

Sustainability of Internationalization of Higher Education in Industrial Revolution 4.0 Era:

A systematic literature review

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Abstract—Throughout the last decade, Internationalization becomes highlight of Higher Education implementation all over the world. Internationalization is strategy of Higher Education to increasing its quality, using international factors as implementation institution standard. Internationalization of Higher Education comes with two different perspectives which is the opportunity to increase the quality of Higher Education or otherwise it could become global competitiveness threat. After Industrial Revolution 4.0, implementation of Internationalization of Higher Education gathers so much attention. Many countries around the world have developed implementation of Internationalization in the time of Industrial Revolution 4.0. However, some countries still facing many challenges such as: integration of Internationalization with the state policy and the limited resources of Higher Education institution. In order not to left behind, a country should simultaneously accelerate Internationalization with technological reinforcement. Therefore, the purpose of this paper is to analyze the developing of Internationalization in Industrial Revolution 4.0 and to discover new resource for future research. Systematic Literature Review being used as methodology to find the purpose of this paper. This paper could be used as literature for Internationalization of Higher Education and help stakeholder to make policy in the future.

Keywords—sustainability; internationalization of higher education; industrial revolution 4.0

I. INTRODUCTION

Over the past decade, internationalization has become a trend in the implementation of higher education around the world. Internationalization is defined as the process of integrating international, intercultural or global dimension into the purpose, function or delivery of postsecondary education [1]. In general, internationalization can be understood as the process of integrating international dimension in research, teaching activities and administration of educational institutions that aim to seek scientific excellence and commercialization in Global society [2-4]. The implementation of higher education internationalization is a potential step to produce a marketable graduate, attracting more international students and generating innovations through research and development [5,6].

In an effort to increase excellence, internationalization has a considerable contribution to the development of higher education and on the other hand, also affects the economy and society [7]. The phenomenon of internationalization is not merely a trend but has become part of the effort to improve the quality of education in various countries. The implementation of the college internationalization is designed to align with college objectives without leaving existing values and norms.

Internationalization is also a challenge for universities to make changes following international standards. The goal of change is to prevent the organization's crisis, increase capacity in competition and face environmental turmoil [8]. One of the factors affecting change is the dynamics of the environment through the renewal and development both internally and externally [9-11]. As a result of an organizational environment that is constantly changing, organizations are then required to change if they want to remain to exist and succeed in the future.

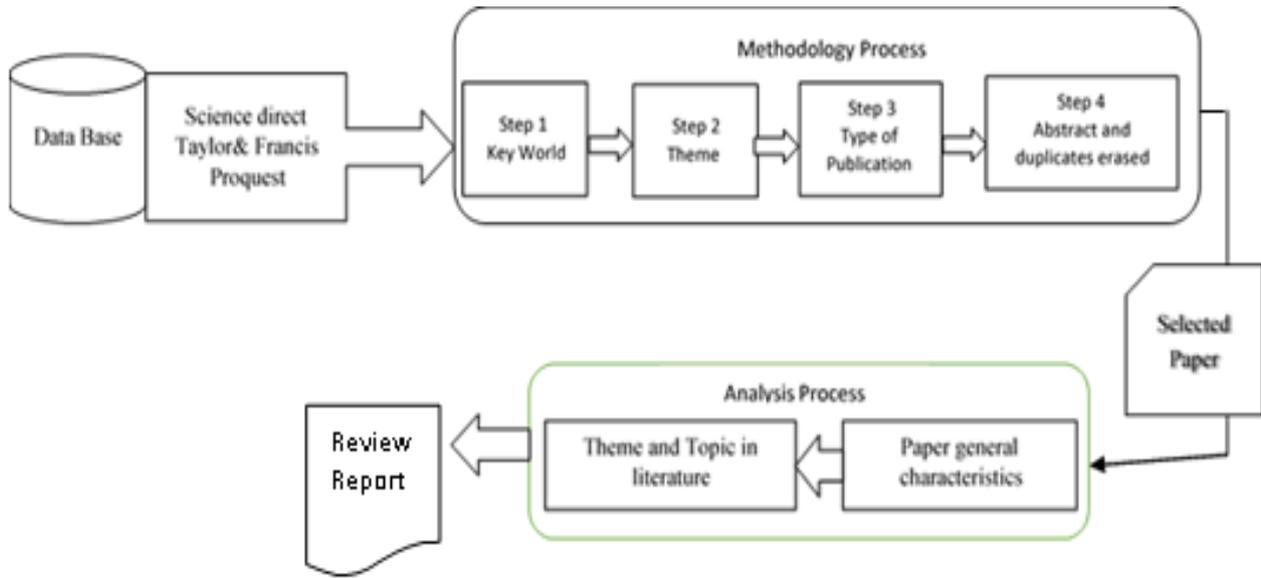
Currently, the implementation of the internationalization of the college has entered a new chapter of the era of the Industrial Revolution 4.0. The Era of the 4.0 Industrial Revolution is characterized by the increasing use of technology in various areas of life one of the education. The revolution affects not only the production of goods and services but also the labor market and education system. The 4.0 Industrial Revolution comes with the benefit of and challenging the socio-economic status of countries that have been involved in such transformations [12]. As a result of the industry Revolution 4.0, some professions and jobs will disappear. So to respond to these challenges the college should reformulate the internationalization strategy to strengthen themselves into the global market.

