The Knowledge and Skills Gap of University IT Graduates in Jordan

Enterprise Survey Report

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EXECUTIVE SUMMARY

Covid-19 is having a profound and damaging impact on the global economy. Many countries are reporting dramatic rises in levels of unemployment. There is concern that these changes are having a disproportionate impact on young people. This report explores how these economic changes are impacting on graduate recruitment in many countries.

ELEGANT (www.elegant-project.eu) is an Erasmus+ project co-funded by the European Union aiming at enhancing university enterprise cooperation in order to improve the teaching and learning experience of students and enhance the employability of IT graduates. As part of its activities, a survey was developed to study current knowledge and skill gaps between companies' requirements and IT graduates acquired skills. Princess Sumaya University for Technology [PSUT] and the team from the University of Dubrovnik developed the questionnaire for this survey (see Appendix 1 for the Questionnaire). The Information Technology Association of Jordan (INT@J), using its list of ICT companies in Jordan, conducted the online survey, using Cognito forms, exported to Microsoft Excel, and processed using the Statistical Package for Social Sciences (SPSS). A sample of one hundred and six (106) companies were selected randomly almost all located in Jordan with 52% of them having been established after 2010. The survey was carried out during September, October, and November 2020, mostly with either the HR manager or a member of staff of his/her department accounting for 36.8% of respondents. Other respondents were either the CEO, General Manager or the owner of the company. Some features of companies in the sample were: more than 90% are located in Amman, 40% are partnerships, and 72% are domestically owned; around two-thirds of the sample consisted of small (5-20) and medium (21-100) sized companies; 78% of companies had hired university IT graduates in the past three years and these included companies in all size groups. Public announcements, recommendations from friends as well as graduates approach were the most frequent means of hiring IT graduates. 62% of the companies in the sample had offered internships to university IT students or graduates and had participated in university events.

Most importantly, 81% of companies in the sample maintained that there exists a gap between graduates' knowledge and skills and their own needs, this being a serious issue worth highlighting. Cloud computing, cybersecurity, AI and Telecommunication were areas in which companies felt IT graduates have deficiencies. 74% of companies consider that on-the-job training is important to closing the gap between required and acquired skills. All hiring procedures considered relevant factors for hiring decision made by companies' managers. Also, the contribution of IT graduates played a small part in developing the scope of success of companies they work for. This may simply reflect the fact that new graduates have significant knowledge and skill gaps at the beginning of their work and thus are not able to make more important contribution to their companies' activities. There is a good level of cooperation with local universities (51% of the sample) but corporation with foreign universities is very low (6%).

Most companies with previous experience of cooperation with universities, motivated mostly by mutual approaches, found this cooperation beneficial. From their experience, companies value the provision of scholarships and internships as good enhancers for employability.

Partial findings of this report were based on responses to call for evidence about the graduate labour market under Covid-19. Some respondents to the call were typically CEOs or heads of research from employer associations, senior higher education careers professionals or employers. All are offering a subjective, but informed, opinion on the situation. The key trends that emerged are as follows:

- Covid-19 matters everywhere and it matters to everyone. Even in Jordan which have, so far, successfully managed the outbreak and in other countries here there have been relatively some cases of Covid-19, employers have had to lockdown some of their activities in the short term and have concerns about the longer-term impacts.

- The graduate market mirrors problems in the wider economy. While IT graduates often escape the worst impacts of recessions, the size and health of the graduate labour market is tied up with the wider economy. The magnitude of the current crisis means that it is impacting on workers of all skill levels and is likely to be particularly difficult for those entering the labour market for the first time and those working in the sectors which are feeling the worst effects.

- IT-graduate recruitment volumes are down everywhere. During 2020 many employers have taken the decision to delay or reduce the number of IT graduates that they are recruiting. This has led to overall numbers of jobs in the formal IT-graduate labour market going into decline in all sectors that participated in this questionnaire.

- The IT-graduate market will not recover straight away.

- Uncertainty is the only thing that people are certain of. Respondents report a loss of certainty in normal narrative about how graduate transitions work. This uncertainty is making planning difficult.

-Working practices and business processes are changing and moving online. Within the IT-graduate recruitment field this means that both attraction (on campus activities) and selection (interviews and assessment centers) are either moving wholly online or into a blended format combining online and face-to-face approaches

INTRODUCTION

The ELEGANT Erasmus+ project (www.elegant-project.eu) co-funded by the European Union aims to enhance university enterprise cooperation in Jordan and Lebanon in order to improve the teaching and learning experience of students and enhance the employability of graduates. The project responds to the widely recognized problem that university graduates often lack the employability skills needed by employers and, in addition, their knowledge in the field of ICT is behind the state of the art and below that of companies they want to work in. The project involves upgrading and updating the capacities of University staff and improving the curricula of at least ten subjects in each university. Study periods to EU universities will be arranged to provide the updating and upgrading opportunities for Jordanian and Lebanese academic and technical staff during which they can improve their own knowledge of the latest developments in their subjects and also upgrade the curricula of their subjects. The upgrading of curricula consists of enhancing both the scientific and technical skills of students as well as their employability skills. EU universities have been engaged in serious discussions about graduate employability and partner country staff can learn a great deal from this experience and take steps to produce 'work ready' graduates. EU staff will support the upgrading of curricula and engage in teaching in Jordan and Lebanon institutions and help the internationalization agenda. The general objectives of the project are stimulating the development of an enterprise cooperation culture at partner universities, promoting the sharing of good practice for establishing university-based Enterprise Liaison Offices, and developing new forms of industry-oriented education in a number of Jordanian and Lebanese Universities, improving the ICT curricula and upgrading the capacities of academic and technical staff of partner universities, developing a coherent information and communication strategy for the University communities within the local business environment, and last but not least is developing a program strategy to support students to develop their master theses and internships with enterprises to enhance their employability. The expected results of ELEGANT project are establishment of a Universities-enterprises cooperation network, appointing of Liaison Officers and establishment of Liaison Offices in

partner universities, signing MOUs with enterprises, pilot implementation of the operations of the newly created Liaison Offices, providing

Student internships/placements in enterprises, starting student projects based in enterprises and mentored by staff of enterprises, enterprise staff participating in lectures at universities, upgrading the knowledge and capacities of teaching, technical and other staff of universities, raising public awareness and dissemination actions of project results throughout the project duration.

Project Consortium

ELEGANT project consortium consists of **4 European partners** (University of Dubrovnik – Croatia –as project coordinator-, Universita Politecnica Delle Marche – Italy, Staffordshire University – UK, and Psicoglobal Co. – Portugal), **4 Jordanian partners** (Princess Sumaya University for Technology, Jordan University for Science and Technology, The Information and Communications Technology Association of Jordan , and Al Balqa Applied University), and **3 Lebanese partners** (Modern University for Business and Science, Beirut Arab University, and Syndicate of Computer Sciences)

Work Packages

This project contains 6 main work packages as stated below:

WP1: Preparation

WP2: Implementation of new forms of industry-oriented education

WP3: Improving the human capacities of University staff and revise/upgrade the ICT Curricula in partner universities

WP4: Quality Control & Monitoring

WP5: Sustainability & Dissemination

WP6: Management of the project

METHODOLOGY

A Questionnaire with 29 questions was designed for the survey. The questions were broken down into 15 questions bearing single answers,7 bearing multiple answers and 7 questions bearing open-ended answers. Out of the single answer's questions, 10 were designed to bear Likert scales. The survey was conducted on line, supplemented by telephone calls. The data was processed on the Statistical Package for Social Sciences (SPSS). Both single and multiple answers were coded numerically into SPSS to ease findings depiction. Findings were mostly displayed in either tables or charts. Deployed charts were mostly bar and pie. Most of the study analysis exhibits descriptive and visual statistics with an exceptional inferential intervention at the level of measuring hiring against size of company.

This survey is designed to identify the gaps in the knowledge and skills of IT graduates with a view to improving their study programs and fostering successful employment. The survey also aims at identifying and assessing different forms of cooperation between universities and enterprises. We selected 106 companies randomly and sent them the questionnaire. As the number of returns was below 30% after three weeks, we contacted the companies by phone. Once the number of replies reached 106, we stopped further contact with companies. Hence the response rate accounted to 71.4%. 100 interviews were conducted partially by telephone and the provision of a survey link, the latter prevailing due to the second wave of COVID-19 pandemic. Face-to-Face interviews therefore had to be abandoned. Almost all contacted companies are located in Jordan with a majority of them based in Amman (90%). 72% of companies are owned domestically against 16% by foreign parties and 11% joint venture. 36% of respondents were either the HR manager or member of his/her staff while 56% were owners or CEOs.

