ELEGANT

# The Knowledge and Skills Gap of University IT Graduates in Lebanon

# Enterprise Survey Report

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# DISCLAIMER

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# EXECUTIVE SUMMARY

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. The Questionnaire for the survey was prepared by colleagues from the University of Dubrovnik and commented by the Project Management team (see Appendix 1 for the Questionnaire). The survey was conducted online, using Cognito forms, exported to Microsoft Excel, and processed using the Statistical Package for Social Sciences (SPSS). A sample of one hundred (100) companies have been selected randomly all located in Lebanon and two-thirds (67%) of them having been established post 1990. The survey was carried out during September and October 2020, mostly with either the HR manager or a staff of his/her department accounting to 58% of respondents. The other 42% were either the CEO, General Manager or the owner of the company. Worth highlighting is the profile of companies in the sample: 65% are located in Beirut, 56% are individual proprietorships, and 83% are domestically owned. Half of the sample consisted of small sized companies employing 10 to 49 employees. Overall 80% had hired IT graduates during the past three years. All companies, irrespective of their sizes (number of employees) had hired IT graduates equally in the past three years. Public announcements and outreach to career centers were the most frequent means of hiring IT graduates. Only half the companies in the sample had offered internships to university IT students or graduates.

Most importantly, 75% 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, AI, cybersecurity and programming were areas in which companies felt IT graduates have deficiencies. 59% of companies consider that on-the-job training is important to closing the gap between required and acquired skills. Formal education and work experience remain the main factors affecting the hiring decision made by companies'

managers. All of the previously mentioned factors lead companies to consider the contribution of IT graduates to be not very important 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. This view may also reflect the fact that the level of cooperation with universities is very low. Only 26% of companies in the sample had cooperation arrangements with local universities and only 5% of them with foreign universities.

Most companies with previous experience of cooperation with universities, which have been 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.

With the COVID-19 pandemic, the world is shifting into virtual mode, where physical contact is minimized and activities shifted online. COVID-19 led to a small loss of sales and exports by companies, but did not result in the loss of skilled employees. IT graduates were able to contribute to shifting to virtual work and digital communication with suppliers and clients and thus played an important part in enabling their companies to cope with the pandemic.

# 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 answers 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 histograms, bar and pie charts that provide good visual comparisons. 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 140 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 100, 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. All contacted companies are located in Lebanon with a majority of them based in Beirut (65%). 83% of companies are owned domestically against 10% by foreign parties and 7% joint venture. 58% of respondents were either the HR manager or member of his/her staff while 42% were owners or CEOs.

**Survey Link: https://www.cognitoforms.com/MUBS1/ERASMUSELEGANTPROJECT**

# DATA ANALYSIS AND FINDINGS

## Sample Characteristics

In this section various characteristics of the sample are discussed. To start with the location of companies, as shown in the figure below, 65% of companies in the sample were located in Beirut, which is the most vibrant part of Lebanon. 94% of companies are scattered around Beirut and Mound Lebanon.
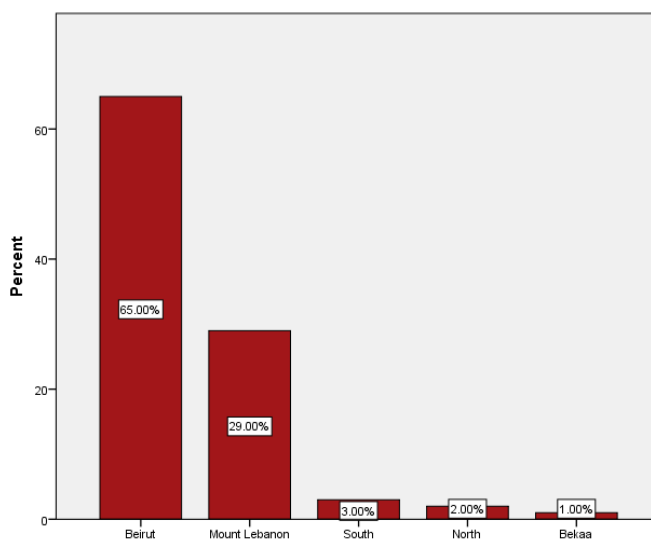