II. METHODOLOGY

This article uses systematic literature review as a method of analysis. This method was initially developed from the field of medicine used to improve research performance and quality of review processes. The systematic literature review method was chosen to maintain the same principles on the type of social research. Systematic Literature Review in this paper will use the elaboration steps of the Piccarozzi research covering the

selection of the base data, methodology process, selecting articles, analysis process, and review conclusions [13]. The use of the systematic literature review method aims to compile information using various viewpoints about the complete

picture of the internationalization of universities in the era of the 4.0 Industrial Revolution. In more detail, the process of methodology that will be used in this article can be seen in Figure 1.



Source: our elaboration and Piccarozzi model

Fig. 1. Review process.

As described in figure 1, this research begins with identifying three scientific base data, namely Science Direct, Taylor & Francis and ProQuest. These three base data are chosen based on the consideration that the three have been widely recognized by the international community in social studies. Many of the works have been published in the journals with a high amount of citation. This is attested to the combination that is produced can form a systematic review according to the desired topic. Each work found on the three base data is then extracted 4 times. The first step of filtering uses the 4.0 industry keywords and education to obtain the widest possible result. The second stage of screening works is limited to the internationalization theme of the college. The third step is done by filtering based on the differentiated research type in journal form and review. In the last step, the filtering is done by looking at the abstract and analyzing article objectives. Based on the steps then choose a number of relevant articles to be included in the review. The stages for extracting these works can be seen in table 1.

A total of 21 articles have been extracted as much as 4 times later downloaded from each database. These articles are then parsed and analyzed to produce findings that have the potential to explain the theme of sustainability of the internationalization of high-level college in the era of the 4.0 Industrial Revolution.

III. RESULTS AND DISCUSSION

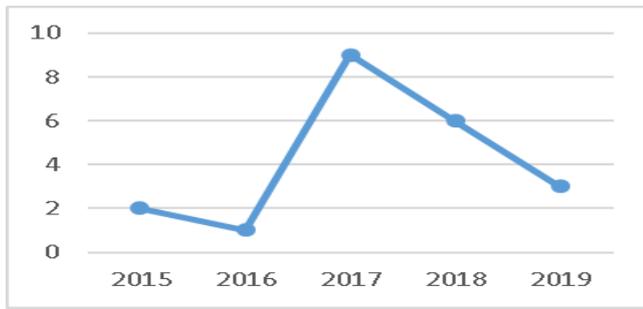
The last few years of the 4.0 Industrial Revolution became one of the most popular themes in various research at the college level. The research study of the 4.0 industrial Revolution is characterized by the increasing use of modern technologies that have been developed as teaching materials. The purpose of improving technology is to improve the quality of higher education graduates amid the development of information and communication technology that is increasingly modern and fast. To face a number of challenges in the era of the 4.0 Industrial Revolution then the college needs to reformulate the strategy of internationalization sustainably.

