world has witnessed paradigm shifts of technological advancement called Industry 4.0 (IR 4.0). Technological advancement in IR 4.0 referred to systems updated to innovative and intelligent levels. In other words, technology can be embedded in the human body. This could be described as the most routine activities that will employ automated systems and machines, clouds and the Internet of Things (IoT) in IR 4.0 era. IR 4.0 benefits are extended to the whole industry and society nationwide. These act to facilitate and increase the efficiency and productivity of operations. In the education sector, dealing with advanced technology, digital systems, and the Internet of Things (IoT) has also been known to benefit lecturers and students. Attaining knowledge via cloud systems in the form of mobile devices become a trend lately (Pereira et al. 2017). The world has also witnessed a burgeoning of massive open online courses (MOOC) accessible to all without boundaries. Student registration in MOOC in 2015 has increased from 18 million to 35 million (Asmaa Abu Meziad, 2016).

Paradoxically, the widespread use of technological and digitized systems may result in the industry facing disruptive challenges. In the context of IR 4.0, this is certainly true for the education sector due to the speed at which innovations take place. This is because designing a curriculum within the IR 4.0 landscape and filling in industry needs are big deals. Moreover, in

the education sector, curriculum design and pedagogy/delivery are both vital as they affect the quality of the educational institutions. Harper and Quaye (2009) support this view by stating that student engagement is the indicator to measure educational quality. Thus, with rising advanced technology, digital systems, and the Internet of Things (IoT), all collaborating towards great engagements between lecturers and students in a cloud medium. However, measurement of an educational institution's quality is not merely tied to that parameter only, and there could be more. Dean and Gibbs (2015) highlighted five (5) approaches of measuring quality within educational institutions, which are in terms of excellence, perfection, fitness for purpose, value for money and transformation. Thus, the question arises whether our education sector is ready for IR 4.0? Faced with the speed of innovations and IR 4.0, the education sector needs to prepare the relevant groundwork to ensure readiness and success in adapting to changes occurring in the IR 4.0 era. This paper reviews the readiness aspects in the education sector for engaging the new frontier of IR 4.0 and identifies the possible ways of succeeding in IR 4.0.

## **LITERATURE REVIEW**

The readiness aspects of the education sector in IR 4.0 is significant to ensure that it meets the needs of the ever-changing globalized industry. This requires laying down the right foundation to secure the readiness and success in adapting to changes occurring in the IR 4.0 era. To review the readiness of the education sector in engaging the new frontier of IR 4.0, the Chapnick Readiness Model (2000) was employed. According to Chapnick (2000), this model of readiness is categorized into eight parts consisting of:

Psychological Readiness - Emphasizing on the individual's mind

Sociological readiness – Consisting of environmental details in which programs are conducted

Environmental readiness - Involving internal and external factors

Human resource readiness – Related to human support system

Financial readiness – Includes readiness on financial aspects

Technological skill readiness – Related to support system in technical areas

Equipment readiness – Refers to availability and sufficient equipment

Content readiness - Focuses on readiness in curriculum design

This model covers a wide range of aspects of readiness. However, due to time constraints, this study will focus only on five (5) aspects of readiness namely psychological, environmental, financial, technological skills and content.

### ***Readiness Aspects and Possible Ways to Succeed in IR 4.0***

### ***Psychological Readiness***

The education sector has been confronting disruptive changes due to innovation and technology that keep updating and evolving into IR 4.0. Innovation and technology are now ubiquitous to survive in the industry. The education sector consists of large institutions. Thus, a transformation of the individual's mind (psychological readiness) to adapt to global challenges ahead to serve Gen-Z and the 21st-century education are necessities. It is thus imperative that the education sector/organization has a hand in creating the goals of their organizations that will, in turn, support the individual's mind (psychological needs) in adapting to global challenges ahead. D'Souza and D. Mudin (2018) have emphasized that each institution is required to set its goals towards achieving IR 4.0 in 21st-century education. Orîndaru (2015) found higher education image and reputation are also being used as criteria to influence students in educational services.

### ***Environmental Readiness***

Malaysia was recorded at 23<sup>rd</sup> place in global competitiveness rankings for IR 4.0. As such, the education sector in Malaysia should have a strong foundation for educational transformation in IR 4.0 to pave the way for the establishment of strategic collaborations between university and industry. These require detailed blueprints of collaboration (D'Souza and D. Mudin, 2018) to ensure qualifications complement are following industry needs. As a result, knowledge in cloud technology and information computer technology are increasingly necessary to survive. This is the foundation stage for students to get well prepared in a challenging future workforce suited to their employability needs. Therefore, innovativeness in learning is the greater way to explore.