*Figure 1-Location of company*

In terms of legal form, 56% of companies in the sample were individual proprietorships while 27% were corporations, which reflects the prevalence of sole entrepreneurships.
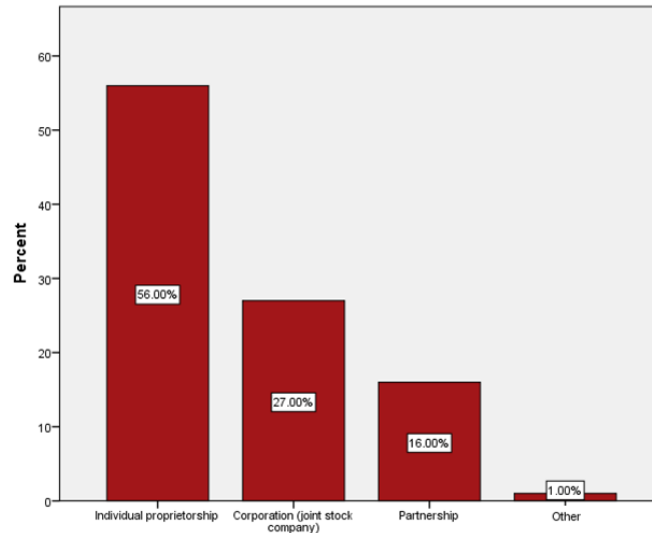
*Figure 2-Legal status of company*

In terms of ownership, 83% of companies in the sample were domestically owned, which reflects the situation of the Lebanese economy that lost huge external investors due to the complicated political situation and current financial crisis. This is almost 5 times the percentage foreign and joint venture companies.
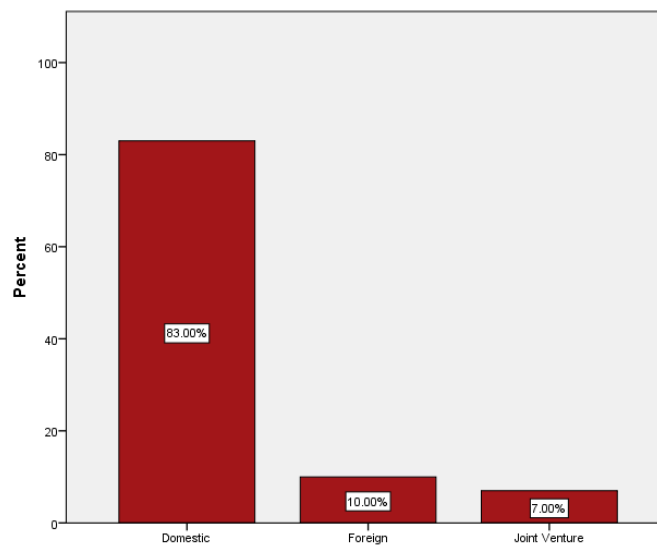


*Figure 3-Company ownership*

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## Sectoral Distribution of the Sample

The sample companies were dispersed over several sectors of activity spanning mostly IT/Digital (26%), Retail (21%), Services (21%) and Food and Beverages (16%), Manufacturing (9%), Hospitality (4%), and Consulting (3%). This reinforces the fact that the sample is representative by means of its diversity along this factor.

Two thirds of companies were established post 1990 (67%), i.e., after the end of the Lebanese civil war which lasted from April 1975 until October 1990.
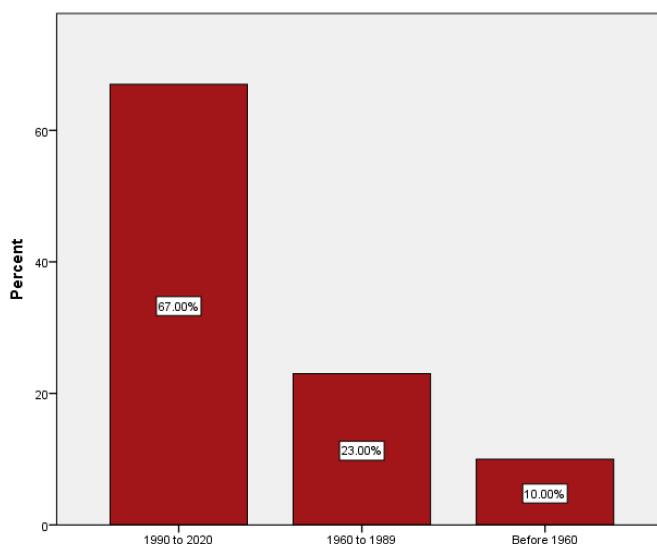


