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A Framework to Enhance the International Competitive Advantage of Information Technology Graduates

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ABSTRACT

The main objective of any educational institution is to provide its students with the best educational knowledge and experience so, they can be employed to meet the labor market demands. Due to the rapidly changing in the technology industry and the expanding need for information technology (IT) professionals. The mismatch between IT graduates and the needs of the labor market leads to their inability to employ and job misplacement. Therefore, this paper aims to identify the most significant factors affecting IT graduates' employability and their ability to compete in the local, regional, and international labor markets through a detailed literature review and by conducting two surveys, one for IT graduates and the other for IT employers. Then, data were collected and analyzed by Statistical Package for Social Sciences (SPSS) 28.0 to build our proposed framework which will integrate all factors and parties involved to enhance graduates' employability to match the labor market demands. The proposed model will assist all parties in improving their plans for producing graduates who are skilled, knowledgeable, and meet the labor market demands.

Keywords: IT Graduates; Employability; Higher education; Labor market

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1. INTRODUCTION

The employability of graduates and their suitability to the needs of the labor market is a global issue due to the increasing number of graduates produced by higher education institutions (HEIs) each year. Especially information technology (IT) graduates due to the rapid progress in technology [1]. IT is a rapidly expanding field with numerous job opportunities. As a result, employment in computer and information technology occupations is predicted to rise 13% faster than the average for all professions between 2020 and 2030 in the current job market [2]. Higher education's role in preparing students for the workforce and providing them with the relevant job skills and knowledge is a mounting concern for families, students, and policymakers who make decisions about the alignment between the labor market and HEIs output [3]. Therefore, HEIs are always challenged to keep their courses and curricula current with new and evolving technological changes in the field while also remaining relevant to the business community. Skill mismatch is defined as an imbalance between labor market requirements and the quality of human resources produced by HEIs. Because the productivity of graduates who are qualified to meet the demands of the labor market is the key measure by which higher education institutions can assess their success. HEIs must reconsider their positions in the evolving IT industry [4],[5].

Meanwhile, in today's highly competitive and modern global labor market, this concern will transition into the employability phase [6]. So, unemployment among IT graduates is a major problem that may be due to the mismatch between HEIs' outputs and employers' expectations [3],[7]. Teaching and learning are processes in which students gain attitudes, behaviours, new knowledge, and skills that will help them achieve their goals such as getting a job in a company [8]. This paper aims to identify the most significant factors affecting IT graduates' employability to match the labor market demands and enhance their competitive advantage to compete in the local, regional, and international markets, as well as determine the in-demanded skills in the IT job market, which can greatly help understand the extent to which IT graduates were prepared for these highly technical careers to enter the IT workforce and shed the lights on all parties involved in the process of transition from university to the job market and their roles through introduced proposed framework. So, this research tests five hypotheses as follows:

H1: The IT graduates' competencies affect their employability in the labor market.

H2: Practical training has a positive effect on the employability of IT graduates.

H3: HEIs play a positive role in the development plan according to their strategic plan and curricula.

H4: The employability of IT graduates is influenced by the English language.

H5: The IT graduates' soft skills affect their employability to match labor market demands.

The remaining of this paper is organized as follows: Section 2 presents the literature review. Section 3 describes the research methodology. Section 4 discusses the results and Section 5 presents the conclusion and the future work.

2. RELATED WORK

Enhancing the employability of graduates is a key role in the success of any educational institution enabling them to compete in the global market [9]. Many researchers have attempted to identify the most important factors influencing graduates' employability and the factors causing the mismatch between the labor market and the outputs of higher education systems. To generate preliminary ideas about the significant factors. We divided this section

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into two sections as follows: 1. Presents the labor market factors that influence employability and the employers' demands. 2. Discusses the significant factors of higher education institutions in enhancing the employability of graduates.

2.1 Labor market

Employers are increasingly looking for employees who can add value to a variety of work environments in their company [10]. In [11] argued the impact of university graduates with STEM degrees (Science, Technology, Engineering, and Mathematics) earning the highest pay premiums. In this sense, a mismatch between supply and demand can result in significant imbalances that have far-reaching consequences for both individuals and the country. The authors in [12] demonstrated that unemployment was caused by the quality of graduates rather than a lack of job opportunities and having good grades did not guarantee employment for recent graduates. The graduates must be fluent in English and possess other soft skills.