### ***Financial Readiness***

The education sector nationwide is well experienced in terms of financial struggles. Financial readiness is very important to succeed in IR 4.0 as it influences efforts towards a well-functioning higher education system. According to Amadi and Ememe (2013), the education sector in Nigeria seems to have a lack of readiness in the 21st-century learning and accreditation system. A few factors are contributing to these issues, such as poor collaboration among staff and curriculum planners, lack of funding and poor ICT knowledge (Amadi and Ememe, 2013). The debate on financial aspects is always a key topic highlighted by many researchers resulting in new innovative ways to increase funding. The education sector in Germany always emphasized on public funds initiatives to increase their finances (Teichler, 2018). These public funds will then be spent on research areas contributing to the excellent performance of universities.

Conversely, there was a lack of public funding in the Japanese education sector. In the American education sector, the academic areas have to strike a balance with business perspectives for financial effectiveness (Hansen, 2018). Meanwhile, the Indian education sector emphasizes the concept of community engagement through the utilization of online courses and employment of partnership models to tackle financial challenges.

### ***Technological Readiness***

To keep up with current technological advances, the education sector needs to have technological readiness in developing organizations based on IR 4.0. Hence, creating smart,

intelligent products flexible enough to provide relevant information to users is essential. The information must be flexible to access, intelligently used and well-linked (Pereira et al., 2017) as it influences students' choice of a study place. Acquiring knowledge is no longer limited to the classroom but is available globally without boundaries. Living with big data management, advanced technology and digitized system, the possible way for the education sector to succeed in IR 4.0 is to utilize the Internet of Things (IoT) strategically. It must prioritize creativity, smart flexibility and innovative learning systems. These include digitizing courses through massive open online courses (MOOC), which has become a trend (Asmaa Abu Mezied, 2016). In dealing with large data and short deadlines, the creation of strategic systems such as eMQA would speed up data retrieval.

### ***Content Readiness***

Living in the 21<sup>st</sup> century, where learning can be done through digitized devices and cloud medium, the education sector must transform its delivery/pedagogy approaches as well as modify the content of curricula to meet industry needs. Generally, different fields of programs require different content and areas of emphasis in the curriculum. The main element mostly emphasized and required by industry in any course and program offered is a practical skill, which is fundamental for graduates to secure employability in the workforce. In the UK, practical skill has been identified as a priority aspect to be included in the curriculum design of the hospitality field (Leung et al., 2018). Ismail and Mohammed (2015) found that TVET education curricula in Nigerian educational institutions have been recorded to pay less attention to practical skills. This consequently affected the education sector adversely as a whole, whereby students become less competitive for employment and produced poor quality of the workforce. The curriculum design content must be strategic to counter changes in IR 4.0 landscape. Baena et al. (2017) highlighted that education content needs to shift according to industry needs and global trends, thus ensuring a prosperous society rather than merely increasing profits to industry (Asonitou, 2015). In IR 4.0 era, designing a curriculum should be flexible at an intelligent level to produce new learning strategies for experiential students' learning leading to higher employability. Blackwell et al. (2001) and Bannett et al. (2000) suggested that innovative learning such as specific skills courses, experiential learning, and use of information technology in innovative ways, service learning, career planning, students' logbooks, extra-curricular activities, and work-based education are among the learning strategies to promote employability skills.

## RESEARCH METHODOLOGY

Various literature from previous researchers has been reviewed to explore on readiness aspect in the education sector and possible ways for it to succeed in IR 4.0 era. The analysis was done through a brief review of the literature. Subsequently, this study outlined the readiness aspects and its possible ways to be ready for success in IR 4.0.

Due to time limitations, this study will only focus on five (5) aspects of readiness, namely psychological, environmental, financial, technological skills and content. The result could be better if the study covers the whole aspects of readiness, which could determine the aspects of readiness to be considered in the education sector by the whole view in facing a wave of IR 4.0.

## RESULT AND DISCUSSION

Based on numerous literature reviewed, the readiness aspects and possible ways to succeed in IR 4.0 are as tabulated below:

**Table 1: Readiness Aspects and Possible Ways to Succeed in IR 4.0**

<b>Readiness Aspects</b>	<b>Keywords</b>	<b>Possible Ways to succeed in IR 4.0</b>
<i>Psychological Readiness</i>	Creating goals for their organizations	D'Souza and D. Mudin (2018) emphasized that each institution is required to set goals towards achieving IR 4.0  Orîndaru (2015) found higher education image and reputation are being used as criteria to influence students' choices in educational services.
<i>Environmental Readiness</i>	Strong collaboration between universities and industry	A detailed blueprint of collaboration for both (university-industry) should be created (D'Souza and D. Mudin, 2018)
<i>Financial Readiness</i>	Funding  Innovative Public funding  Partnership Models	Collaboration among staff  Germany puts a strong emphasis on public funds initiatives to increase their financial standing (Teichler, 2018).  In the American system, the education sector is balanced with business perspectives for