*Figure 4-Date of Establishment*

## Size Distribution of the Sample

Companies were randomly selected between micro, small, medium, and large companies from different sectors of the economy.
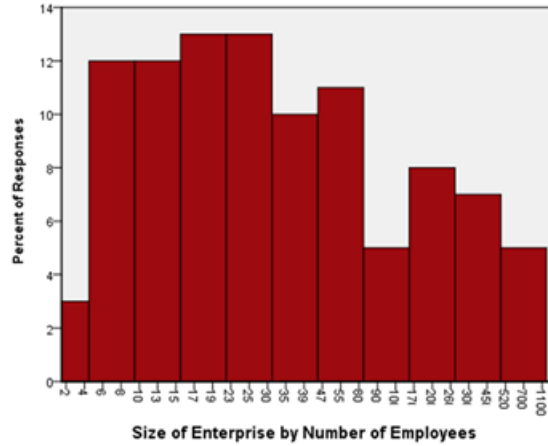
Figure 5-Number of employees in enterprises in the sample

Companies have been subdivided into four size categories as per the standard categories adopted by the Lebanese Ministry of Economy and Trade. Micro enterprises employ less than 10 to 49 employees; small enterprises employ 10 to 49; medium enterprises from 50 to 99 and large enterprises from 100 and above. Almost half of the sample was made up of small enterprises.

*Table 1- Enterprise size*

|  | Frequency | Percent | Cumulative Percent |
|---|---|---|---|
| Micro Enterprise | 15 | 15.0 | 15.0 |
| Small Enterprise | 49 | 49.0 | 64.0 |
| Medium Enterprise | 13 | 13.0 | 77.0 |
| Large Enterprise | 23 | 23.0 | 100.0 |
| Total | 100 | 100.0 |  |

## Company Size and Employment of IT Graduates

54% of small enterprises, the latter constituting almost half the sample, had hired 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 | 9 | 6 | 0 | 15 |
| | % of total | 11.3% | 33.3% | 0.0% | 15.0% |
| Small Enterprise | Count | 43 | 5 | 1 | 49 |
| | % of total | 53.8% | 27.8% | 50.0% | 49.0% |
| Medium Enterprise | Count | 12 | 1 | 0 | 13 |
| | % of total | 15.0% | 5.6% | 0.0% | 13.0% |
| Large Enterprise | Count | 16 | 6 | 1 | 23 |
| | % of total | 20.0% | 33.3% | 50.0% | 23.0% |
| Total | Count | 80 | 18 | 2 | 100 |
| | % 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.

**H0:** 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 0.118 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.

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*Table 3- Chi-square test- dependent or independent*

|  | Value | df | Asymptotic Significance (2-sided) |
|---|---|---|---|
| **Pearson Chi-Square** | 10.163 | 6 | .118 |
| **Likelihood Ratio** | 9.993 | 6 | .125 |
| **Linear-by-Linear Association** | .081 | 1 | .776 |
| **N of Valid Cases** | 100 |  |  |

## The Main Market of Sample Companies

On average exports accounted for 19% of companies' revenues. 81% 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 | 19.36 | 26.310 |