DATA ANALYSIS AND FINDINGS

Sample Characteristics

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In this section various characteristics of the sample are discussed. To start with the location of companies, as shown in the figure below, 90% of companies in the sample were located in Amman, which is the most vibrant part of Jordan. 6% of companies were in governorates where the rest from outside Jordan.
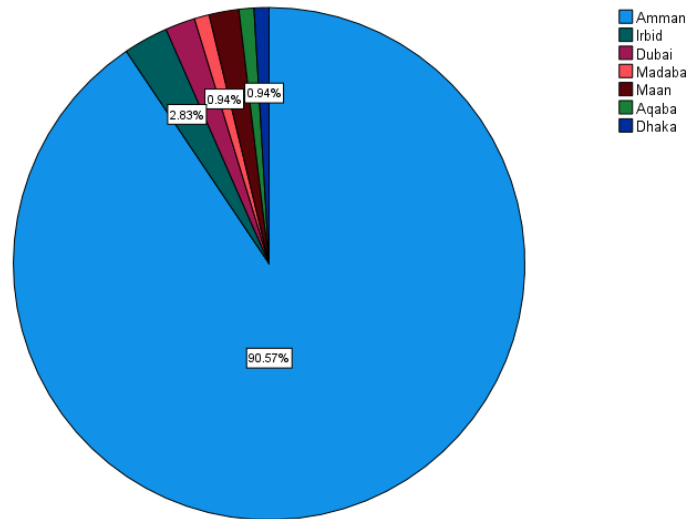
Figure 1-Location of company

In terms of legal form, 40.57% of companies in the sample were partnership while 22.64% were individual proprietorships.
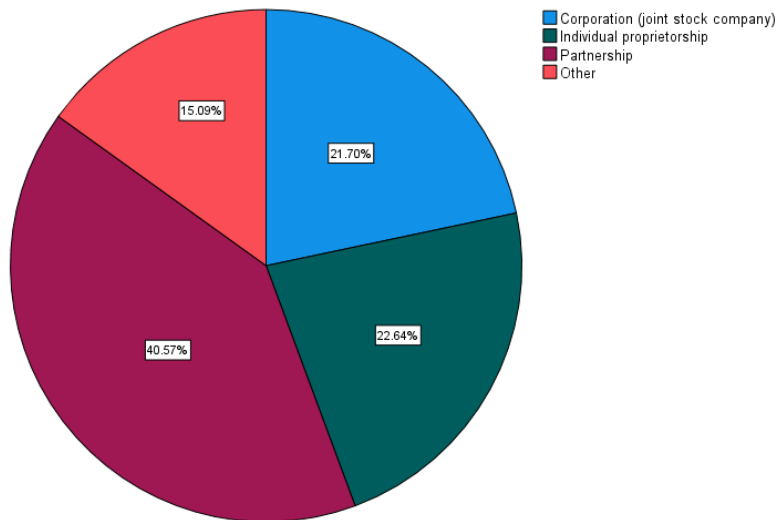
F igure 2- Legal

In terms of ownership, 73% of companies in the sample were domestically owned, which reflects the situation of the Jordanian economy that lost huge external investors during the current financial crisis. This is almost 3 times the percentage of foreign and joint venture companies.
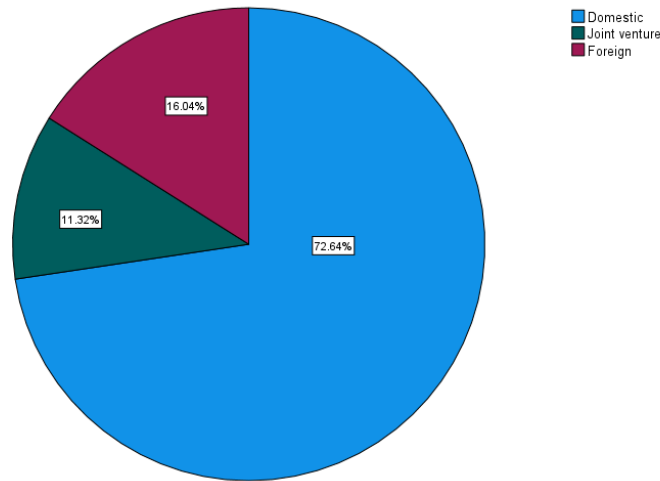
Sectoral Distribution of the Sample

The sample companies were dispersed over several sectors of activity spanning mostly IT/Digital (61%), Training/Education (23%), Services (12%), and Retail (4%). This reinforces the fact that the sample is representative by means of its diversity along this factor.
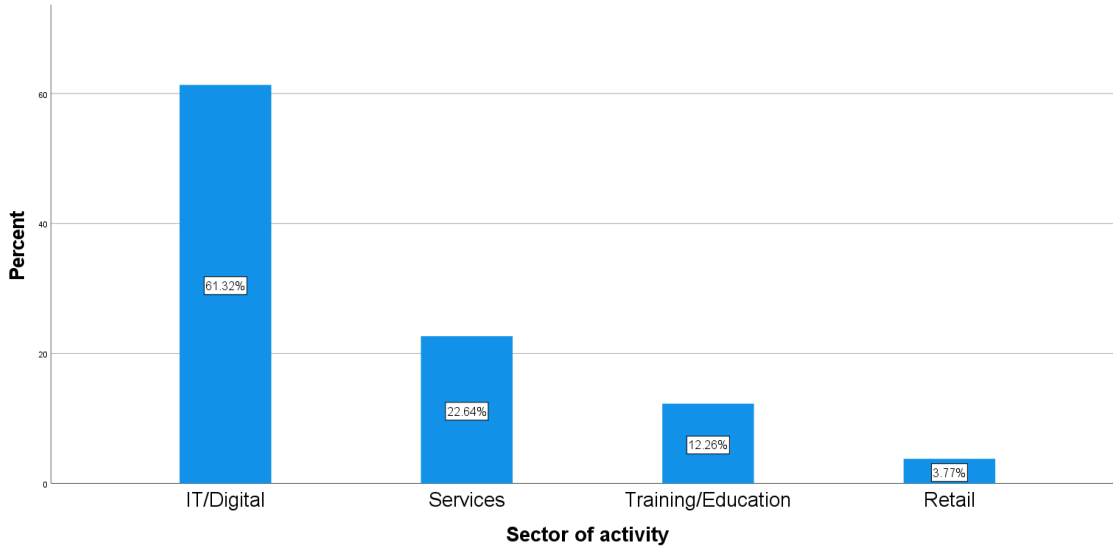
Figure 4-Sector Distribution

More than half of companies were established after 2010 (52%), which mean there is a lot of mature companies in the sample.
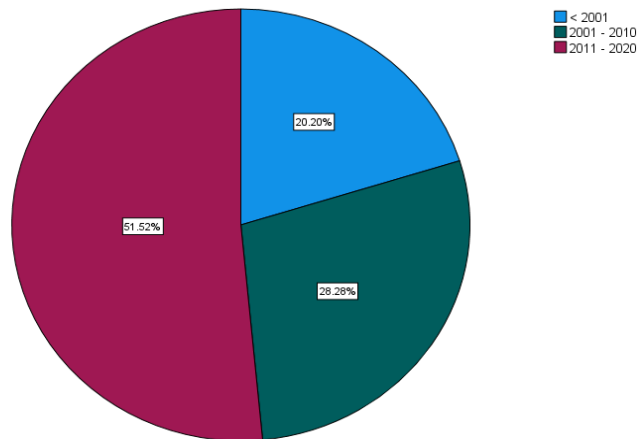
Figure 5-Date of Establishment

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Size Distribution of the Sample

Companies were randomly selected between micro, small, medium, and large companies from different sectors of the economy.
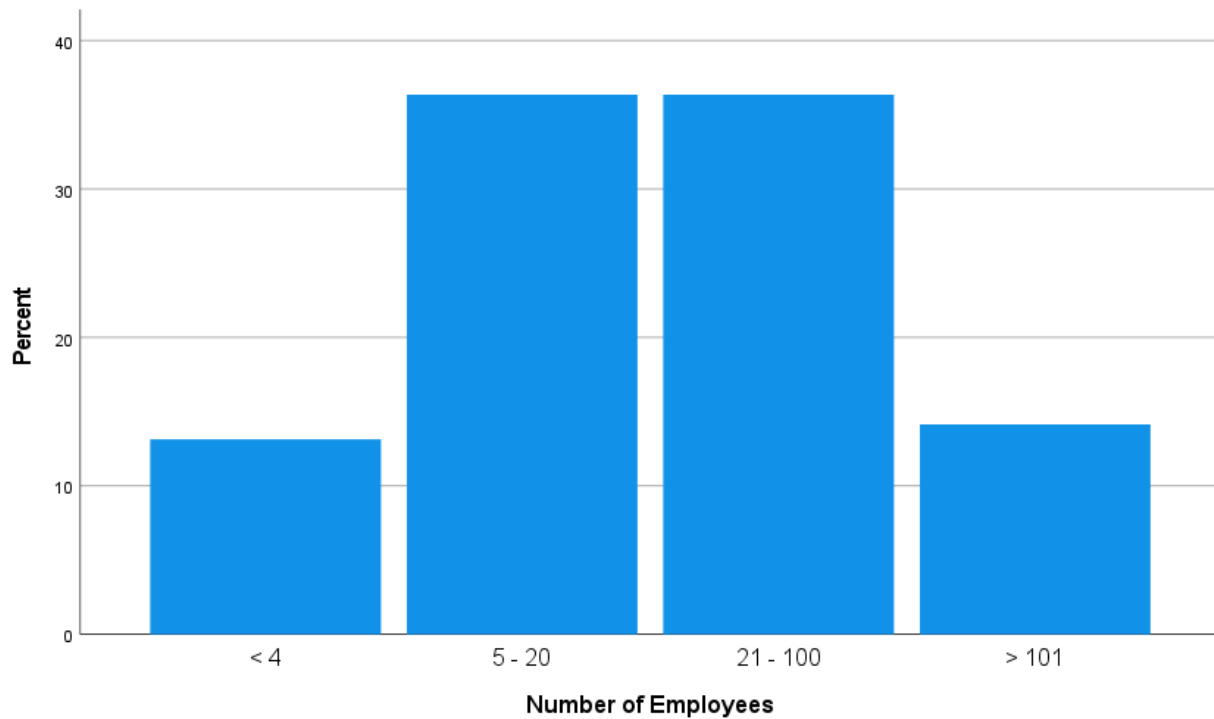
Figure 6-Number of employees in enterprises in the sample