		financial effectiveness (Hansen, 2018).
		The Indian education sector practised a concept of community engagement through the utilization of online courses and partnership models employed to tackle financial challenges.
<b><i>Technological Readiness</i></b>	Smart, intelligent and flexible products  Digital systems	Creating smart, intelligent products flexible enough to provide relevant information to users.  Information is flexible to access, intelligently used, and linked (Pereira et al., 2017).  Creativity, smart flexibility, and innovative learning systems are being prioritized.  Digitizing courses through massive open online courses (MOOC) has become a trend (Asmaa Abu Mezied, 2016).
<b><i>Content Readiness</i></b>	Practical Skills  Pedagogy/delivery approaches  Flexible curricula at an intelligent level	Transform delivery/pedagogy approaches used, as well as the content of curricula.  In the UK, practical skills are identified as priority aspects to be included in the curriculum design of hospitality fields (Leung et al., 2018).  Baena et al. (2017) highlighted education content needs to shift according to industry needs and global trends, thus ensuring a prosperous society rather than merely increasing profits to industry (Asonitou, 2015).

Designing a curriculum should be flexible at an intelligent level to produce new learning strategies for experiential student learning leading to a higher employability rate.

Blackwell et al. (2001) and Bannett et al. (2000) suggested innovative learning such as specific skills courses, experiential learning, use of information technology in innovative ways, service learning, career planning, students' logbooks, extra-curricular activities, and work-based education are among the learning strategies to promote employability skills

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**Source: Author (2018)**

The results of this study found that to succeed in IR 4.0, several aspects of readiness need to be incorporated in the education sector. These aspects consist of psychological, environmental, financial, technological skills and content/curriculum design. Resilient education sector goals in IR 4.0, robust collaboration with industry, innovativeness in generating funding, intelligent and flexible digital products, emphasis on practical skills, and flexible curricula are among the elements required to be ready to attain success in IR 4.0. The resilient education sector goals in IR 4.0 are significant as a support system and creates an image for the whole organization in adapting to the new wave of the technology landscape. These are critically stated by Orîndaru (2015), whereby higher education image and reputation are being used as criteria to influence students' choices in educational services. Meanwhile, Kosogova and Araslanova (2015) iterated that the education sector needs to strive for strong linkages and greater engagement with industry to secure employability in the workforce based on IR 4.0 landscape for future generations. Thus, to be well-equipped in IR 4.0, it is that suggested the education sector institutions ought to endeavour for memorandums of understanding (MoU) with industry, thus able to reflect a degree of seriousness and mutual sharing. Such MoU is beneficial to both parties as a basis for smart partnerships in sharing benefits towards improving service delivery.

Literature indicated that funding in the education sector is a critical element faced nationwide. A high number of student enrolment creates unwarranted financial challenges. Amadi and Ememe (2013) reported that Nigeria is still not ready for 21<sup>st</sup>-century learning due to insufficient funding and poor ICT knowledge. Funding in the education sector is valuable to ensure a well-functioning higher education system. It is thus significant to leverage financial readiness in the education sector to engage the new frontiers of IR 4.0. In response to these challenges, a model of a strategic partnership to generate funding shall be emphasized. A case in point is the German education sector that has been focusing on public funds initiatives to

increase their financial standing (Teichler, 2018). On the other hand, the Indian education sector employed partnership models to tackle financial challenges.

Dealing with big data management and digitized systems, the education sector needs to be more innovative towards increased use of the Internet of Things (IoT). The education sector comprises large institutions and is always dealing with large data and short deadlines. Thus, innovativeness in creating products that are intelligently used has become a priority to succeed in IR 4.0. Pereira et al. (2017) compounded that digitized products to retrieve information must be flexible to access, intelligently used and linked (Pereira et al., 2017). For instance, in dealing with large data for accreditation and quality assurance purposes, creating a system such as eMQA would speed up data retrieval and ensure data accuracy. Besides that, learning through massive open online courses (MOOC) is also identified as a possible approach to be used.

The readiness in the content of education also needs to be aligned with industry needs and technological changes to secure industry employability for future generations especially Gen-Z. The transformation of educational delivery methods needs to be delved into in IR 4.0. Proposals abound towards establishing innovative learning, flexible curricula and empowering practical-based skills as bases in facing new frontiers of the IR 4.0 era. Innovative learning such as virtual learning environment (VLE), experiential learning, use of information technology in innovative ways, service learning, career planning, students' logbooks, extra-curricular activities, and work-based education are among the learning strategies to secure workforce employability for the future generations in IR 4.0 era.

## CONCLUSION

IR 4.0 benefits are extended to the whole industry and society throughout the country. IR 4.0 aims to facilitate, increase the efficiency and productivity of the industry. However, the extensive advancement in the use of technology may result in disruptive changes to certain sectors of industry including the education industry. The whole support systems including human support, need to be transformed and readied to engage IR 4.0. This is to align with the IR 4.0 landscape and secure the workforce employability for the future generations. Due to time limitation, this study focuses on five (5) aspects of readiness only namely psychological, environmental, financial, technological skills and content. The analysis could be better if the study encompasses the whole aspects of readiness, hence determining the entire aspects of readiness to be considered by the education sector to face the onslaught of the IR 4.0 tidal wave.

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