## Skills and Knowledge Gaps of IT Graduates

The large majority (75%) of companies in the sample believe there exists a gap between graduates' knowledge and skills and companies' needs. This proportion (3 to 1) is consistent among all ownership types as demonstrated in Figure 6.
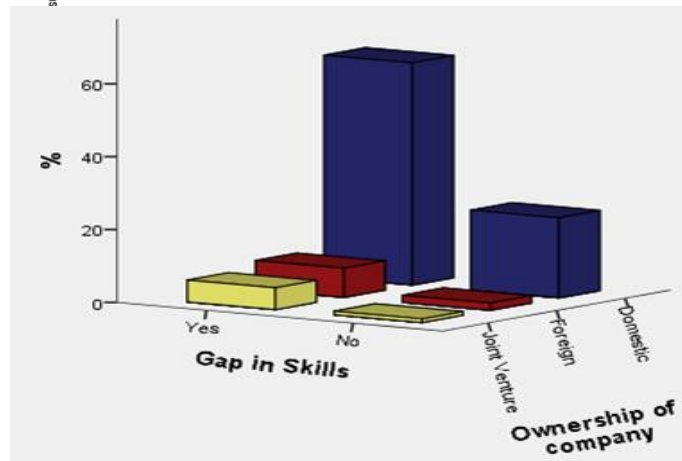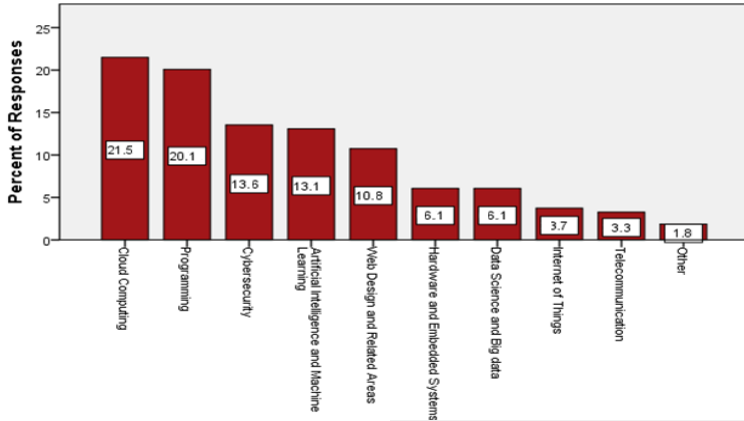
*Figure 6-Gap in skills and knowledge by ownership of the company*

## 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 and programming were respectively mentioned as the first two areas of deficiency by 21.5% and 20% of respondents respectively. Telecommunications and internet of things were considered as areas of deficiency by only about 3% of respondents

*Figure 7-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 and AI exhibited highest perceived gaps with average ratings exceeding 4.33, where 5 corresponds to a "Very Large Gap". Telecommunications and Hardware registered the lowest at 3 and 3.13 respectively. 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 | 48 | 4.60 | .644 |
| Cybersecurity | 28 | 4.46 | .637 |
| AI and Machine Learning | 30 | 4.33 | .994 |
| Programming | 48 | 4.00 | 1.05 |
| Data Science & Big Data | 17 | 4.00 | 1.22 |
| Web Design and Related Areas | 29 | 3.24 | 1.18 |
| Internet of Things | 15 | 3.20 | 1.20 |
| Hardware and Embedded Systems | 15 | 3.13 | 1.35 |
| Telecommunication | 11 | 3.00 | 1.18 |

## The Importance of Soft Skills

Generally, the respondents considered all of soft skills mentioned in the questionnaire very important. Problem solving and teamwork were highlighted as being the two most important soft skills needed with 4.68 and 4.65 rating out of 5 respectively (5 being "Very Important"). Cultural awareness skills registered the lowest intensity at a rating equal to 3.81.

*Table 6-Importance of soft skills*

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|  | N | Mean | Std. Deviation |
|---|---|---|---|
| **Problem Solving** | 76 | 4.68 | .547 |
| **Teamwork skills** | 75 | 4.65 | .604 |
| **Communication** | 75 | 4.56 | .620 |
| **Creative thinking** | 76 | 4.54 | .701 |
| **Knowledge of foreign language** | 74 | 4.31 | .875 |
| **Leadership** | 76 | 4.11 | .946 |
| **Digital business** | 74 | 4.09 | .924 |
| **Cultural awareness** | 74 | 3.81 | .917 |

## 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 2.70 to 3.14, with 1 represents meeting the requirements to a large extent). All soft skills, except the knowledge of foreign language, with average rating of around 3 demonstrate that these skills need improvement.

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

|  | N | Mean | Std. Deviation |
|---|---|---|---|
| Leadership skills | 74 | 3.14 | .998 |
| Creative thinking skill | 75 | 2.96 | 1.006 |
| Digital business skills | 67 | 2.94 | 1.013 |
| Cultural awareness skills | 70 | 2.91 | .847 |
| Problem solving | 76 | 2.88 | 1.019 |
| Teamwork skills | 76 | 2.83 | .900 |
| Communication skills | 76 | 2.70 | .938 |
| Knowledge of foreign language skills | 73 | 2.10 | 1.303 |