Companies have been subdivided into four size categories. Micro enterprises employ less than 5 employees; small enterprises employ 5 to 20; medium enterprises from 21 to 100 and large enterprises from 101 and above. Almost two-thirds of the sample were made up of small and medium enterprises.

Table 1- Enterprise size distributio

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	< 4	13	12.3	13.1	13.1
	5 - 20	36	34.0	36.4	49.5
	21 - 100	36	34.0	36.4	85.9
	> 101	14	13.2	14.1	100.0
	Total	99	93.4	100.0	
Missing		7	6.6		
Total		106	100.0		

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<u>Company Size and Employment of IT Graduates</u>

Less than 10% of all enterprises tried to hire but were unsuccessful in hiring university IT graduates while 12% did not employ any university IT graduates in the past three years.

Table 2- Company size and employment of IT graduates

Company Size		Have you employed any university IT graduates in the past 3 years?			Total
		Yes	No	Tried but Were Unsuccessful	
Micro Enterprise	Count	7	3	3	13
	% of total	7.03%	3.03%	3.03%	13.13%
Small Enterprise	Count	26	6	4	36
	% of total	26.26%	6.06%	4.04%	36.36%
Medium Enterprise	Count	32	2	2	36
	% of total	32.32%	2.02%	2.02%	36.36%
Large Enterprise	Count	13	1	0	14
	% of total	13.13%	1.01%	0%	14.14%
Total	Count	78	12	9	99
	% of total	100.0%	100.0%	100.0%	100.0%

The chi-square test checks whether there is any dependence between the size of the company and its IT graduates hiring activity. Technically, it tests the null hypothesis that hiring IT graduates is independent of company size.

The test is carried out at the 5% significance level where a p-value less than 5% would lead to the rejection of the null hypothesis.

H$_0$: All companies regardless of their size are equally likely to hire IT graduates, hence employment of IT graduates is independent of size.

H₁: At least one size differs in its hiring patterns, hence employing graduates is dependent on size of company.

The Pearson chi-square value equals 0.115 is significantly larger than 0.05, therefore we do not have enough evidence to reject H₀. All companies regardless of their sizes hire IT graduates in an equal manner.

Table 3- Chi-square test- dependent or independent

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	10.235	6	.115
Likelihood Ratio	10.87	6	.092
N of Valid Cases	99		

The Main Market of Sample Companies

On average exports accounted for 38% of companies' revenues. 62% of sales were local. That means local markets are much more important for companies and also promising, a fact that favors cooperation between companies and local higher education institutions.

Table 4-Share of exports in company's sales in the past 3 years

	N	Minimum	Maximum	Mean	Std. Deviation
On average, what proportion (%) share of exports in company's sales in the last 3 years (2017, 2018 and 2019)	99	0	100	38.05	36.026

Skills and Knowledge Gaps of IT Graduates

A large majority (81%) of companies in the sample believe there exists a gap between graduates' knowledge and skills and companies' needs. This proportion is consistent among all ownership groups as well as all sectors as demonstrated in Figures 6 and 7.
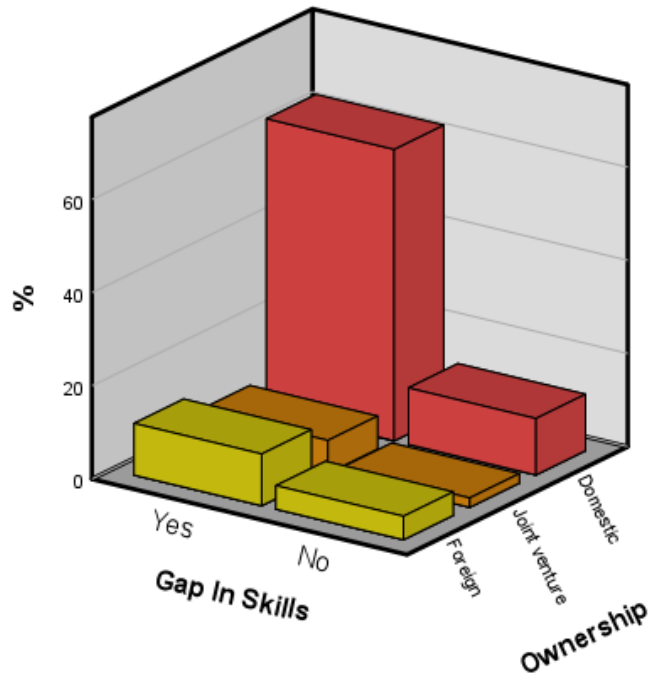
Figure 7-Gap in skills and knowledge by ownership of the company
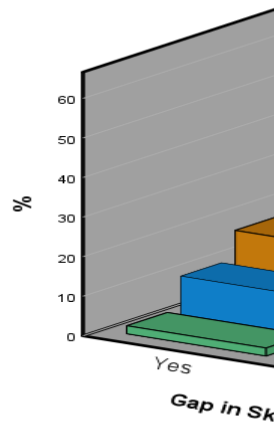
Figure 8-Gap in skills and knowledge by Sector of the company

Areas of Knowledge and Skill Deficiency

The respondents were asked further to identify the specific areas of computer science and computer engineering in which they believe there are deficiencies. As shown in the below figure, Cloud, Computing, Programming, Artificial Intelligence and Machine Learning, and Data Science and Big data were respectively mentioned as areas of deficiency by 56%, 47% and 47% of respondents respectively. Also, we can see from the figure that all other areas of deficiency in range between 14% to 38%.
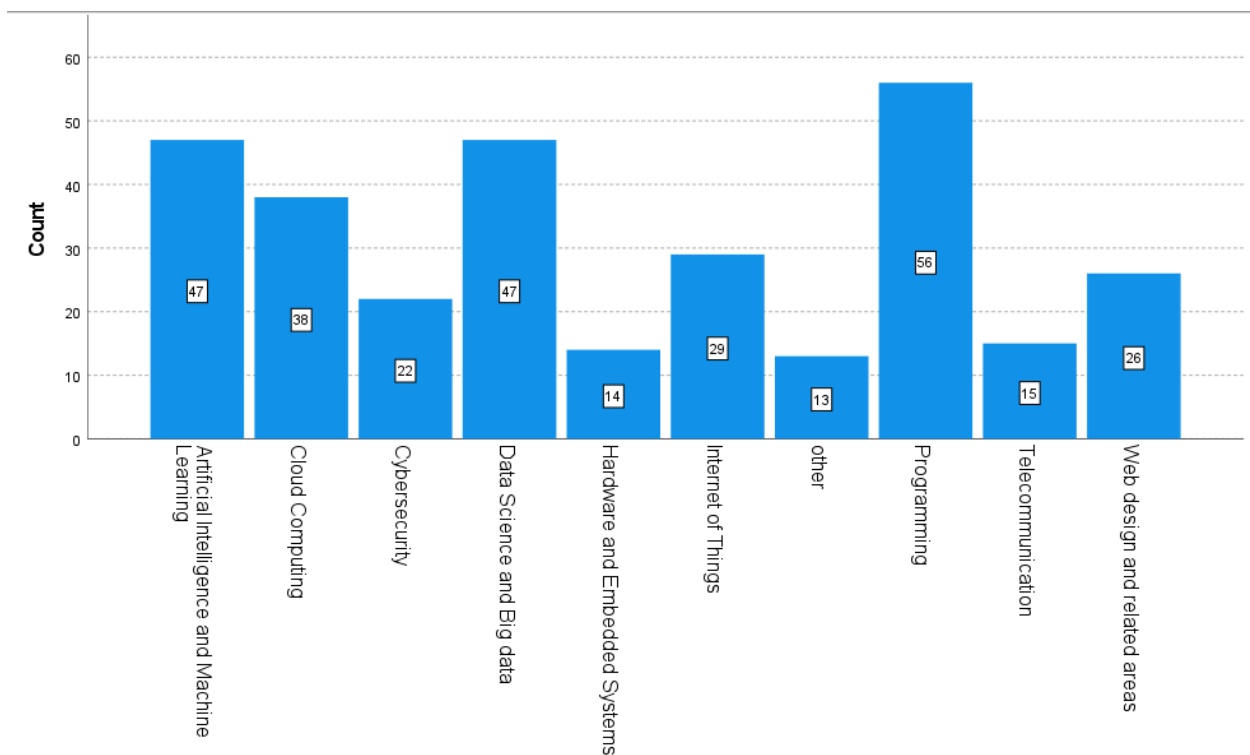
Figure 9-Areas of knowledge deficiency

The Extent of the Knowledge and Skill Gap

The respondents were then asked to identify the extent of the gap between the knowledge and skills of IT graduates and those needed by their companies. Cloud computing, cybersecurity, AI and Telecommunication exhibited highest perceived gaps with average ratings exceeding 4, where 5 corresponds to a "Very Large Gap". Hardware registered the lowest at 3.23. The results are shown in the Table 5.