Systematically a number of articles have been extracted four times so as to produce a number of samples used to perform the analysis in this article. From a number of samples obtained, the selected article was published in several time periods.

TABLE I. OVERALL OVERVIEW OF THE RESEARCH

Step		Science direct	Taylor & Francis	ProQuest	Total
Step 1	Industry education 4.0,	1731	1817	1524	5072
Step 2	Themes (internationalization of higher education)	63	132	304	499
Step 3	Type (Review and Research article)	45	46	57	148
Step 4	Abstract Duplicate	11	5	5	21

Source: our elaboration



Source: our elaboration

Fig. 2. Temporal distribution of publications.

The figure 2 shows that the research with the theme and the topic of the industrial revolution is quite much in demand as an alternative in research studies in high. In a number of selected samples, as many as 9 articles were conducted in 2017. The article dominates the analysis of the sustainability theme of the college's internationalization in the revolution of the 4.0 industry.

A number of 21 articles in the form of journals and selected reviews are written by a number of authors who influence the complexity of their views on the phenomenon of the 4.0 industrial Revolution. The number of authors involved in the average article writing is still dominated by one to three people. This indicates that an article is ideally written no more than three people. But author involvement in articles of more than three people is also not overlooked in this analysis. The number of authors in 21 sample articles can be seen in table 2.

TABLE II. NUMBER OF AUTHORS PER PAPER

N of author	Paper	%
1	5	24
2	6	28
3	5	24
4	4	19
5	-	-
6	-	-
7	1	5
Total	21	100

Source: our elaboration

Furthermore, from a selected sample, the analysis of topics and themes used in each article. The results of the analysis can be seen in the following table 3.

TABLE III. ANALYSIS OF TOPICS AND THEMES

Researcher	Topik
[14-17]	Digital manufacturing
[18-21]	ICT, virtual classrooms, virtual laboratories
[22,23]	Humand Factor
[24]	Integrated application
[12] [25-28]	Innovation, organizational change
[29-31]	Education and learning system

Source: our elaboration

Based on table 3 it can be seen that there are several topics that can be developed in analyzing the sustainability of internationalization strategies. These topics cover the potential

of digital manufacturing; virtual classroom and laboratory use; analysis of human resource factors related to opportunities and competencies; innovation and organizational change in facing global challenges; and the use of technology-based learning and education systems as learning media.

A. Review Report

The 4.0 Industrial Revolution is an era of digitization characterized by technological advances, mechanization, and automation. These aspects play the main role of evolution in the field of [18,32]. In the era of the 4.0 industrial revolution, there were a few more critical challenges or obstacles to increasing productivity in the workplace [16]. Innovation in a broad sense is a key solution to improve productivity and the needs of the community to achieve prosperity [12]. The 4.0 Industrial revolution has not only influenced production, but also the labor market and education system [16,32]. The 4.0 Industrial Revolution offers possible use of technology to improve job-based learning [15]. The arrival of new technologies requires increased talent and skills as well as the creation of knowledge-based innovations [25]. This situation, in turn, gives a claim for graduates of high-level to become more skilled.

One of the main numbers of a country's endogenous growth is human. Universities play an important role in maintaining and building human resources [23]. Universities, particularly in the open and competitive economies, face the challenge of increasing competition in human resource management. The presence of the 4.0 industry has stimulated the skill shifts and manpower qualifications required in the workforce [15]. Only qualified and educated employees will be able to control the occurrence of this technological change [32]. Along with the demands of major changes in skills and qualifications, the labor industry in the 4.0 industry revolution plays an important role. The ability of higher education systems to raise qualified standards of students is the key to determining the quality of future graduates [23]. There are at least three aspects that students need to have in the 21st century are (1) Learning Skills and innovation, (2) Information media and technological skills, as well as (3) Life and career skills [30].