## Methods for Closing Knowledge and Skills Gaps

59% 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 at less than 2%.
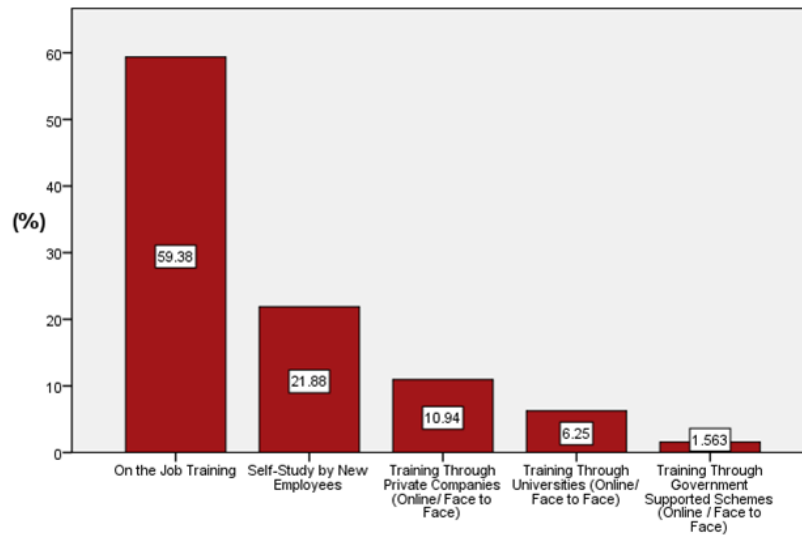


*Figure 8-Methods of closing knowledge and skills gap*

## Hiring Procedures

Formal education and work experience are considered the two most relevant factors for hiring. This is expressed by respondents giving an average relevancy rating of 4.38 and 4.3 respectively out of 5 (where 5 means very relevant). The reputation of the institution from which employees had graduated was still considered relevant despite registering the lowest relevancy rating.

*Table 8- Relevance of factors affecting hiring decisions*

|  | N | Mean | Std. Deviation |
|---|---|---|---|
| **Formal educational qualification (university diplomas)** | 99 | 4.38 | .944 |
| **Work experience** | 100 | 4.30 | .823 |

| | | | |
|---|---|---|---|
| **Recommendation from trusted persons** | 99 | 3.94 | .890 |
| **Reputation of institution they graduated from** | 99 | 3.67 | 1.152 |

## Experience of Hiring IT Graduates

As clearly shown in the below figure, 80% of companies in the sample had hired IT graduates during the last three years, while 20% did not hire. Their views regarding the knowledge and skill gaps of graduates, were therefore based on direct knowledge and experience of these graduates.

2 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.
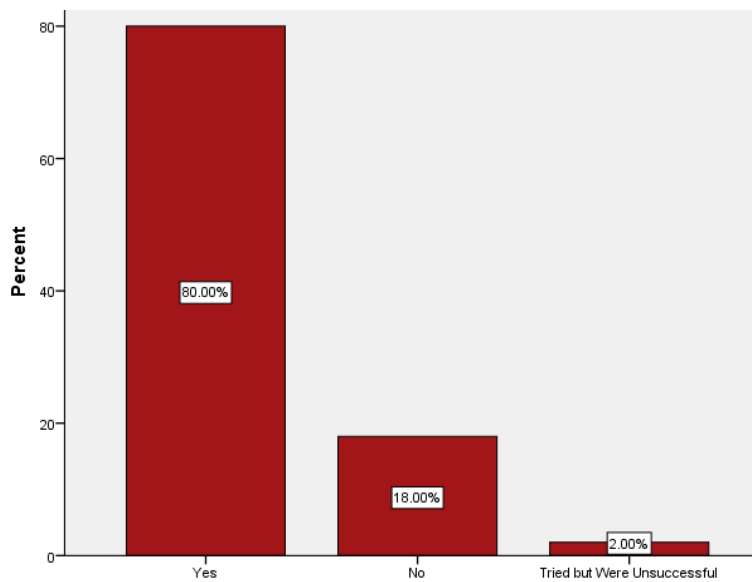


*Figure 9- Companies hired IT graduates*

## Means of Reaching IT Graduates

Public announcements followed by career centers in universities were the two mostly used means of recruiting graduates earning a rating of 4.53 and 3.3 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 1.48.

