Graduates' Skillsets towards Industrial Revolution 4.0 Technology in Tanzania

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Abstract
This study examined the graduates' skillsets towards industrial revolution 4.0 technology in Tanzania using Institute of Accountancy Arusha and University of Arusha as case study. This study used a descriptive survey research design. The convenience sampling method was employed to obtain respondents. A total sample of 141 students had answered the survey. The primary data was collected by using questionnaires. Data was analysed using descriptive and inferential statistics with the aid of SPSS. Results showed that, they were aware to the Industry Revolution 4.0 technology to the little extent. This study concludes that Tanzanian graduates have weak skillsets towards Industrial Revolution 4.0 technology. This study recommends that, the Ministry of Education Science and Technology to analyse and reorganize existing program curriculum in order to produce graduates who are more knowledgeable, capable, and conversant with IR 4.0 technology. Moreover, similar studies should be conducted, but this time the focus should be on the employees' skillsets towards IR 4.0 technology.

Keywords: Graduates, Readiness, Industrial Revolution

1. Introduction

Over time, industry experienced a series of "industrial revolutions" with increasing complexity and productivity, which altered the existing paradigm. The term "Industrial Revolution" refers to a situation in which there is a growth in productive technological capacity through creativity, with an impact on the economic, environmental, and social dimensions (Adnan and Yusof, 2019). The German government introduced Industry Revolution 4.0 (IR 4.0) in 2011 as one of the country's high-tech strategic economic developments. This strategic plan aims to improve their industry's efficiency, productivity, transparency, and safety (Marr, 2018). IR 4.0 was defined as an industry revolution embedded with advanced internet technology to serve as a backbone in the integration of humans, physical objects, intelligent machines, production lines, and production processes across organizational boundaries to form a new intelligent, networked, and agile value chain (Gerbert et al. 2021). IR 4.0, according to some experts, is a new paradigm that embraces future technologies such as the Internet of Things, the Internet of Services, robots, big data, cloud manufacturing, and augmented reality (Pereira & Romero, 2017). The

advancement of technology in IR 4.0 has a significant economic impact (Kazancoglu & OzkanOzen, 2018).

An Industrial Revolution may be seen of as a system of macro innovations that create events that transform society in a decisive and pragmatic way, independent of the scientific reason for doing so (Roepen 2020). According to Falnok (2018), the industrial revolution has the potential to have a significant influence on education, particularly in educational institutions. As a source of skill and information to a workforce, the educational sector needs to change the way graduates are taught in order to prepare them for future career trends (Rayner and Papakonstantinou 2020). Currently, complex problem solving, critical thinking, creativity, people management, digital literacy, emotional intelligence, judgment and decision making, service orientation, negotiation, and cognitive flexibility, which were previously considered 'soft' skills, are now considered critical for initial career entry and future career readiness (Shafie and Nayan 2021). Without a doubt, in the post-Industry 4.0 era, these skills will no longer be viewed as soft or even inferior to technical skills, but as crucial skills necessary not just to survive but also to succeed in the future workplace (Vakola 2021).

Without these critical skills, the next generation of employees will not only be unable to find future jobs, but they will also be unable to contribute constructively to the Industry 4.0 economy and society at large. As it is, without regular and determined effort, these critical qualities are exceedingly difficult for the younger generation to develop (Naik 2019). As a result, colleges and universities must establish themselves as main testing grounds for crucial Industry 4.0 capabilities. This is due to the fact that failing to gain these skills will surely impair the career preparation of the younger generation of future workers. Although the idea of IR 4.0 technology was officially launched in Germany in 2011, it is still new to Tanzanian education sector (Weili Teng, Chenwei Ma, Saeed Pahlevansharif, & Jason James Turner, 2019). As a result, it is unclear if graduates possess sufficient skillsets in relation to IR 4.0 technology. Therefore, this study sought to examine the graduates' skillsets towards industrial revolution 4.0 technology in Tanzania using Institute of Accountancy Arusha and University of Arusha as case study.