In [13] the authors explained that ICT graduates at all levels of qualification struggle to get vacancies due to socioeconomic problems and work experience, namely a lack of soft and hard skills and business skills. In [14] attempted to prove that the competency gap could be considered a deficit in the quality of education. The greatest gap was in critical thinking and problem-solving. In [15] showed that demographic factors were found to have a statistically significant relationship with whether graduates could obtain full-time or part-time work. [16] investigated the impact of sourcing initiatives in HEIs, specifically on graduates' employability. According to the findings, impact sourcing may improve future graduates' technical and soft skills by enhancing their employability in the global business services market.

In [17] presented that skilled IT graduates have a better chance of being hired because they have specific expertise and can accomplish a task more effectively than those who did not possess any skills. The author in [18] illustrated how a lack of communication between HEIs and industry results in a student who does not match the wants and needs of the employers. To obtain jobs in the global competitive market, students must attend specific training. So, universities and industries must engage in conducting internships to provide students with relevant work experience. In [10] the authors identified the gap between employers' expectations and assessments of higher education graduates' enterprise capabilities driving university curriculum renewal to combine work-integrated learning (WIL). Also, in [3] the authors indicated that to increase graduate employability, universities must engage with labor market businesses.

In [5] investigated that there is poor communication between the labor market and HEIs, this mismatch is driven by both the demand and supply sides. The labor market is also affected by economic conditions. In [19] the authors demonstrated the significance of vocational education and that the rate of youth unemployment is reduced by the rate and the structure of employment, the demographic structure of the region, and the level of economic development of the region. In [20] the authors investigated the relationship between internships and graduate labor market performance, as well as how internship experience assists in entering the job market. the results showed that attending an internship increased the speed of finding a job as graduates continue in the same firm after the internship ends. Through internships, students can gain practical experience and exposure to both technical and general skills so these internships must be evaluated and analyzed. In [21] examined IT internship postings to see how well the expected outcomes corresponded to professional standards for IT programs years.

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The authors in [22] analyzed how participating in an internship during college increases graduates' earnings, and mandatory internships should be included in university curricula because they improve educational quality. [23] observed that gender, IT core subjects, and IT Professional Subjects have a direct impact on whether IT graduates will work in an IT-related field or not. Graduates' English communication skills, as well as their social and human relationship skills, are also important factors in their employability. In [24] the authors analyzed the job market demands for IT professions which are highly demanded today and developed an educational program that will help the students acquire the needed skills in the job market.

2.2 Higher education factors

The authors in [25] identified that interpersonal skills such as the ability to convey an idea, communication skills, state of the body, and the state of active mind are the most important factors predicting the students' employability. In [5] indicated that family background has the greatest impact on the mismatch between the supply and demand side. Furthermore, pre-college experiences are required to determine how college students' expressed interest in a computing career changes over time.

The authors in [26] revealed that after taking the introductory course, 53.5 percent of students expressed an interest in a career in computing. In [27] indicated that scholastic achievement admission test score is the most reliable predictor of future student performance among pre-admission criteria. Therefore, career development is being integrated into an undergraduate IT curriculum by [28] to assist students in developing their career interests and navigating the changing labor market.

Several researchers in [12], [13], [17],[29],[30] implied that soft and technical skills are crucial factors affecting IT graduates' employability and the lack of these skills causes a discrepancy between industry required skills and the skills acquired by students through their learning process. Also, [31],[32] stated the importance of soft skills, especially for technical fields as they focus on technical skills and lack those soft skills.

In [33] the authors investigated the effect of a voluntary intra-curricular internship while studying at university on one's chances of getting a job interview. According to the findings, applicants with internship experience have a 12.6% higher chance of being invited to a job interview than those without internship experience. In [34] demonstrated that co-curricular activities have been shown to have an impact on the academic performance of students because they are an important part of educational institutions' efforts to assist students in developing their personalities and improving classroom learning.

The authors [35] indicated that personal qualities are an important factor, and universities should develop curricula and training as they are one of the positive indicators of the employers' interests. In [2] discussed the dynamically changing in today's technology which leads to equip every computer science (CS) student with the foundational knowledge and practical experience, so a higher education institution should integrate these topics and skills into the curricula. And must adjust their courses to fit the employers' demands [1].