Table 5-The extent of knowledge deficiency in different areas of computing

	N	Mean	Std.
Cloud Computing	38	4.45	.69
Cybersecurity	22	4.41	.91
AI and Machine Learning	46	4.37	.80
Programming	56	3.62	.82
Data Science & Big Data	47	4.28	.88
Web Design and Related Areas	26	3.24	1.10
Internet of Things	28	3.38	.85
Hardware and Embedded Systems	13	3.23	1.24
Telecommunication	14	4.00	1.11

The Importance of Soft Skills

Generally, the respondents considered all of the soft skills mentioned in the questionnaire very important. Problem solving, Communication and teamwork skills were highlighted as being the three most important soft skills needed with the rating of 4.5, 4.48 and 4.4 out of 5 respectively (5 being "Very Important"). Leadership registered the lowest intensity at a rating equal to 3.54. The results are shown in the Table 6.

Table 6-Importance of soft skills

	N	Mean	Std. Deviation
Problem Solving	80	4.5	.71
Teamwork skills	80	4.4	.94
Communication	80	4.48	.73
Creative thinking	80	4.26	.87
Knowledge of foreign language	80	4.05	.98
Leadership	80	3.54	1.22
Digital business	79	3.92	.93
Cultural awareness	80	4.11	.95

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Extent to Which IT Graduates Meet Company Requirements of Soft Skills

While the university graduates meet the requirements of companies in terms of soft skills to some extent, they fall short of meeting them fully (the average ranking ranging from 2.43 to 3.08, with 1 indicating meeting the requirements to a large extent). All soft skills, with average rating of around 2.75 demonstrate that these skills need improvement. The results are shown in the Table 7.

Table 7-The extent to which university graduates met the skills requirements of companies

	N	Mean	Std. Deviation
Leadership skills	79	2.43	.98
Creative thinking skill	80	2.56	.95
Digital business skills	80	2.58	1.03
Cultural awareness skills	79	2.77	1.02
Problem solving	80	2.6	.87
Teamwork skills	80	3.08	.94
Communication skills	80	2.74	.94
Knowledge of foreign language skills	80	2.91	1.01

Methods for Closing Knowledge and Skills Gaps

As Shown in Figure 10, bellow, 74% of respondents used the "On-the Job Training" as the main method of closing the knowledge and skills gap, followed by "Self-Study" carried out by graduates themselves during employment. Government funded programs aimed at enhancing the capabilities of IT graduates is minimal 10%.

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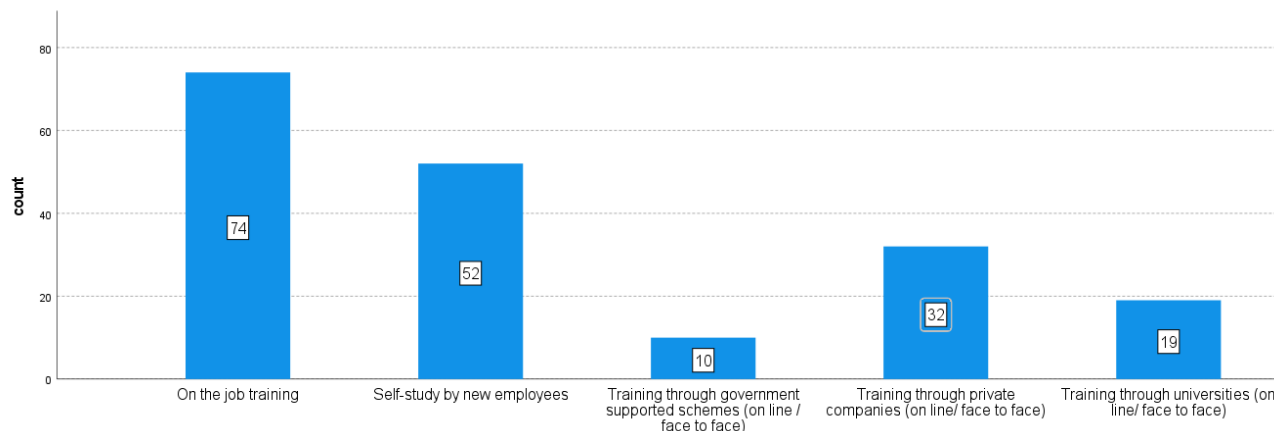
Figure 10-Methods of closing knowledge and skills gap

Hiring Procedures

All hiring procedures considered relevant factors for hiring with average 3.77, work experience get the highest 3.95, and reputation of the institution they graduated from as the lowest 3.54 (where 5 means very relevant).. The results are shown in the Table 8.

Table 8- Relevance of factors affecting hiring decisions

	N	Mean	Std. Deviation
Formal educational qualification (university diplomas)	99	3.83	1.28
Work experience	99	3.95	1.08
Recommendation from trusted persons	98	3.77	1.03
Reputation of institution they graduated from	98	3.54	1.12

Experience of Hiring IT Graduates

As clearly shown in the below figure, 79% of companies in the sample had hired IT graduates during the last three years, while 13% did not hire. Their views regarding the knowledge and skill gaps of graduates, were therefore based on direct knowledge and experience of these graduates.

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9% of companies in the sample had tried to employ IT graduates but were unsuccessful. Their reason for the inability to hire was mainly the lack of necessary technical skills and to a lesser extent the lack of other soft skills.
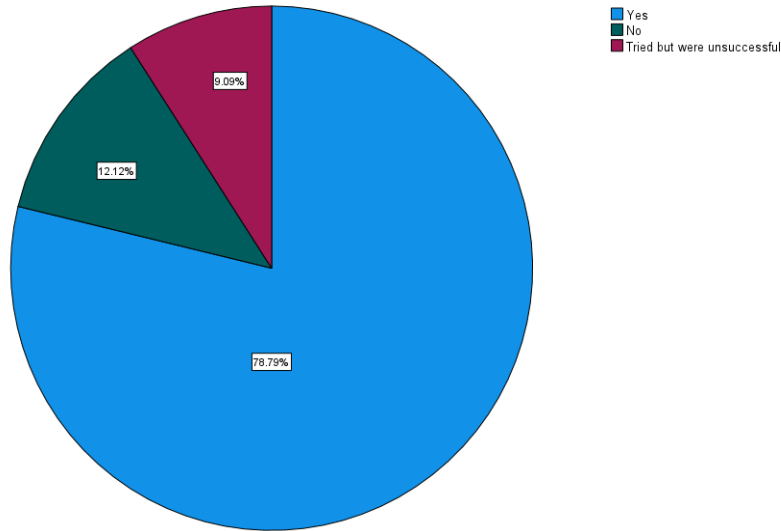
Figure 11- Companies hired IT graduates

Means of Reaching IT Graduates

Public announcements, recommendations from friends as well as graduates' approach, were the mostly used means of recruiting graduates earning a rating of 3.89, 3.36 and 3.28 respectively out of 5 (where 5 means used extensively). Discontentment with the National Employment Office was clearly expressed being least used and the low average rating of 1.87 as shown in table 9 below.

Table 9- Means of reaching prospective graduate employees

	N	Mean	Std. Deviation
Public announcement	75	3.87	1.24
University career centers	63	2.46	1.42

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Recommendations from friends, family or business partners	75	3.36	1.22
Graduates approach	75	3.28	1.25
Partner universities	62	2.71	1.36
National employment office	54	1.87	1.30
Internships and scholarships offered to university students	64	2.98	1.44

IT Graduates Contribution to Company

Generally, graduates employed in the last three years make little contribution to the development of new ideas or new technologies with the rating of their contribution around 3. (on a 1-5 scale). Perhaps, three years is too short a period for young graduates joining companies to make significant contributions to companies' activities. At the same time, the deficiencies in the graduates' knowledge gap discussed earlier may reduce their ability to make more important contributions.