To anticipate the challenge of the 4.0 Industrial Revolution, the college is required to improve the technology-oriented learning system [17]. Nowadays, there are a variety of technology-based learning systems implemented by universities such as e-learning, development of learning platform, collaborative industry learning as well as the use of virtual reality [19-21]. Virtual Reality is a rapidly growing field in industrial skill development aimed at minimizing security issues, developing skills and knowledge to train new workers [21,32]. The goal of a virtual learning method is to create a future environment for teachers and students to innovate with a knowledge transfer methodology that helps and improves learners' understanding [19].

On the other hand, the development of the current management system is also being directed at the collaboration between humans and machines. Some universities in the world have developed a learning plant that is equipped with a Cyber-physical production system [17]. The learning system is

expected to complement the qualifications and abilities of students as well as provide technical skills inherent to the multidisciplinary properties of smart systems and manufacturing progress [17]. Factory learning has a function to enable learning-oriented practices in an environment close to the industry. This is to facilitate the effective transfer of knowledge and overcome future challenges faced by the manufacturing industry [15]. Many countries with advanced economies have struggled to defend their manufacturing bases in an era of globalization. The literature says that the most successful countries in preserving manufacturing with the help of robust education and vocational training system can provide a highly competent and knowledgeable workforce supply to the industry.

Colleges are a place to improve knowledge and skills of human resources. The quality of the college plays a special role in the international competitiveness management system and the national education system with implementing education policy [29]. The competitiveness is an effective ability to meet the needs of the state using the nation's intellectual resources. Intellectual resources are integrated based on scientific research, educational activities, the establishment of civilization general values, talent cultivation, and involvement in scientific space and global education [29]. Therefore, the competitiveness of a country's higher education system depends on the ability of colleges and other institutions to provide educational services and produce competitive scientific work. Programs and courses that support skill enhancement are required to be more flexible to fit the objectives of students and stakeholders [27].

The presence of technology has revolutionized academics when knowledge was externalized. This formed a new communication between the scientific community and the mixed form between teaching and learning [27]. It is important for colleges to not only replicate the strategies of other higher education institutions but also strive to build on their own strengths and traditions in creating a balance [23]. In its development, it is hoped that the college will become much more integrated with working life. To support colleges, the government should eliminate barriers that prevent intelligent people from gaining skills, as well as attracting talented people to remain in their country [26]. Skills development to comply with technological developments can only be achieved by doing a collaboration between universities, industry, governments and other related organizations to develop innovative skills [28]. The purpose of the collaboration is essentially a shared value to the responsibility of growing the quality of graduates that meet the needs of the global market.

IV. CONCLUSIONS

Based on the results of literature review, it was discovered that the potential of digital manufacturing; use of classes and virtual laboratories; analysis of human resources factors relating to opportunities and competencies; innovation and organizational change in the face of global challenges; and the use of technology-based learning and education systems as learning media are popular topics that are widely examined by world researchers to discuss the 4.0 industry revolution. The study found that the advent of the 4.0 industrial revolution had

stimulated the shifts in skills and manpower qualifications required in the workforce. This gives a claim for a high-level graduate to become more skilled. To anticipate the challenge of the 4.0 college industry revolution is required to enhance the learning system oriented to the use of technology. So far e-learning, development of learning platform, collaborative learning industry as well as virtual reality use has been developed as a learning medium for students. Several universities in the world have also developed a learning factory that aims to enable learning-oriented practices in an environment close to the industry. In its development, it is hoped that the college will become much more integrated with working life so that it can grow the quality of graduates that are suitable to the needs of the global market.

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