3. METHODOLOGY

To achieve the main research objective, which is the identification of the most significant factors affecting IT graduates' employability to match the labor market requirements to fill the gap between HEIs output and labor market demands. Research methodology is divided into three phases as shown in figure 1 for phase 1, a detailed literature review was conducted to identify the most significant factors that researchers focused on to predict the graduate's employability and labor market demands. In phase 2, two electronic surveys were

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developed, one for IT graduates to assess the quality of higher education and their academic achievements and the other for IT employers to assess the quality of fresh graduates and to determine the in-demand skills needed in the job market that fresh graduates must possess. Then, in phase 3, we built our proposed framework to integrate all factors and parties involved in enhancing the IT graduates' employability to match the labor market demands.

3.1 Relevant factors (Phase 1)

To identify the factors affecting the IT graduate's employability to match the labor market requirements, some previous studies related to the subject of the research have been reviewed and discussed by using different sources, such as Science Direct (accessed on 1 February 2022)), Google Scholar (accessed on 1 February 2022)), IEEE Explore (accessed on 1 February 2022)), Elsevier (accessed on 1 February 2022)) and Research Gate (accessed on 1 February 2022)). As shown in Table 1, several employability factors were identified.

3.2 Survey (Phase 2)

To determine the importance of the identified factors from IT graduates' and employers' perspectives, A survey was developed, because the use of IT graduates feedback questionnaires evaluates teaching performance and quality also it is an effective way to collect data from a huge sample geographically located in different places. Data were collected from 20 companies in the field of information technology and 296 IT graduates including (Computers & Artificial intelligence, Business information systems, Software Engineering, and Management information systems) for a period from 2010 until 2021 through a google form consisting of several sections formulated to identify the importance of each factor during Step 1. The participants' responses were based on their experience gained during their work.

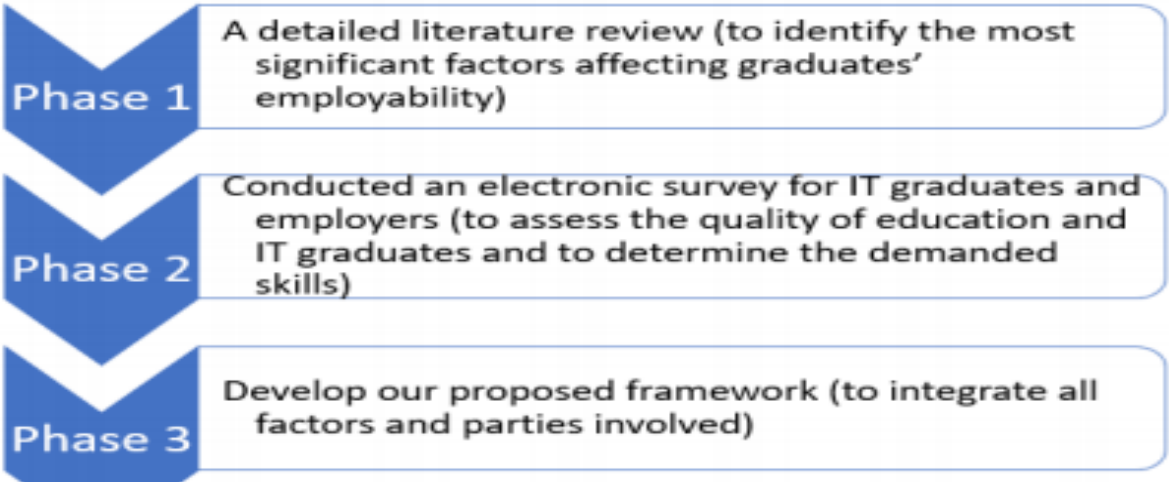

Figure 1. The research methodology

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Table 1. The Relevant factors based on the previous studies