Table 10- Graduates contribution in companies

	N	Mean	Std. Deviation
Developing ideas for new or improved products and	95	2.88	1.02
Engaging with and embracing new technologies	97	3.15	1.30
Widening the company's network of your company	90	2.77	1.05

University-Enterprise Cooperation

As clearly shown in the figure below, 51% of companies had cooperated with local universities in recent times which mean there is good corporation. Strikingly, only 6% of them had

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cooperated with universities abroad. This lack of aboard cooperation must have a negative effect on the companies as they have not been able to benefit from the potential advantages of cooperation. Clearly, this means that companies should exert more efforts to reach out to aboard universities in order to put in place a framework of cooperation. It also has an implication for universities who need to make more effort to develop links with companies.
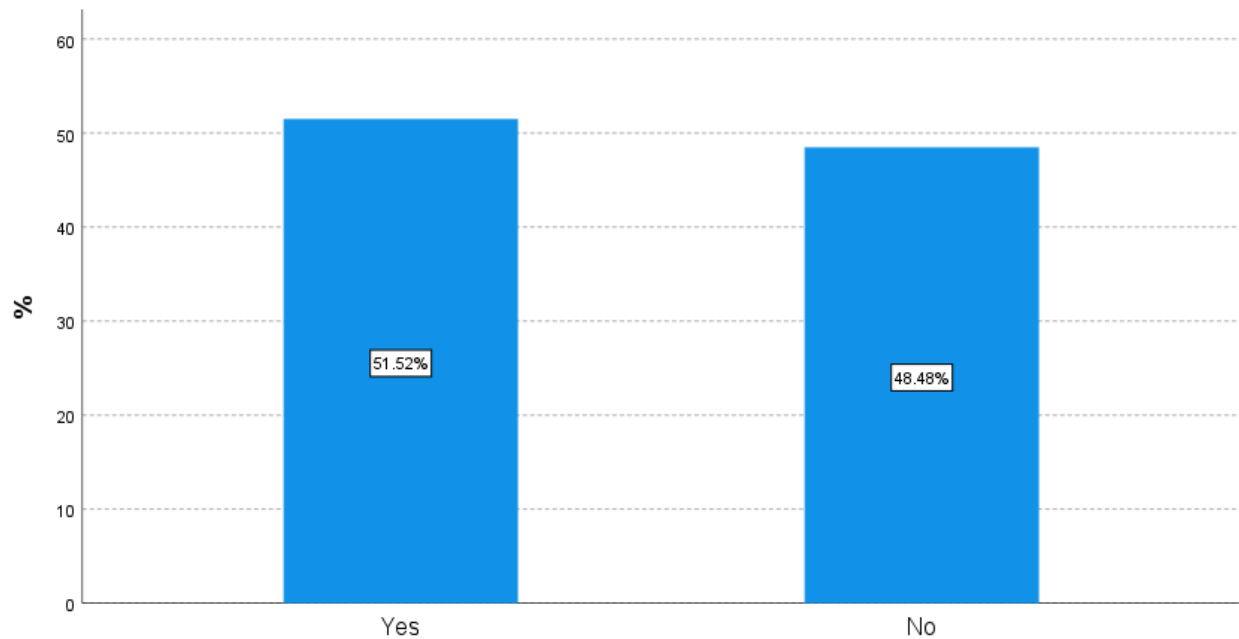
Figure 12- Cooperation between companies and universities in Jordan
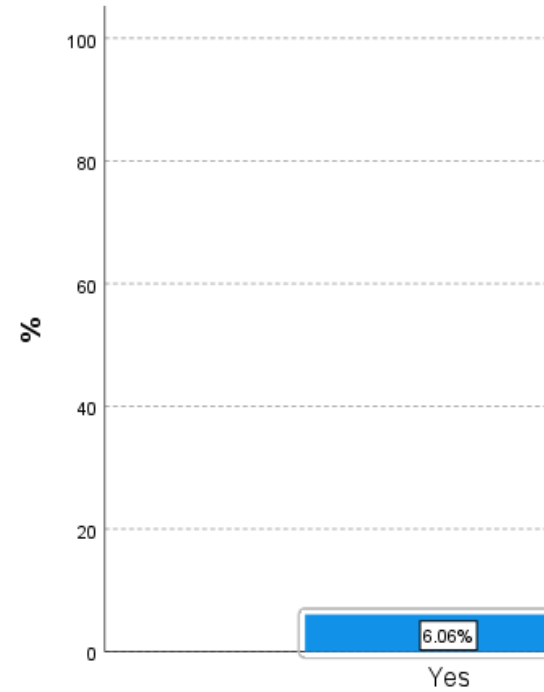
Figure 13- Cooperation between companies and universities outside Jordan

Nature of Cooperation with Universities

The main forms of cooperation, for those companies that did have cooperation with universities, were offering internships to students (32%) and participation in university events (30%). Other methods of cooperation such as technology transfer, participation in curriculum development or joint application for funding were used much less. The diagram below demonstrates the importance of each method.

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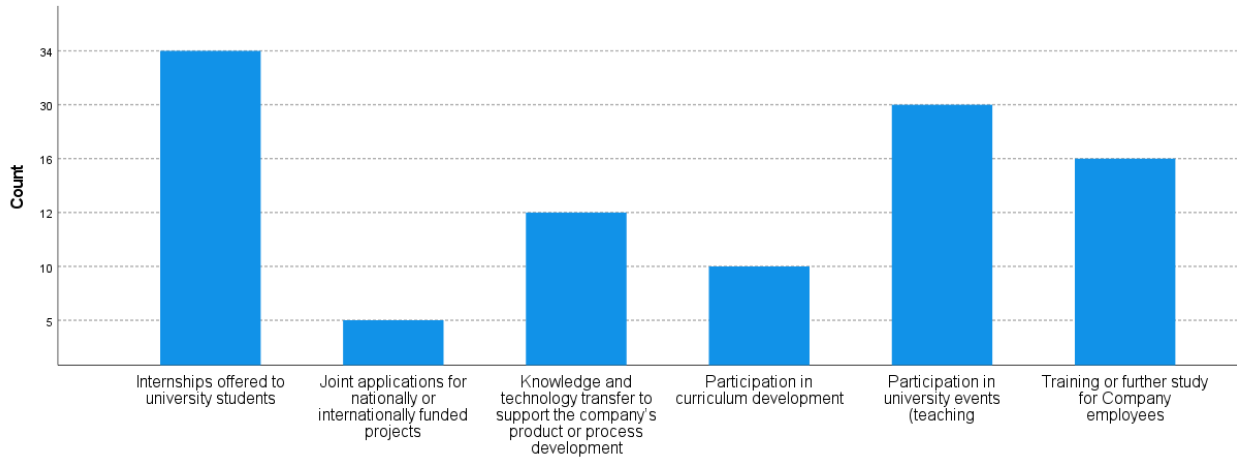
Figure 14-The nature of cooperation with universities

Motivation for Cooperation with Universities

Companies approaching universities and vice-versa were the top two motivators for cooperation with 30% and 26% of respondents respectively, in other words self-initiative on the part of both companies and universities had led to cooperation. Again, the Public procurement of services or goods was minimal as reflected by 5.83% of respondents considering it as motivator.
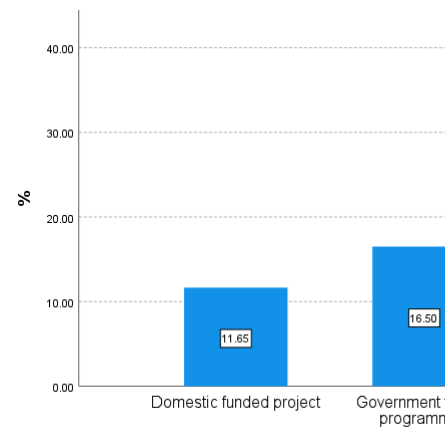
Figure 15 -Motivation for cooperation with universities