*Table 9- Means of reaching prospective graduate employees*

|  | N | Mean | Std. Deviation |
|---|---|---|---|
| **Public announcement** | 80 | 4.53 | .856 |
| **University career centers** | 66 | 3.30 | 1.336 |
| **Recommendations from friends, family or business partners** | 66 | 3.14 | 1.226 |
| **Graduates approach** | 49 | 2.90 | 1.358 |
| **Partner universities** | 46 | 2.43 | 1.361 |
| **National employment office** | 29 | 1.48 | .911 |
| **Internships and scholarships offered to university students** | 0 |  |  |

## IT Graduates Contribution to Company

Generally, graduates employed in the last three years did not make an important 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** | 76 | 3.53 | .916 |
| **Engaging with and embracing new technologies** | 97 | 3.45 | .890 |
| **Widening the company's network of your company** | 97 | 2.90 | 1.026 |

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## University-Enterprise Cooperation

Strikingly, only 26% of companies in the sample had cooperated with local universities in recent times. Similarly, only 5% of them had cooperated with universities abroad. This lack of 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 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.
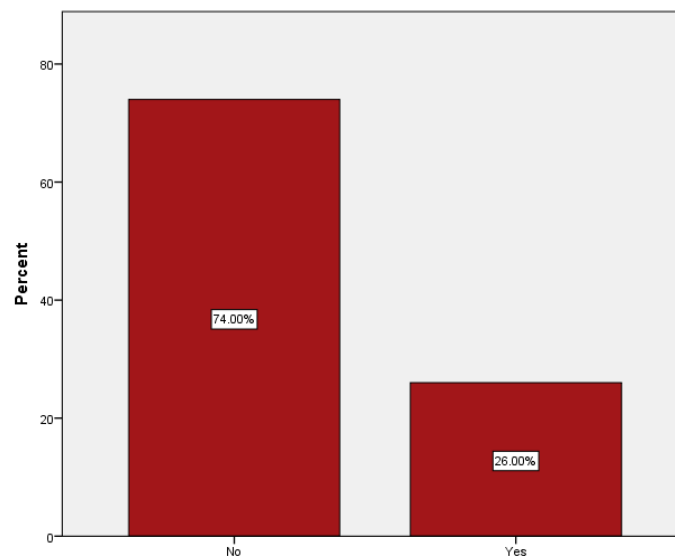


*Figure 10- Cooperation between companies and universities in Lebanon*

## Nature of Cooperation with Universities

The main forms of cooperation, for those companies that did have cooperation with universities, were offering internships to students (36%) and participation in university events (27%). 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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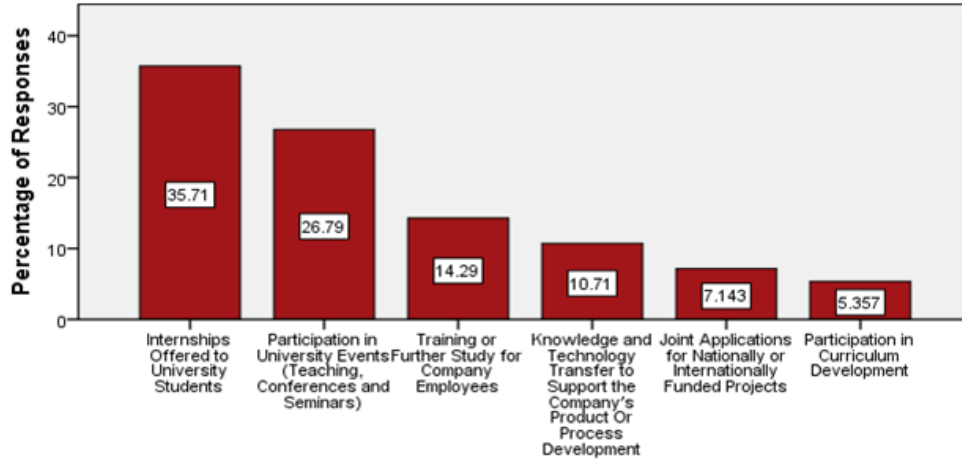
*Figure 11-The nature of cooperation with universities*