Factors	Description	Frequency	References
Demographic	Socioeconomic characteristics	6	[5],[9],[13],[15],[19],[23]
Interpersonal skills	How the individual interacts with others.	6	[17],[18],[25],[27],[34],[35]
Soft skills	Personal traits that improve an individual's ability to complete tasks.	12	[1],[10],[12-14],[16],[19],[25],[29-32]
Technical skills	Knowledge and experience are required in real-world circumstances to complete certain tasks and use specific tools and programs.	11	[3],[4],[12],[13],[16-18],[21],[24] [29],[30]
Good English command	Being able to express appropriately in English, including basic knowledge, grammar, and sentence structure.	2	[12],[14]
Work-Integrated-Learning	Educational activities that combine academic study with workplace practice.	5	[10],[13],[17],[21],[24]
Internship	Job-related training to be qualified to do specific tasks.	7	[1],[14],[18],[20],[22],[29],[33]
Extra-curricular activities	Activities to help students learn and improve their skills.	3	[14],[34],[35]
Curriculum	The course content offered by an educational institution.	10	[1],[2],[9],[10],[14],[18],[23],[28-30],[35]
Lack of communication between HEIs and the labor market	There is a discrepancy between what is needed and what is acquired.	6	[3],[4],[5],[9],[13],[18]
Economic conditions	The current condition of events in a country's or geographical region's entire economy.	6	[3],[9],[11],[12],[16],[19]

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3.3 Build our proposed framework (Phase 3)

Based on the previous two phases, we will build our proposed framework to integrate the most significant factors and all parties involved that will help enhance IT graduates' employability to compete in the local, regional, and international labor markets to fill the gap between higher education outputs and labor market demands and to build new competencies for educating, training, and reskilling the current students and future graduates according to labor market changes. All these factors integrated can contribute to increasing graduates' employability to be qualified with the appropriate knowledge and job skills to match the labor market demands, as will be discussed in figure. 6.

4. RESULTS AND DISCUSSION

The findings related to the previously discussed steps are presented below.

4.1 Relevant factors (Phase 1)

The findings related to the factors influencing graduates' employability based on our analysis of the detailed literature review are described as follows in table 1.

4.2 Survey analysis (Phase 2)

After we collected the questionnaire data from IT graduates & employers, we used SPSS 28.0 to analyze the collected data. Table 2 illustrates the graduates' background. Then, table 3 explains our findings on the most significant factors affecting their employability.

Table 2. IT Graduates' background

	N	%	Total
Q1: Gender			296
Male	131	44.26	
Female	165	55.74	
Q2: Age			
21-23	92	31.08	
24-26	157	53.04	
27-29	29	9.80	
30-32	10	3.38	
33-35	8	2.70	
Q3: Year of Graduation			
2021-2019	221	74.66	
2018-2016	51	17.23	
2015-2013	13	4.39	
2012-2010	11	3.72	
Below 2010	-	-	
Q4: Work Field?			
IT Sector	80	27.03	
Banking Sector (IT field)	18	6.08	
Banking Sector (Business field)	57	19.25	
Business Sector	113	38.18	
Teaching Field	28	9.46	
Q5: Reasons for joining the IT Program?			
High School Scores	54	18.24	
Interested in IT field	109	36.82	
Social Media	2	0.67	
Based on Family or Friends recommendations	124	41.90	
Other	7	2.37	

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Table 3. The data analysis of the most important factors through the conducted survey

		N=296	
No.	**Factors**	**Mean**	**SD**
1	**Soft skills**		
	-Teamwork	0.77	0.42
	-Communication skills	0.70	0.46
	-Problem-solving	0.50	0.50
	-Creative thinking	0.36	0.48
	-Time management	0.49	0.50
2	**English language**	0.49	0.50
3	**Applied/Technical skills**		
	-Programming Languages	0.59	0.49
	-Databases	0.66	0.47
	-Data Security	0.49	0.50
	-Network Security	0.54	0.50
	-Web Development	0.58	0.49
	-System Analysis & Design	0.60	0.49
4	**Demanded skills**		
	-Machine Learning (ML)	0.12	0.33
	-Data Science	0.25	0.43
	-Data Analytics	0.42	0.49
	-Internet of Things (IoT)	0.26	0.44
	-Artificial intelligence (AI)	0.17	0.37
	-Cloud computing	0.19	0.39
	-Cybersecurity	0.19	0.39
5	**Curriculum**	1.06	0.91
6	**Internship**	1.64	0.71
7	**Workshops**	0.34	0.47
8	**Summer training**	0.60	0.49
9	**Need additional courses**	0.82	0.38
10	**Qualified or not**	0.32	0.47

The survey is consisting of several sections as follows:

Section1: showed a general profile of the IT graduates. Descriptive analysis was performed to better understand the graduates' backgrounds. Such as gender, age, year of graduation, work field, and their initiative to join the IT program. (44.26%) of the graduates were males and (55.74%) were females. The majority of the graduates' respondents were aged between 24-26 years old (53.04%) and the year of graduation from 2021-2019 (74.66%). Accordingly, the responses indicated that most of the IT graduate's professions fall into the business field (38.18%). Only (27.03%) are related to the IT field and (6.08%) are in the banking sector (IT Department). Finally, the reason for joining the IT Program is (41.90%) based on family or friends' recommendations to enter the IT program followed by (36.82%) based on their interests in the IT field.

Section2: showed what kind of soft skills IT graduates lack and have not been

adequately trained on during their college studies in the IT program. The graduates agreed on creative thinking, time management, and English language skills followed by problem-solving skills. (Factors 1&2) so, there is a positively relationship between soft skills and English language of the IT graduates and their employability to match labor market.

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Section3: identified what technical/applied skills the graduates lack sufficient practice in during their college studies in the IT program. Most of the respondents agreed that data security and network security do not have sufficient practical applications. (Factor 3) therefore, the IT graduates' employability is positively influenced by their competencies.

Section4: aimed to determine graduates' knowledge of the most in-demand topics in today's global job markets, and whether they had studied or applied any of these topics during their college studies in the IT program. Most of the graduates agreed they do not have been trained about these topics whether in their curriculum or their lab work. (Factor 4) so, the HEIs' curricula have a negative effect on IT graduates' employability.

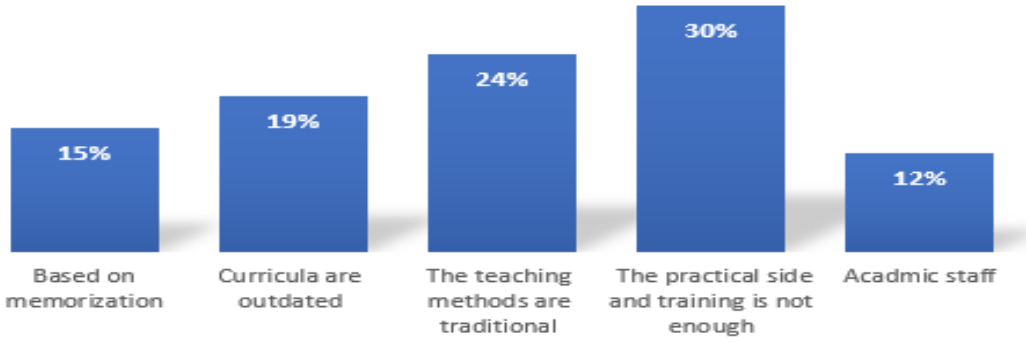

Figure 2. The weakness points in the teaching methods from graduates' perspective

Section5: discussed the weakness points in the teaching methods during the graduates' years of study. Based on their responses, figure 2 showed that attention to the practical side and training is not enough which is considered the crucial factor the IT graduates lacked followed by the traditional methods of teaching which do not depend on modern technologies in addition the curricula are outdated and do not coupe with recent developments in IT field. Also, they said that the academic staff used traditional methods and do not have adequate knowledge of the recent technologies to provide them with the appropriate skills. (Factors 3,5,6,7 & 8)

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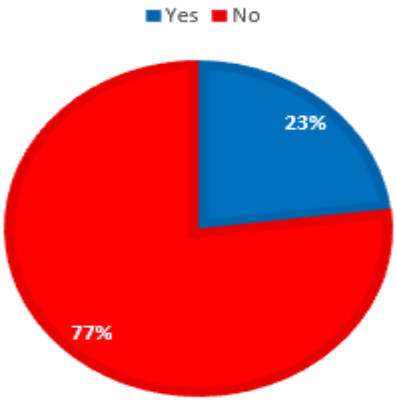