Evaluation of Cooperation between the Company and Universities

69% of companies evaluated their cooperation to be either good or fair. little considered it as very poor. This indicator should act as a motivator for IT companies to embark on cooperation since it has proved beneficial to those that have been collaborating with universities.
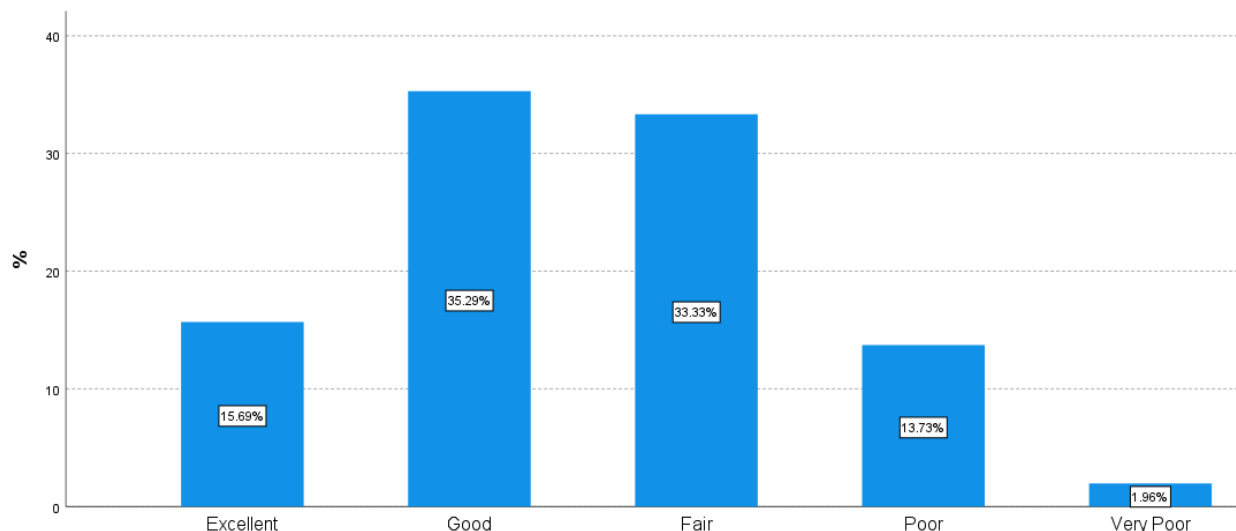
Figure 16-Evaluation of cooperation with universities

Importance of Forms of Cooperation for Improving Employability

Internships and scholarships together are considered by companies to be most important in enhancing employability of IT graduates with a rating of 4.14 out of 5, the latter meaning very important. This is followed by the Business involvement in the development of new curricula 3.82 out of 5. Network of alumni is seen as not so important with a rating as low as 3.43.

Table 11- Important university-entreprise activities that would improve employability for graduates

	N	Mean	Std. Deviation
Internships and scholarships to recruit talented students of alumni	95	4.14	.89
Business involvement in the development of new curricula	99	3.82	.94

University network of alumni	96	3.43	.97
University staff participation in entrepreneurial activities	98	3.67	1.07
Setting up university-enterprise cooperation centers	95	3.75	1.02
University-based training programs for enterprise staff	94	3.70	1.15
Knowledge and technology transfer from universities to the business sector	94	3.48	1.22

Companies Offering Internships to University Students

The proportion of companies offering internships to IT students is 52%. This fact should entice companies to reflect on their own weakness of not hosting IT students for internships and undertaking this practice more often. It also shows that there is great potential for universities to approach and discuss internships with companies.
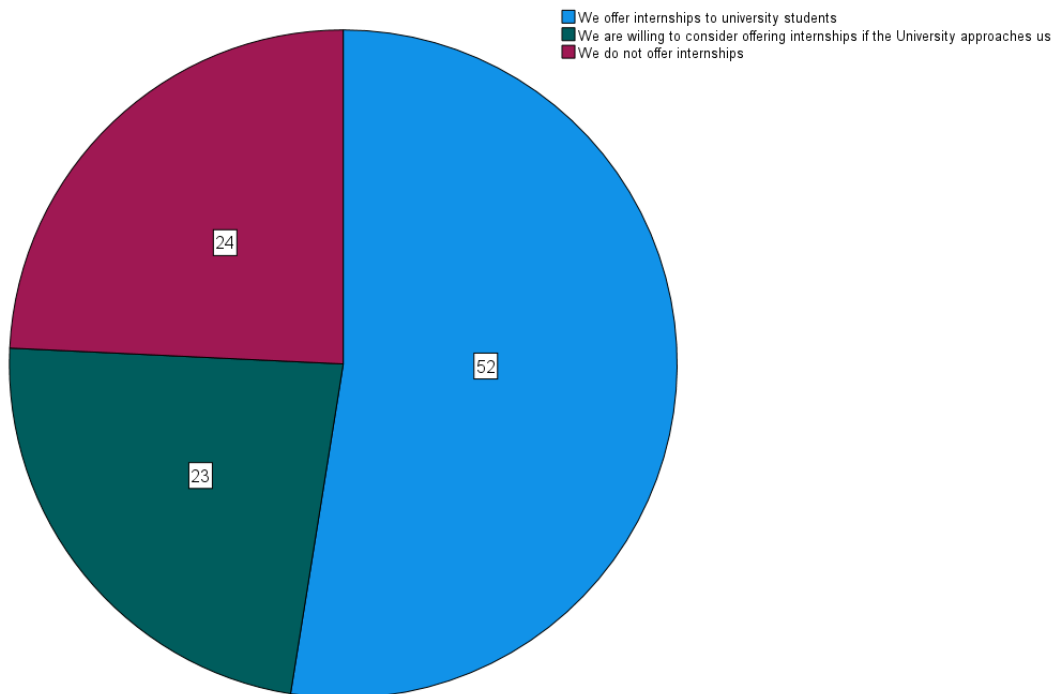
Figure 17- Internships offered by companies

The Impact of Covid-19 on Future Skills Requirements

Overall, it seems that the majority of companies in the sample have average suffer as a result of Covid-19 pandemic. The impact of the pandemic on the loss of domestic or foreign sales, new products and processes, innovation efforts or delays in production were all ranked, on average, between 2.27 and 3.37 (with 5 being 'very significant'). The effect was least on 'losing skilled employees in the IT departments' with an average rating of 2.27 out 5.

Table 12- Effects of Covid-19 on companies

	N	Mean	Std. Deviation
Delays in production and other business activities	91	3.16	1.39
Loss of domestic sales	91	3.37	1.31
Loss of established supply	85	2.78	1.15
Abandonment of new product/service lines or ongoing innovations	91	3.03	1.36
Loss of foreign sales	89	3.33	1.35
Loss of skilled employees in the IT department	85	2.27	1.16

Evaluation of IT Graduates Contribution to Enterprise Activities during Covid-19

IT graduate employees played an important part in enabling the companies to cope with the pandemic. The contribution of IT graduates was considered most important in adjusting to work in virtual teams virtually and transition to digital communication with clients and suppliers earning respectively ratings of 3.85 and 3.66 out 5 respectively, 5 being "very important". The contribution of IT graduates to other areas of work such as the use of social media to promote the business, the management of change, and application for public support were also important to a lesser extent.

Table 13- IT graduates employees' contribution during Covid-19

	N	Mean	Std. Deviation
Adjustment to work in virtual teams	88	3.85	1.02
Transition to digital communication with customers and suppliers	86	3.66	1.04
Use of social media to promote your business	85	3.39	1.23
Change management	80	3.03	1.31
Penetration of new market niches and new technologies	86	3.28	1.15
Application for public funds	73	2.82	1.24

Relevance of Skills for Performance of Enterprises in the Post-COVID-19 World

All listed skills were considered as very relevant or relevant for the performance of enterprises in the post COVID-19 world with virtual teamwork considered most relevant with an average ranking of 4.31 out of 5.

Table 14-Skills relevant in the post Covid-19 world

	N	Mean	Std. Deviation
Virtual team working	98	4.31	.84
Digital customer and supplier management	95	3.92	1.02
Social selling (through social media)	92	3.96	1.08
Change management	96	3.72	1.10
Intercultural communication	96	3.82	.85

SWOT ANALYSIS

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	Enablers Opportunity	
External	- Adapting fast to work virtually - Partnerships in support of university initiatives - Increase demand for mid-career redirection and lifelong learning - Increased interest in global initiatives - Availability of scholarship and joint efforts to develop curricula - Companies participating in university events - Companies cooperating with universities career centers and public announcements - On-the-Job Training - Soft skills needed mostly	o o o o o
	Enablers Strengths	
Internal	- Average loss (2.27) of IT graduates' employability during the pandemic - Positive reputation in the external community - Dedicated and Expert faculty - Have good transactional computing skills - Foreign language - Strong, active external boards - Ability to work virtually - Digital interaction with clients and suppliers	o o o o o o o o

IT graduates should seize all available opportunities. These opportunities will improve weaknesses that IT graduates currently possess. For instance, availability of scholarships and joint efforts

between companies and higher education institutions to develop the curricula will help minimizing the large skill gaps between IT graduates and company's required skills in Cloud, Computing, Programming, Artificial Intelligence and Machine Learning, and Data Science and Big data. Seizing these opportunities will help mitigating threats concomitantly. Hence, companies participating in university events will increase the number of companies offering internships for IT graduates.

IT graduates should emphasize their strengths and deploy them at their workplace. Their good transactional computing skills, ability to work virtually, and a solid knowledge of foreign language are assets that most companies value in the post-COVID-19 world.

LIMITATIONS

As in any research project, there are a number of limitations that should be taken into consideration when analyzing the results and drawing inferences. For instance, the data collection was held during the COVID-19 pandemic, so there was no direct contact with the participants. Data collection was conducted through personal phone calls, or by filling an online survey on the following link: https://www.

In terms of communication, the questionnaire was presented to Jordanian companies in English language and not in Arabic, the latter being the native language, yet English is comprehensible to all respondents. This would not be the cause for any bias as almost all Jordanian company managers are able to communicate in English.