1.1. Need for the Study

The need of this study lies in its exploration of the readiness of Tanzanian graduates towards Industry 4.0 technology. As the world shifts towards Industry 4.0, it is crucial to ensure that graduates possess the necessary skills and knowledge to contribute to the economy and society at large. This study provides insight into the extent to which graduates in Tanzania are prepared for the changing technological landscape and identify any gaps in their skillsets. The findings of this study will be useful for policymakers, educational institutions, and employers to better understand the readiness of the workforce and make informed decisions regarding education and training. Furthermore, this study provides a basis for future research in the field of Industry 4.0 and education, particularly in developing countries where the impact of Industry 4.0 may be even more pronounced. Ultimately, this study contributes to the development of a more skilled and competitive workforce in Tanzania, which could have positive economic and social implications.

2. Literature Review

This chapter provides the literatures review from different studies in order to capture ideas which guided the development of this study:

Trait and Factor Theory of Career Choice and Development

This study was guided by Frank Parson's Trait and Factor Theory of Career Choice and Development (1930s) which was developed by Frank Parson (1930s). Parson felt that each individual contains a distinct and constant set of characteristics essential for successful execution of the critical tasks of each career (Williamson & Biggs, 1979). This means that people have diverse abilities that correspond to different vocations. Only when an individual is placed in a suitable working environment can his or her capabilities be noticed. Individuals must thus be put in the correct vocation that corresponds to their strengths and interests in order to achieve greater performance and higher production. The Trait and Factor theory is applicable in this study since it emphasizes comprehension of graduates' skill sets, the IR 4.0 technology, and matching the two. According to this theory, skillset is a mix of skills that are part of personality traits. Self-confidence, adaptability, critical thinking, problem solving, honesty, and other traits are impacted by both inherited and environmental factors. According to Yorke (2011), the majority of graduates' encounter unemployment due to a mismatch between their skills and labor market demands. Currently, most organizations need graduates who can work with IR 4.0 technology and have sophisticated problem solving, critical thinking, creativity, people management, digital literacy, emotional intelligence, judgment and decision making, service orientation, negotiation, and cognitive flexibility (Stefan & Rovio, 2012). This theory has been useful in examining the graduates' skillsets towards IR 4.0 technology in Tanzania using Institute of Accountancy Arusha and University of Arusha as case study.

Empirical Literature Review

The discovery of new technologies is the focus of Industry 4.0. According to Cordes and Stacey (2017), autonomous robots, simulation, horizontal and vertical system integration, the Industrial Internet of Things (IoT), cyber security, the cloud, additive manufacturing, augmented reality, and big data and analytics are the nine thrusts of Industry 4.0. Tanius (2020) studied the relationship between new graduate knowledge, competence, technology, and preparedness to work in IR 4.0. According to the findings, technical and soft skills both contributed to the readiness to work in IR 4.0. The respondents, on the other hand, acknowledged that they had a shortcoming in employing technology in their studies. Furthermore, the level of preparation was consistent across all universities. Quaratul (2020) found concerns about the job preparedness of local graduates prior to working in an IR 4.0 environment. According to the data, Malaysian graduates have a lack of expertise about functioning in an IR 4.0 context. Other growing difficulties include graduates' failure to utilize the talents they learned throughout their courses, particularly soft skills, their low fluency in English, low self-confidence, and an attitude problem. Ismail (2020) investigated students' preparedness to face the Industrial Revolution 4.0 among technical teacher education students. The data revealed that the pupils' understanding of IR 4.0 was lacking. The survey also discovered that students' enthusiasm and attitudes were strong, as was their willingness to deal with IR 4.0. Sharita et al. (2018) discovered that students' knowledge is lacking. This is because students are unlikely to be habituated to using IR 4.0 technology during teaching and learning sessions in class or in everyday life. According to Tapper (2021), graduates who can transfer critical thinking abilities to workplaces would be sought for by companies in order to enter a professional workplace in the business. As a result, critical thinking that leads to issue solutions is vital.

3. Methodology

In order to gather and analyse data from respondents, this study used a descriptive survey research design. Ravid (2011) defines descriptive survey design as the discovery and measurement of cause and effect correlations among variables. It allows the researcher to get detailed information on the population being

investigated. This research was carried out at in Arusha, Tanzania. Two Higher Learning Institutions (HLI) were selected; these are Institute of Accountancy Arusha and Arusha University. The convenience sampling method was employed to obtain respondents. A total sample of 141 students was used in this study. The primary data was collected by using questionnaires. Data from the questionnaires will be quantitatively analysed using SPSS descriptive and inferential statistics. Because of its robust analytical capability and ease of data analysis, the SPSS version 26 package was chosen. Descriptive statistics was used to present frequencies and percentages to illustrate the results, while inferential statistics was used to show the relationship between research variables through regression and correlation analysis.