Figure 3. Qualified or not

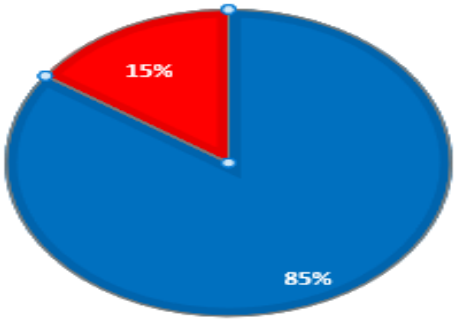

Figure 4. Additional training

Section6: explored whether there is a job mismatch between the higher education institutions' output and the labor market demands based on IT graduates' professions to find out the extent to which the job mismatch and the unemployment among IT graduates. (67.6%) said that they were not qualified to enter the job market after their graduation immediately and they need additional training before applying for a job (82.1%). Most of the respondents said that the college does not conduct any internship or a workshop (77.7%), only (8.8%) attended an internship, and (13.5%) said that an internship does not add value and needs to be evaluated. According to their responses, most of the faculties do summer training regularly and sometimes do workshops. (Factors 6,7,8,9 &10). Therefore, the IT

graduates' employability is positively affected by practical training, the graduate who had training can be more employable to get a job offer than others.

Finally, according to their recommendations for future IT graduates to be able to compete in the international job markets to be knowledgeable of new and recent developments in the IT field (30%) and use different communication techniques (19%). in addition, the universities should increase the hours allocated for practical applications (27%) and establish more job fairs (26%) to assist future graduates in entering the labor market. On the other side, based on the employers' survey figure 3 shows their responses according to Q: Are IT graduates qualified to be employable immediately after graduation? (77%) said that fresh IT graduates are not qualified after graduation immediately due to a lack of employability skills to be employable in the dynamic labor market. As a result, in figure 4 they stated that (85%) of IT graduates need additional training before being employed. Accordingly, this will cost any organization a significant amount of time, money, and efforts.

Figure 5 showed what skills IT graduates currently lack from the employers' perspective. As shown below the applied skills along with IT graduates' knowledge of new and recent developments in the field are the most critical (36%) followed by English language skills (16%).

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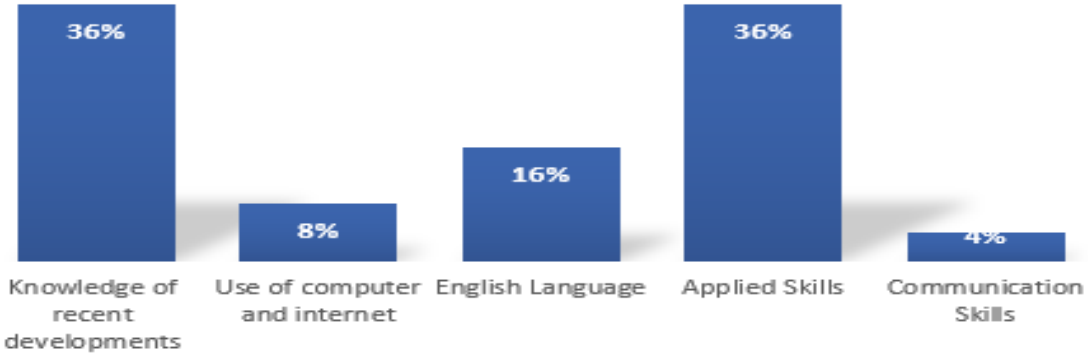

Figure 5. The lack of skills from employers' perspectives

Figure 6 illustrates the highly needed skills in the job market from IT employers' perspective. Most of them indicated that IT graduates have poor practice skills (93%) in addition to technical skills (88%), which may be lacking due to poor communication between HEIs and IT companies. Also, they are lacking soft skills such as creative thinking, problem-solving, and communication skills. Furthermore, the demanded skills in today's global market such as machine learning (ML), artificial intelligence (AI), internet of things (IoT), and data analytics.

So, we can reject the H0. All these factors contribute to the development of our proposed framework, which will be discussed in the following step.

4.3 The proposed framework (Phase 3)

Based on our analysis of the previous two steps, we identified the most significant factors influencing the mismatch between labor market requirements and graduate employability. Many researchers have attempted to combine all these factors but have focused only on one or a few of them. Our proposed framework figure 7 integrates all these factors to shed the light on all parties involved and their roles, starting with the student's admission to the educational institution program and concluding with how qualified the graduates will be to match the labor markets.

Enhancing employability and graduate qualifications is a joint responsibility shared by policymakers, HEIs, the labor market, and students. **Students** applying to a higher education institution seek to acquire the necessary knowledge and skills to be employable.