CONCLUSION and RECOMMENDATIONS

The survey helped confirm that a gap does really exist between the needs of companies and knowledge and skills of hired IT graduates. Most of the gaps are of technical nature. We know for a fact now that these relate to areas such as Cloud, Computing, Programming, Artificial Intelligence and Machine Learning, and Data Science and Big data. Universities should capitalize on this insight by improving their curricula further, enhancing the knowledge and skills of students in those areas. There is also a little gap in terms of all softer skills which universities should take note of.

Based on the study results, analysis and realization, a number of conclusions and recommendations can be reached, which could satisfy the purpose of bridging the gaps in knowledge and skills between supply (universities and graduates) and demand (labor market). It is advisable to implement the recommendations in parallel at all levels, and with complete integration and coordination between stakeholders.

Conclusions and Recommendations for Ministry of Higher Educations and Scientific Research:

- Labor Market Monitoring Unit: Universities launch and offer different study Majors in IT based on the trends of students and as requirements of ministry. Lack of labor market information limits the decision making and choices available for universities management when revising or restructuring Majors. As the highest authority responsible for the policies and strategies of HE institutions, ministry is encouraged to establish a function or a unit that monitors the labor market needs of graduates in terms of specializations, quantity and quality. This unit will provide updated information about the status of the labor market to the decision makers in universities in order to introduce new specializations, cancel or limit old specializations, modify study plans of study Majors, or develop and improve certain subjects within the Majors study plans. This unit will conduct regular surveys of the needs of the labor market, using standard survey instruments, and create links with public and private universities to keep open channels of communications regarding this matter. Furthermore, this unit may benefit the entry-level university student in deciding which specialization or study Majors that best suits his/her interest and vision.

Conclusions and Recommendations for Universities:

-Review of Study Plans: Both graduates and employers concentrate on the specific knowledge and skills related to the line of work or the sector. As a result of the fast track of advancement in the IT fields, new technologies and techniques are introduced into the market every day. To sustain business and competitiveness, employers become interested in up-to-date knowledge and skills of graduates that can be utilized effectively in the workplace. IT faculties in public and private universities should review the study plans of study Majors, in light of the scientific developments and the labor market needs. The review process should result in increased number of subjects that meet the requirements of business organizations, in addition to more balanced ratio of practical application and field training compared to theoretical courses. Within the same understanding, compulsory and elective program courses should have higher ratio compared to basic and general knowledge of faculty requirements.

- Quality Assurance: Due to the increasing number of HEI and students in Jordan, there are variations in the quality of graduates entering the labor market every year. Employers rarely have a well-designed mechanism to assess the quality and competence of graduates during recruitment, and they rely on personal judgments or reputation of the university. Universities should develop and establish a central quality assurance function that ensures that the graduate complies with high standards as determined by ministry. The quality assurance scope should cover the curriculum components, course contents, teaching and lecturing methods, qualifications of faculty staff, level measurement methods and tools (testing) and students' knowledge and capacity levels.

- University Repositioning: In developed countries, with excellent reputation in HEI such as USA and EU, it is customary that academic institutions are categorized according to the type of specializations and study Majors they offer. Some universities are known their IT programs. Jordanian universities are increasing day by day, and ministry is approving and licensing more and more private universities, so it is expected to create tough competition among universities in the HEI market of Jordan in the near future. Unless a repositioning process is carried out, the quality of HEI is excepted to be negatively affected, which is not in favor of the graduates nor the labor market. The purpose of university repositioning is to publicly recognize each Jordanian university for being a landmark in a certain field of HEI. The recognition should be on the specialization level or the study Majors level. For example, Princess Sumaya University for Technology (PSUT) could be recognized as the main academic and professional source of IT specializations,

particularly Software Engineering Major, while other University could be recognized as the unique source of other program graduates in the other majors. This process will lead to distinct and unique position for each and every existing university in Jordan. Furthermore, to preserve the quality and uniqueness of each university, regulation should require the introduction of one, or more, new specializations/programs from any new university or academic institution opening in Jordan. This measure will provide labor market with up-to-date graduates, and facilitate the process of recruitment to the employer, since certain vacancies can only be filled with graduates from certain universities and certain specializations.

- Linkages with Business Community: Significant gaps exist between academic institutions and business community, due to the absence of communication channels and lack of coordination. Universities should seriously work to establish links with firms and organizations which form the labor market. There are many feasible approaches to do so; a memorandum of understanding or an agreement regarding students' field training or internship programs, arrangement of regular open days to discuss the needs of potential employers in presence of future graduates, and organizing academic-labor market conferences to address the gaps in knowledge and skills, and ways to overcome these gaps. Such activities are expected to create awareness among employers of the relevance of universities and study Majors to their businesses.

Conclusions and Recommendations for the IT-Graduates:

- Orientation: Students are usually driven by personal preference, rumors and peers' advice when selecting certain specialization or Bachelor degree study Major. Students, before and while completing their academic education should seek help and orientation to assist them in making the right decision regarding the desired university, specialization, and the study Majors based on the study plans. In addition, students should do their own research to find their expected position in the labor market.

- Skills Upgrading: Students assume that academic education is the only source of knowledge and skills needed to obtain a career in the business world. They think that the study period absolutely qualifies them to win a job in the labor market and to adequately perform job duties. Graduates should continue adding to their knowledge and skills after graduation and even during work. For example, IT graduates should engage in Programming Languages training courses needed by the labor market, while BA graduates should attend training on business skills and financial skills.

There are a variety of skills upgrading sources available in the market, which suit the needs and conditions of different graduates.

Conclusions and Recommendations for Employers:

-Employer Satisfaction Survey: In general, employers are concerned with their own business issues and employees, and use their experience to build their own perception about the graduates and the labor market trends, without referring to scientific or statistical information. Certain bodies or committees (e.g. Chamber of Industry, Chamber of Commerce) working in the business environment should conduct an annual or biennial Employer Satisfaction Survey to measure the level of satisfaction among different economic sectors regarding the newly-appointed graduates in various fields. The survey should detect critical knowledge, skills and attitudes which are unsatisfactory from an employer perspective.

-Sponsorship and Support of Universities: Employers always expect that universities should address their needs when designing certain specializations and programs. Employers interaction with academic institutions is limited, though the number of companies and private organizations is huge. Labor market organizations should offer financial and in-kind support to universities, basically because they are regarded as the suppliers of educated human resources. The cooperation relation between companies and universities will influence the students and graduates to gain more relevant knowledge and skills that can be used in the workplace. Sponsorship could take several forms; support of exceptional students, sponsorship of academic activities, support of R&D projects and other forms.

-Links with Internship Programs: Employers suffer from different economic and legal stresses in Jordan, and try to answer to the growing demands of the market and the needs of the existing staff. Also, employers allocate limited resources for contribution to the development of staff. Business organizations and firms should positively respond and apply to the different graduates training and internship programs. Their involvement will provide them with almost free labor, and the opportunity to build the human resources capital of the organization. Recruitment of employees will be kept to the minimum if the employer supported and invested in graduates nominated by internship programs and showed rapid progress in work, to the degree that they can hold their positions independently. Internship programs would serve as "Employment Offices" for firms and companies

The level of cooperation between universities and enterprises is only moderate, with only half the companies having any cooperation with Universities. This points to a significant potential opportunity for both sides. Enterprises employing IT enterprises may benefit from the opportunity of collaborating with universities' careers centers through which they have a good chance to hire graduates up to the sought level of competence. Companies should also inform university academics about their own technical requirements and those communicated by their own clients. These must then constitute the substance of curricular amendment and development. Concomitantly, the government should develop policies aimed at nurturing and rewarding cooperation between private enterprises and higher education institutions. Such programs of joint cooperation could start for instance by companies taking the initiative to develop cooperation by offering internships to IT students and by trying to involve universities in joint research and technology transfer.

Whenever internship openings are available, companies should disseminate them through joint events with universities. IT graduates should then actively participate in those events to seize the opportunity of obtaining internships which are likely to lead to employment. IT graduates will increase their chances of success if they capitalize on their problem-solving and teamwork skills.

Higher education institutions should consider including representatives of IT enterprises in the design and updating of IT curricula and study programs for the development of a curriculum that is up-to-date and relevant for the labor market. Moreover, higher education institutions should

also promote IT senior projects and theses that are either based in companies or based on problem solving and the application in practical solutions that are relevant to enterprises.

APPENDIX

Enterprise Survey

ENTERPRISE SURVEY QUESTIONNAIRE

ELEGANT is an EU-funded project aimed at improving the University-Enterprise cooperation for the benefit of all stakeholders. The objectives of this cooperation are:

a. To improve the curricula of the IT Faculties (Computer Science, Software Engineering and Computer Engineering areas) of universities in order to reflect the needs of the ICT sector companies and improve the employability of ICT graduates; and
b. To facilitate the transfer of knowledge from universities to the ICT sector.