4. Analysis and Interpretation

In this study, 150 questionnaires were distributed to the respondents, but only 141 questionnaires were returned and used for analysis representing 94% response. This response rate was considered excellent and representative to allow generalization of the findings.

Demographic Information

This section describes the general characteristics of the respondents such as gender, age, educational level, and IR 4.0 technology awareness.

Table 1: Demographic Information

Demographic Characteristics		Frequency	Percentage (%)
Institution	IAA	75	53.2
	UoA	66	46.8
Gender	Male	60	42.6
	Female	81	57.4
Age	17-20 Years	16	11.3
	21-24 Years	75	53.2
	24-27 Years	50	35.5
Education Level	Certificate	12	8.5
	Diploma	45	31.9
	Bachelor Degree	84	59.6
To what extent are you aware of the Industry Revolution 4.0 technology	Very Large Extent	0	0.0
	Large Extent	12	8.5
	Moderate Extent	30	21.3
	Little Extent	54	38.3
	Not Aware	45	31.9

Based on the Table 1 above, majority of the respondents were from IAA (53.2%) compared to (46.8%) and majority of the respondents were female (57.4%). Again, majority of respondents (53.2) were at the aged 21 to 24 years old. The highest education level attained by different respondents was also of interest in the study. The table above shows that majority of the respondents (59.6%) had bachelor degree. However, results showed that, graduates were aware to the Industry Revolution 4.0 technology

to the little extent. This implies that the, IR 4.0 technology is still new concept to the majority of Tanzanian graduates.

Correlation Analysis

The correlation coefficient is measured on a scale that varies from +1 through 0 to -1. According to Schober (2018), correlation coefficients, whose magnitude are between 0.71 and 0.10, indicate that the variables are strong correlated and 0.51 to 0.70 indicate that the variables are moderately correlated while 0.1 to 0.5 indicate that the variables have a weak correlation. The table below shows the relationship between variables of this study:

Table 2: Correlations

Variables		IR 4.0 Technology
Graduate Skillsets	Service Orientation	.241
	Negotiation	.240
	Creativity	.238
	People Management	.238
	Judgment and Decision Making	.237
	Emotional Intelligence	.231
	Critical Thinking	.230
	Cognitive Flexibility	.227
	Complex Problem Solving	.221
	Digital Literacy	.201

The table above shows the correlations among the variables. The results show that IR4.0 technology was consistently associated with service orientation (0.241) and negotiation (0.240). More frequent positive effect on creativity (0.238), people management (0.238), also, judgment and decision making (0.237), emotional intelligence (0.231) and critical thinking (0.230). Either, less common effect on cognitive flexibility (0.227) and complex problem solving (0.221) as well as digital literacy (0.201). This implies that graduates' skillsets were weak but positive towards IR 4.0 technology.

Regression Analysis

Regression analysis is a reliable method of identifying which variables have impact on a topic of interest. Findings on regression analysis are shown below:

Table 3: Regression Output

Model Summary					
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**	**Durbin-Watson**
1	.729[a]	.662	.658	1.93065	.338

ANOVA						
Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
1	Regression	306.59	3	135.53	98.46	.000[b]
	Residual	208.73	137	3.72		
	Total	515.32	140			

Coefficients						
Model		**Unstandardized Coefficients**		**Standardized Coefficients Beta**	**t**	**Sig.**
		B	**Std. Error**			
1	(Constant)	.117	2.145		8.241	.000
	People Management	.102	.758	.125	9.123	.000
	Complex Problem Solving	.068	.245	.214	3.985	.002
	Service Orientation	.081	.048	.603	9.377	.000
	Negotiation	.090	.152	.233	2.247	.029
	Creativity	.091	.100	.425	1.477	.011
	Judgment and Decision Making	.087	.143	.402	4.661	.014
	Critical Thinking	.098	.152	.233	2.247	.029
	Digital Literacy	.102	.214	.214	3.457	.011
	Emotional Intelligence	.085	.235	.233	9.564	.034
	Cognitive Flexibility	.077	.075	.327	3.550	.001