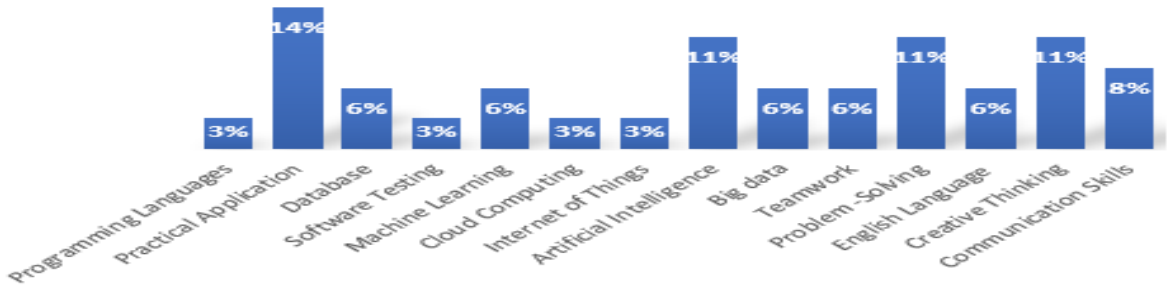

Figure 6. The highly demanded skills from employers' perspectives

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Firstly, the students should take an aptitude test. If passed, the students will undertake an interview. During this interview, **HEIs** should observe the students' demographics and characteristics such as gender, age, manner of speaking, a way of expressing or thinking about something, Physical condition means the state of the body, mental readiness refers to the state of the mind's attention, their ability to present ideas simply, oral, and written communications, and their level of the English proficiency because all courses in these colleges are conducted in English. Once accepted based on the overall evaluation foundation for a higher education institution.

Since the IT field depends on competency-based rather than theoretically based therefore, to combine academic study with workplace practice HEIs must give attention to (training & development) practical aspects such as lab work, workshops, and internships. More grades should be assigned to them so, students can immerse themselves in a practical project. Accordingly, a big part of the grades will be assigned based on their practical project to ensure their application. Also, there should be proper and specific summer training given to students that enable them to acquire the appropriate skills & knowledge to attain jobs in the local, regional, and international markets. Due to the high demand for IT professions, the IT curricula must be updated on an annual basis to keep up with the rapid evolution of the field. Furthermore, academic staff is the prime mover of the educational wheel, must be assessed and trained continuously to provide students with new and recent knowledge and experience in the field of specialization, and students should be given support services for career development and guidance.