It is generally agreed that University graduates do not always possess the knowledge and skills required by companies, i.e., there is a mismatch between graduates' knowledge and skills and what the companies need.

This Enterprise Survey is designed to identify the gaps in the knowledge and skills of graduates with a view to improving their study programs and enable the graduates to be ready for the world of employment. The survey also aims at identifying and assessing different forms of cooperation between universities and enterprises.

Your participation in this survey is therefore crucial for identifying the IT graduates' knowledge and skill gaps. The survey is voluntary and you can stop the interview at any time if you so wish. The results of individual questionnaires will not be discussed or shared with anybody outside the research team. The overall results will be published in aggregate form for the benefit of universities and government departments dealing with higher education institutions.

The Jordanian participating institutions of the ELEGANT project Princess Sumaya University for Technology and the local Jordanian partners in Elegant) are grateful for your time.

I. GENERAL QUESTIONS ABOUT THE COMPANY

1. Name of Company:

2. Location (Town/City)   Website Address:

3. Legal status:

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a. Individual proprietorship

b. Partnership

c. Corporation   (joint stock company)

d. Other (please specify)

4. Ownership:

    a. Domestic

    b. Foreign

    c. Joint venture

5. Sector of activity:

    Please indicate your main sector of activity: _____

6. What is your position in the company?

    a. Manager/Owner/CEO

    b. Manager or a member of staff of Human Resources Department

    c. None of the above

    If the answer is (c), please terminate the survey.

7. Year of establishment: _____

8. Number of employees in your enterprise at the end of 2019: _____

9. On average, what proportion (%) of your company's sales in the last 3 years (2017, 2018 and 2019) was from exports? ____%

II. SKILLS AND KNOWLEDGE GAPS OF IT GRADUATES AND TRAINING

10. Do you think there is a significant gap or deficiency (at least in some areas) between the skills and knowledge of recent computer science or computer engineering graduates that you have employed or considered for employment and the skills and knowledge your company needs?

        a. Yes   *b. No* (please go to Question 16)

11. If yes, please specify the general areas where you feel there are deficiencies *(please mark only those areas that are relevant to your company)*. You may select more than one answer.

        a. Programming

        b. Artificial Intelligence and Machine Learning

        c. Data Science and Big data

        d. Cybersecurity

        e. Internet of Things

        f. Telecommunication

        g. Hardware and Embedded Systems

        h. Web design and related areas

        i. Cloud Computing

        j. Others (please specify)_____

12. How big is the gap between the skills and knowledge of your recently employed university graduates and the skills and knowledge your company needs in the following areas *(please mark only those areas that are relevant to your company)*?

	1	2	3	4	5	Not Applicable

1 = Minor gaps; 5= Very large gaps

        a. Programming

        b. Artificial Intelligence and Machine Learning

        c. Data Science and Big data

        d. Cybersecurity

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e. Internet of Things

f. Telecommunication

g. Hardware and Embedded Systems

h. Web design and related areas

i. Cloud Computing

j. Others (please specify)_____

13. In addition to the technical and subject related knowledge, graduate employees are expected to have some or all of the following skills (sometimes referred to as soft skills). From your point of view, how important are these skills?

	1	2	3	4	5	Not Applicable

1 = Not important; 5= Very important

a. Leadership skills

b. Problem solving skills

c. Communication skills

d. Digital business skills

e. Creative thinking

f. Teamwork

g. Cultural awareness

h. Knowledge of a foreign language

i. Others (please specify):_____

14. In your opinion, to what extent your recently employed university graduates meet your requirements in the following areas:

	1	2	3	4	5	Not Applicable

1 = To a large extent; 5= Only to a small extent

a. Leadership skills

b. Problem solving skills

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c. Communication skills

d. Digital business skills

e. Creative thinking

f. Teamwork

g. Cultural awareness

h. Knowledge of a foreign language

i. Others (please specify)

15. How do you close the gap and raise the level of knowledge and skills of new employees to the level your company needs? You may select more than one answer.

    a. On the job training
    b. Training through universities (on line/ face to face)
    c. Training through private companies (on line/ face to face)
    d. Training through government supported schemes (on line / face to face)
    e. Self-study by new employees
    f. Others (please specify): _____

III. HIRING PROCEDURES

16. In your hiring procedures, how relevant are the following factors?

	1	2	3	4	5	Not Applicable

1 = Not relevant; 5= Very relevant

a. Formal educational qualification (university diplomas)

b. The reputation of institution they graduated from

c. Recommendation from trusted persons

d. Work experience.

e. Other (please specify):_____

III. GRADUATE EMPLOYMENT EXPERIENCE

17. Have you employed any university IT graduates in the past 3 years?

a. *Yes*   *b. No*   *c. Tried but were unsuccessful*
(if c, go to question 19)

18. If yes, how extensively were the following methods used to reach your prospective graduate employees?

	1	2	3	4	5	Not Applicable

1 = Not used at all; 5= Used extensively

a. Public announcement

b. Recommendations from friends, family or business partners

c. Through the National Employment Office

d. Through partner universities (if applicable)

e. Through university career centres

f. Graduates approach our company

g. Internships and scholarships offered to university students

h. Others (please specify):_____

19. What was the main reason that you were not able to hire your prospective graduate employees?

a. Lack of necessary technical skills

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b. Lack of other skills (such as communication, teamwork, leadership, problem solving, cultural awareness and language skills).

c. Incompatibility of personal characteristics with your company's culture

d. Others (please specify): _____

20. How would you rate the contribution of your graduate employees to the following activities of your company in the past three years?

	1	2	3	4	5	Not Applicable

1 = Not important; 5= Very important

      a. Developing ideas for new or improved products and services
      b. Engaging with, and embracing, new technologies
      c. Widening the company's network
      d. Others (please specify):_____

IV. UNIVERSITY-ENTEPRISE COOPERATION

21. Over the past three years have you cooperated with universities?

      a. In your country   *Yes*   *No*

      b. Abroad   *Yes*   *No*

If answer is yes, please continue with the next question. If the answer is no, please go to Question 25.

22. Which of the following describes best the nature of your cooperation with universities? You may select more than one answer.

      a. Participation in university events (teaching, conferences and seminars)

      b. Participation in curriculum development

      c. Internships offered to university students

      d. Knowledge and technology transfer to support the company's product or process development

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e. *Training or further study for Company employees*

f. *Joint applications for nationally or internationally funded projects*

g. *Others (please specify)*

23. What motivated your cooperation with universities? You may select more than one answer.

a. *Government funded programmes*

b. *Public procurement of services or goods*

c. *Domestic funded project*

d. *Internationally funded project (e.g. EU-funded CBHE, etc.)*

e. *University approached the company*

f. *Your company approached the University*

g. *Others (please specify): _____*

24. How would you evaluate your cooperation with universities?

a. *Excellent*   b. *Good* c. *Fair*   d. *Poor* e. *Very Poor*

25. In your opinion, how important are the following forms of cooperation for improving the employability of graduates?

	1	2	3	4	5	Not Applicable

1 = Not important; 5= Very important

a. *Business involvement in the development of new curricula*

b. *University staff participation in entrepreneurial activities*

c. *Network of alumni*

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d. *Setting up university-enterprise cooperation centres*

e. *Internships and scholarships to recruit talented students*

f. *University-based training programmes for enterprise staff*

g. *Knowledge and technology transfer from universities to the business sector*

h. *Others (please specify):_____*

26. Does your company offer internships to university students?

   a. We offer internships to university students
   b. We are willing to consider offering internships if the University approaches us
   c. We do not offer internships

V. COVID-19 IMPACTS AND FUTURE SKILLS REQUIREMENTS

27. From the perspective of your enterprise how significant were the following effects of Covid-19 for your organization?

	1	2	3	4	5	Not Applicable

1 = Not significant; 5= Very significant

   a. *Loss of domestic sales*

   b. *Loss of foreign sales*

   c. *Abandonment of new product/service lines or ongoing innovations*

   d. *Loss of established supply lines*

   e. *Loss of skilled employees in the IT Department*

   f. *Delays in production and other business activities*

   g. *Others (Please specify):_____*

28. How would you rank the contribution of IT graduate employees to the following activities of your enterprise during Covid-19 pandemic?

	1	2	3	4	5	Not

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						Applicable

1 = Not important; 5= Very important

a. Transition to digital communication with customers and suppliers

b. Penetration of new market niches and new technologies

c. Adjustment to work in virtual teams

d. Use of social media to promote your business

e. Application for public funds

f. Change management

g. Others (please specify): _____

29. In your opinion, how relevant will the following skills be for the performance of enterprises in your industry in the post-Covid-19 world?

	1	2	3	4	5	Not Applicable

1 = Not relevant; 5= Very relevant

a. Virtual team working skills

b. Social selling (through social media)

c. Intercultural communication

d. Change management

e. Digital customer and supplier management

f. Others (specify): _____

THANK YOU FOR YOUR TIME. YOU HAVE BEEN MOST GENEROUS AND HELPFUL.