According to the table above, the R Square, or coefficient of determination, is .662, which is the square of the multiple correlation coefficients. It demonstrates that independent variables (graduates' skillsets) explains 66.2% of the variation in the dependent variable (IR 4.0 technology). This suggests that additional factors not investigated in this study account for 33.8% of the variation in the dependent variable. Furthermore, the statistic for Durbin Watson was discovered to be 0.338, which is within an acceptable range. This implies that there is no association with serial mistakes, implying that the model was adequately represented. According to the table above, the significance value (P value) for ANOVA was 0.000, which is less than 0.05. As a result, the variables in this study are positively associated because, at the 5% level of significance and 95% confidence level, the significant value (P value) in the ANOVA and coefficient regression ranges between P 0.000-0.05. On the coefficients, the results of the analysis show that all variables give positive effect and significantly predict the IR 4.0 Technology.

5. Results and Discussion

The IR 4.0 is redefining not just the industrial environment, but also the knowledge and skills required by plenty of industrial sectors. In order to address the new problems posed by IR 4.0. Automation, cloud technology, Internet of Things (IoT), big data, and augmented reality are all part of the industrial scene. This new type of industry revolution has necessitated the availability of skilled workers who are knowledgeable and capable of dealing with simulation and virtual reality, vertical and horizontal system integration, the IoT industry, cyber security, cloud computing, add-on manufacturing, supply chain, data

analysis, and robot automation. Findings showed that graduates had relatively weak skills towards Industrial Revolution 4.0 technology. This is backed by the Trait and Factor Theory of Career Choice and Development, which states that most graduates encounter unemployment owing to a mismatch between their capabilities and labor market needs. The findings are also congruent with those of Sharita et al. (2018), who discovered that students' expertise toward IR 4.0 is inadequate. This is because students are unlikely to be acclimated to using IR 4.0 technology during teaching and learning sessions (T&L) in class or in everyday life. In the same vein, Tanius (2020) said that graduates lacked understanding on how to use IR 4.0 technology, while Quaratul (2020) claimed that Malaysian graduates lacked knowledge of how to operate in an IR 4.0 setting. Similarly, Ismail (2020) discovered that students' knowledge toward IR 4.0 was limited, despite their strong enthusiasm, attitudes, and willingness to cope with IR 4.0. According to Tapper (2021), graduates who can transfer critical thinking abilities to workplaces would be sought for by companies in order to enter a professional workplace in the business. As a result, critical thinking that leads to issue solutions is vital. To improve Tanzanian graduates' skill sets, links between universities and industry are required to strengthen the vision of the Industry Revolutionary, such as creating "Smart Factories" in order to further enhance the workforce's skills and qualifications, which is critical to the success of innovative industries. It is critical to pay attention to graduate skill sets since they act as a predictor of graduates' potential in terms of IR 4.0 technology. As a result, establishing adequate skillsets in Tanzanian graduates should be prioritized in order to prepare them to match IR 4.0 job demands.

6. Conclusion

This study concludes that Tanzanian graduates have weak skillsets towards Industrial Revolution 4.0 technology. The Industrial Revolution is distinguished by the convergence of digitalization and automation in order to make machines smart, interactive, and simple to operate. These new technologies will become an integral part of our lives and will have a significant influence on how we work. New types of robots that can interact with humans will emerge. HLIs and the Tanzanian government must also offer students with vital skills related to IR 4.0 technology. To raise student knowledge and commitment, they should offer different initiatives of exposure activities to these advances, such as courses, seminars, and forums. Students should be exposed to the IR 4.0 technology's operating, virtualization, decentralization, real-time capabilities, service orientation, and modularity design ideas. Furthermore, the Tanzanian Ministry of Education Science and Technology should analyse and reorganize existing program curriculum in order to produce graduates who are more knowledgeable, capable, and conversant with IR 4.0 technology. Government and industry sector should work together to improve academics' knowledge and abilities connected to IR 4.0 technology, allowing them to educate students effectively for the sake of modern industrial growth. Moreover, similar studies should be conducted, but this time the focus should be on the employees' skillsets towards IR 4.0 technology.

Abbreviations and Acronyms

IR - Industrial Revolution
ANOVA - Analysis of Variance
IAA - Institute of Accountancy Arusha
IoT - Internet of Things
SPSS - Statistical Package for Social Science
HLI - Higher Learning Institutions

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