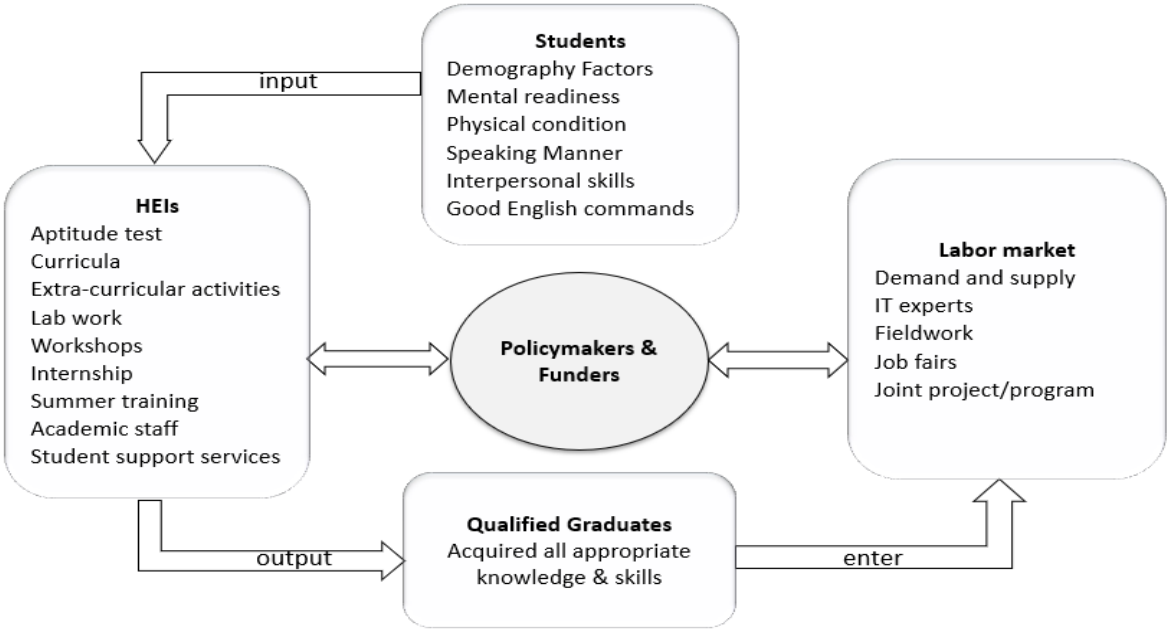

Figure 7. Integrated framework for enhancing the IT graduates' employability to match the labor market demands

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The **labor market** role is affected by demand and supply factors due to the dynamically change in the IT field. Experts from both private and public companies should participate in the university-to-work transition process to equip IT students with work experience through participation in curriculum development and planning work-integrated learning (WIL),
internships, workshops
and inviting them to advise IT students and provide them with the necessary skills which employers desperately need. Also, creating job fairs for career development and awareness for students to offer them job opportunities, ensuring a good match between supply and demand. Because the disparity between an increasing number of graduates and fewer job opportunities is disastrous for the country's economic growth. This situation also results in resource waste.

As a result, the **policymakers and funders** should increase efforts to enforce policy in the form of legislation or rules on both the HEIs and the labor market sectors in order to collaborate with each other more efficiently to meet their needs through joint programs with HEIs and so on. As Higher education institutions must be in line with the rapid development of the IT industry to fill the gap between them.

Finally, integrating all these factors will lead to the entry of qualified graduates with the appropriate knowledge and skills into the labor market to conduct all the activities necessary to raise the standard of living and increase economic growth. So, the proposed model will assist all parties in improving their long-term plans for producing IT graduates who are skilled, knowledgeable, and meet the labor market demands. Also, the findings of the questionnaire implied that to produce qualified IT graduates, match the labor market requirements, the HEIs and labor market sectors must collaborate as both are the main players in this process, pointing to a series of key steps in the process starting by joining the IT student the program to becoming fully operational graduate in the workplace. In the next chapter, we will use the most significant factors affecting graduates' employability to develop the machine learning prediction model to predict IT graduates' employability.

So, the results of the hypotheses tests are:

-There is a positively relationship between soft skills of the IT graduates and their employability to match labor market.

-The IT graduates' employability is positively influenced by their competencies.

-The IT employability is positively influenced by English. Language.

-The HEIs' curricula have a negative effect on IT graduates' employability.

-The IT graduates' employability is positively affected by practical training, the graduate who had training can be more employable to get a job offer than others.

5. CONCLUSIONS AND FUTURE WORK

Higher education institutions (HEIs) produce an increasing number of graduates each year. The employability of information technology (IT) graduates to meet the labor market demands remains a global concern. Due to the rapidly changing IT job market, fresh IT graduates are having difficulty entering the workforce. So, the main objective of any educational intuition is preparing distinguished and competitive graduates to have the appropriate knowledge and skills required to compete in local, regional, and international labor market needs to fill the gap between higher education outputs and labor market demands. This study was conducted in a methodical way to propose a framework for enhancing IT graduates' employability and competitive advantage. The most significant factors affecting IT graduates' employability were firstly identified through a detailed literature review followed by conducted two surveys, one for IT graduates to assess the quality of higher education and their academic achievements and the other for IT employers to assess the

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quality of fresh graduates and to determine the in-demand skills needed in the job market. Then, data were collected and analyzed by using Statistical Package for Social Sciences (SPSS) 28.0 software. Finally, built our proposed framework to integrate all factors and parties involved in enhancing the IT graduates' employability to match the labor market demands. The proposed model will assist all parties in improving their plans for producing graduates who are skilled, knowledgeable, and meet the labor market demands. The findings of the study imply that to prepare qualified graduates that match the labor market requirements HEIs, and labor market sectors must collaborate as both are critical to this success, pointing to a series of key steps in the process from joining the IT study program to becoming a fully operational graduate in the workplace. In our future work, we will use the most significant factors affecting graduates' employability to develop our predictive model for predicting IT graduates' employability.

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