



**EVALUATION OF THE SKILLS GAP FOR PROGRESSION
TOWARDS THE FOURTH INDUSTRIAL REVOLUTION IN LIBYA**

HUSSEIN TAWFIQ SAEID BALRWEIN

**MASTER OF MANUFACTURING ENGINEERING
(INDUSTRIAL ENGINEERING)**

2018



Faculty of Manufacturing Engineering

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HUSSEIN TAWFIQ SAEID BALRWEIN

**A thesis submitted in partial fulfillment of the requirements for the degree of
Master of Manufacturing Engineering (Industrial Engineering)**

Faculty of Manufacturing Engineering

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2018

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DECLARATION

I declare that this project entitled “research on the skills gap for the progression of the fourth industrial revolution in Libya” is the result of my own research except as cited in the references. The project has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature

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Name

:

Hussein Tawfiq Saeid Balrwein

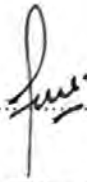
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APPROVAL

I hereby declare that I have read this project and in my opinion this project is sufficient in terms of scope and quality for the award of Master of Manufacturing Engineering (Industrial Engineering)

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DEDICATION

I would like to sincerely dedicate this piece of work to:

To my father beloved Tawfiq and my beloved mother Haniya who supported me and lighted up my life since my birth to this date.

To my brothers and sisters for their effort, moral support and endless encouragement.

To my dearest wife Aman, her parents and my beloved daughter Jumana for their patience, support and unfailing encouragement during the preparation of this work.

Last but not least, I wish to express my gratitude to my family and closest friends for their unconditional trust, encouragement and support enabling this work to be accomplished.

ABSTRACT

We are now witnessing the dawn of the Fourth Industrial Revolution(4IR). In keeping up with the principles underpinning 4IR, smart factories will be configured as highly complex, dynamic and flexible systems. Some experts and researchers even suggest that these realities form challenges to workforce development in different dimensions. On the one hand, measures are needed to develop and train the existing workforce; on the other hand, educational institutions need to meet Industry 4.0 needs, provide broader skill sets and bridge the ICT Skills Gap.

Over the past thirty odd years, the Libyan government has lacked an ideal and realistic strategy to boost youth employment and improve the quality of education. Libya has one of the highest rates of unemployment in the world "about 48% of youth unemployment & female unemployment 25%", compared to its high rate of tertiary enrollment. Lack of qualified Libyan manpower is the most important obstacle to overcome for economic development, technological change and prosperity.

Thus, the primary objective of this study was to gain a deeper understanding of the skills gap for progression towards the Fourth Industrial Revolution in Libya. The main areas covered included: awareness about industry 4.0, evaluation of the current skill level and the causes widening skill gap and readiness of organizations to implement industry 4.0.

This thesis has been researched using quantitative research as this method is appropriate because the underlying rationale is to evaluate the "skills gap". Therefore, this study is used questionnaires to collect the data, targeted at stakeholders such as policy makers, employers/employees, students/teachers and unemployed.

Findings from the research revealed that there is low level of awareness about industry 4.0 among stakeholders in Libya. There is a significant mismatch between the current skill level in Libya and skill sets required for Industry 4.0 (except for personal skills were acceptable), this presented an alarming negative result. On the other hand, educational institutions need to meet Industry 4.0 needs, in this study, we demonstrated the measures that are needed to provide broader skill sets and bridge the ICT Skills Gap. Furthermore, above 50 % of respondents indicated low level or lack of willingness to implement industry 4.0 in their organization. Also, there are many challenges faced by organizations in implementing the technological changes required for progression to industry 4.0.

ABSTRAK

Kini, kita menyaksikan fajar Revolusi Perindustrian Keempat (4IR). Dalam menepati prinsip-prinsip yang akan menyokong perubahan 4IR, kilang pintar akan dikonfigurasi sebagai sistem yang sangat kompleks, dinamik dan fleksibel. Sesetengah pakar dan juga penyelidik mencadangkan bahawa realiti ini merupakan cabaran kepada membangunkan tenaga kerja dalam dimensi yang berbeza. Manakala, langkah-langkah diperlukan untuk membangun dan melatih tenaga kerja sedia ada; dan sebaliknya, institusi pendidikan perlu memenuhi keperluan Industri 4.0, menyediakan kemahiran yang lebih luas dan merapatkan jurang dalam kemahiran ICT.

Sejak tiga puluh tahun yang lalu, kerajaan Libya tidak mempunyai strategi yang ideal dan realistik untuk meningkatkan pekerjaan pemuda dan meningkatkan kualiti pendidikan. Libya mempunyai salah satu daripada kadar pengangguran tertinggi di dunia "kira-kira 48% pengangguran belia & pengangguran wanita 25%", berbanding kadar enrolmen yang tertinggi. Kekurangan tenaga manusia di Libya yang berkecukupan adalah halangan yang paling besar untuk diatasi untuk pembangunan ekonomi, perubahan teknologi dan juga kemakmuran.