## Motivation for Cooperation with Universities

Companies approaching universities and vice-versa were the top two motivators for cooperation with 42% and 39% of respondents respectively, in other words self-initiative on the part of both companies and universities had led to cooperation. Again, the government contribution was minimal as reflected by 2.6% of respondents considering it as motivator.
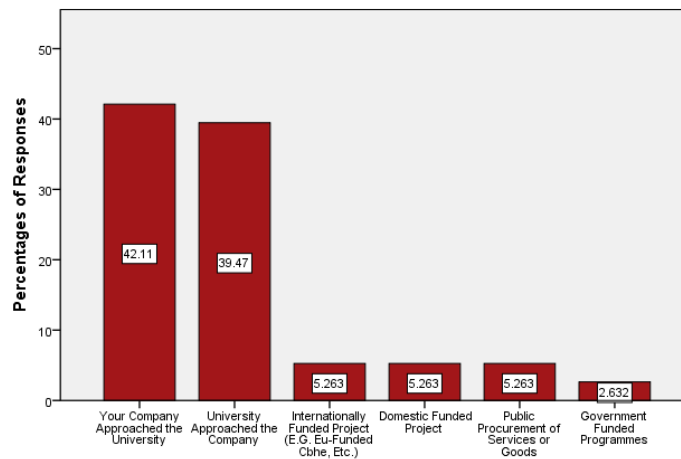


*Figure 12-Motivation for cooperation with universities*

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## Evaluation of Cooperation between the Company and Universities

89% of companies evaluated their cooperation to be either good or excellent. None considered it as either poor or 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.
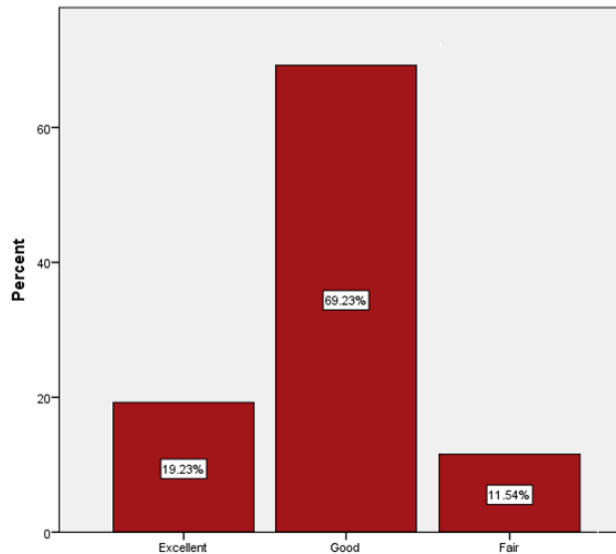


*Figure 13-Evaluation of cooperation with universities*

## 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 4.13 out of 5, the latter meaning very important. This is followed by the cooperation over the development of new curricula rated at 4.10 out of 5. Knowledge and Technology transfer from universities to business is seen as not so important with a rating as low as 3.66 due to the fact that companies currently perceive that a gap exists between requirement for skills of IT graduates and their actual acquired skills.

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*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** | 99 | 4.13 | .709 |
| **Business involvement in the development of new curricula** | 99 | 4.10 | .631 |
| **University network of alumni** | 98 | 4.00 | .786 |
| **University staff participation in entrepreneurial activities** | 98 | 3.98 | .799 |
| **Setting up university-enterprise cooperation centers** | 99 | 3.94 | .818 |
| **University-based training programs for enterprise staff** | 99 | 3.69 | .955 |
| **Knowledge and technology transfer from universities to the business sector** | 99 | 3.66 | .928 |

## Companies Offering Internships to University Students

The proportion of companies offering internships to IT students is exactly the same as those who do not. 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.
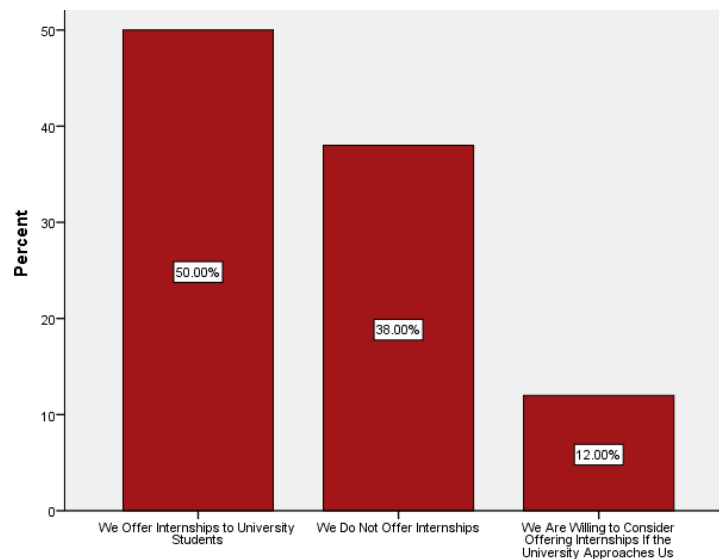