Oleh itu, objektif utama kajian ini adalah untuk mendapatkan pemahaman yang lebih mendalam tentang jurang kemahiran untuk kemajuan ke arah Revolusi Perindustrian Keempat di Libya. Bidang utama yang dibincangkan termasuk: kesedaran tentang industri 4.0, penilaian tahap kemahiran semasa dan punca-punca yang meluaskan jurang kemahiran dan penyediaan organisasi untuk melaksanakan industri 4.0.

Tesis ini telah dikaji menggunakan kaedah penyelidikan kuantitatif kerana kaedah ini sesuai untuk rasional yang mendasarinya adalah untuk menilai "jurang kemahiran". Oleh itu, kajian ini menggunakan soal selidik untuk mengumpul data, yang disasarkan kepada pemegang kritiria seperti pembuat dasar, majikan / pekerja, pelajar / guru dan penganggur.

Penemuan dari kajian menunjukkan bahawa terdapat tahap kesedaran yang rendah mengenai industri 4.0 di kalangan pihak berkuasa di Libya. Terdapat ketidaksesuaian yang ketara antara tahap kemahiran di Libya dan juga set kemahiran yang diperlukan untuk Industri 4.0 yang menampilkan imej negatif. Dalam kajian ini, institusi pendidikan perlu memenuhi keperluan Industri 4.0 kami telah menunjukkan langkah-langkah yang diperlukan untuk menyediakan kemahiran yang lebih meluas dan merapatkan jurang dalam kemahiran ICT. Tambahan pula, atas 50% daripada responden menunjukkan tahap kemahiran ICT yang rendah dan kekurangan kesediaan untuk melaksanakan industri 4.0 dalam organisasi mereka. Selain itu, terdapat banyak cabaran yang dihadapi oleh organisasi dalam melaksanakan perubahan teknologi yang diperlukan untuk perkembangan industri 4.0.

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LIST OF ABBREVIATIONS

3DP	Three-Dimensional Printing
4IR	The Fourth Industrial Revolution
AEO	African Economic Outlook
AGCS	Allianz Global Corporate Specialty
AM	Additive Manufacturing
AR	Augmented Reality
BCG	The Boston Consulting Group
CAD	Computer-Aided Design
CEOs	Chief Executive Officers
CPS	Cyber-Physical Systems
FDM	Fused Deposition Modelling
IaaS	Infrastructure as a Service
IAT	Industrial Automation Thing
ICA	International Controller Association
ICT	Information and communications technology
IEC	International Electrotechnical Commission
IoT	Internet of Thing
IPv6	Internet Protocol version 6

IT	Information Technologies
MENA	the Middle East and North Africa
MGI	McKinsey Global Institute
PaaS	Platform as a Service
R & D	Research and Development
RPA	Robotic Process Automation
SaaS	Software as A Service
SLM	Selective Laser Melting
SLS	Selective Laser Sintering
STEM	Science, Technology, Engineering and mathematics
UNIDO	United Nations Industrial Development Organization.
VR	Virtual world
WBG	World Bank Group.
WEF	The World Economic Forum

CHAPTER 1

INTRODUCTION

This chapter presents the framework of information about this study, the information on this report is organised to disclose the originality of the study. Description are given on the background of the mentioned study, problem statement, research question, objective, scope of the study and significance of the study.

1.0 Background

In the twenty-first century, industrial development has been still appropriate for the poor countries that are trying to catch up with more advanced economies and promoted living standard of population. Although the need for such " industrialization " is still, the challenges more strenuous than in the past (Naudé et al., 2012; Gehrke et al., 2015).

According to the United Nations Industrial Development Organization (UNIDO) (2015), We understand manufacturing as a process that converts any raw materials into completed goods that are required to meet a customers' needs and wants, however. Manufacturing produces the necessary commodities for export and domestic consumption. It also helps to diffuse new technologies to other places in the economy which is related to transportation, agriculture and overall economic growth which is deemed essential for a country to prosper.

According to the McKinsey Global Institute (MGI) (2012), As manufacturing evolves, policy makers need to change their expectations and take a better look at manufacturing more as a driver of productivity and innovation rather than a source of mass employment.

Africa specifically, has become a disheartening profile in the postindependence book of records. There is therefore a need for industrial policy to promote manufacturing in industrially lagging countries and to consider some of the current contexts and challenges (Naudé et al., 2012).

International Controller Association Report (ICA) (2015), The theory that the world is now open to industrial revolutions is well understood by many. The first industrial revolution started with the invention of the steam engine and then slowly after, the introduction of mechanical manufacturing equipment. The interpreted characteristic of the second industrial revolution was then steam being replaced by electricity, then later permitted the introduction to the assembly line and conveyor belt. The third industrial revolution was characterized by the automation of production processes of the increasing use of electronics and information and communication technologies.

Today, after three industrial stages we are also witnessing the dawn of the Fourth Industrial Revolution. It was first mentioned in 2011 by the German federal (Roblek et al., 2016). The terms IoT, Fourth Industrial Revolution, Industry 4.0 and cyber-physical systems are sometimes used synonymously and have recently attracted a lot of attention (Dittrich, 2016). The term depicts the new industrial age based on communication and technology information, this is also distinguished by hyper-connectivity and superintelligence. In particular, it merges all the services and products of the real world with new technologies in various fields such as 3D printing, robotics, biotechnology, and nanotechnology (Jee, 2017). A figure 1.1 shows the framework of the components and contributing digital technologies in Industry 4.0 revolution.

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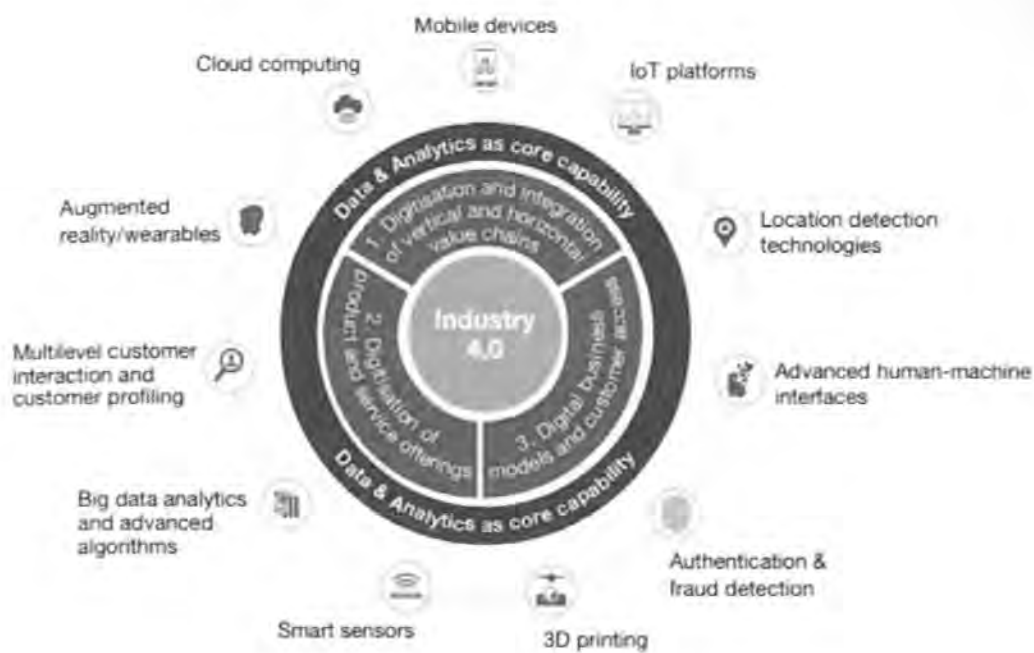


Figure 1.1: Industry 4.0 Framework and Contributing Digital Technologies
(Pwc and Flanders, 2017)

The World Economic Forum (WEF) highlights a variety of risks ranging from the global environment to National security, and the Fourth Industrial Revolution that will begin to affect our everyday business. These risks are expected to have a decisive impact on our political economy, business, and ultimately human civilization in general (Haraoka, 2017). By disregarding the issues at hand in a timely manner, could potentially cost businesses, societies and individuals in an enormous manner. Against this background, to prevent a worst-case scenario, the governments should enhance a better environment, in an effective and quick procedure in order to assist stakeholders to manage change in order to fully seize the opportunities, proactive adaptation and to mitigate undesirable outcomes " e.g. but not limited to, growing inequality, widening skills gaps, massive dislocation of jobs and talent shortages" (WEF, 2016a).

1.1 Problem Statement

Libya is theoretically a wealthy country with a small population. Although young people are one of its greatest resources, lack of qualified Libyan manpower is the most important obstacle to economic development, technological change and prosperity. It would be worth mentioning that a huge result of a mismatch between the competencies precisely developed by the education system and the competencies needed by the labour market (Braun and Jones, 2013). According to the African Economic Outlook (AEO) (2012), Libya will somehow have to face the steady increase of challenges towards unemployment of youths and the many other hurdles that should be addressed as soon as possible in order to promote economic and political stability, reducing social unrest. Over the past thirty odd years, the Libyan government has lacked an ideal and realistic strategy to boost youth employment and improve the quality of education.

Libya has one of the highest rates of unemployment in the world "about 48% of youth unemployment & female unemployment 25%", compared to its high rate of tertiary enrollment as presented in figure 1.2. This pattern suggests that there is a skills gap between work and education. The 2010 Investment Climate Assessment (ICA) showed that thirty percent of firms have reported difficulty in recruiting qualified Libyan nationals. Combined, Libyan nationals comprise around 60 percent; foreign workers account for 40 percent of the labour force (WBG, 2015).