*Figure 14- Internships offered by companies*

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## The Impact of Covid-19 on Future Skills Requirements

Overall, it seems that the majority of companies in the sample did not suffer seriously 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 and 3 (with 5 being 'very significant'). The effect was least on 'losing skilled employees in the IT departments' with an average rating of 1.76 out 5.

*Table 12- Effects of Covid-19 on companies*

|  | N | Mean | Std. Deviation |
|---|---|---|---|
| **Delays in production and other business activities** | 91 | 2.91 | 1.355 |
| **Loss of domestic sales** | 73 | 2.84 | 1.555 |
| **Loss of established supply** | 58 | 2.78 | 1.338 |
| **Abandonment of new product/service lines or ongoing innovations** | 65 | 2.66 | 1.338 |
| **Loss of foreign sales** | 56 | 2.57 | 1.524 |
| **Loss of skilled employees in the IT department** | 63 | 1.76 | .995 |

## 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 4.38 and 4.21 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 | 97 | 4.38 | .918 |
| Transition to digital communication with customers and suppliers | 96 | 4.21 | 1.104 |
| Use of social media to promote your business | 98 | 3.79 | 1.008 |
| Change management | 48 | 3.65 | 1.194 |
| Penetration of new market niches and new technologies | 56 | 3.63 | 1.169 |
| Application for public funds | 35 | 3.34 | 1.552 |

## 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 4.64 out of 5.

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

| | N | Mean | Std. Deviation |
|---|---|---|---|
| Virtual team working | 99 | 4.64 | .721 |
| Digital customer and supplier management | 96 | 4.46 | .767 |
| Social selling (through social media) | 71 | 4.23 | 1.173 |
| Change management | 96 | 4.07 | .811 |
| Intercultural communication | 100 | 4.04 | .942 |

# SWOT ANALYSIS

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| | Enablers<br>Opportunity | Challenges<br>Threats |
|---|---|---|
| **External** | o Adapting fast to work virtually<br>o Availability of scholarship and joint efforts to develop curricula<br>o Companies participating in university events<br>o Companies cooperating with universities career centers and public announcements<br>o On-the-Job Training<br>o Problem solving and teamwork skills needed mostly | o 50% of companies do not offer internships<br>o Lack of external funding for cooperation<br>o Low cooperation with universities locally and abroad<br>o Lack of government funding<br>o National Employment Office ineffective |
| | Enablers<br>Strengths | Challenges<br>Weaknesses |
| **Internal** | o No significant loss (1.76) of IT graduates employability during the pandemic<br>o Have good transactional computing skills<br>o Foreign language<br>o Communication skills<br>o Ability to work virtually<br>o Digital interaction with clients and suppliers | o Neutral contribution of IT graduates to ideas development in companies<br>o Insufficient technical skills in various areas of computing<br>o Leadership skills insufficient<br>o 75% of companies pointed to a gap high skills gap between IT graduates and company's required skills in AI, Cybersecurity and Programming |

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 Artificial

Artificial Intelligence, Cybersecurity, and Programming. 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.cognitoforms.com/MUBS1/ERASMUSELEGANTPROJECT.

In terms of communication, the questionnaire was presented to Lebanese 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 Lebanese company managers are able to communicate in English.

# CONCLUSION

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 Programming, Artificial Intelligence, Cloud Computing, and Cybersecurity. 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

gap in terms of softer skills such as leadership skills, problem-solving skills, etc. which universities should take note of.

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 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 programmes 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 Lebanese participating institutions of the ELEGANT project (Modern University for Business and Sciences, Beirut Arab University and the Syndicate of Computer Sciences of Lebanon) are grateful for your time.

**I. GENERAL QUESTIONS ABOUT THE COMPANY**

1. Name of Company:

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2. Location (Town/City)          Website Address:


3. Legal status:

       *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: _____

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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

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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)_____*

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 |
|---|---|---|---|---|---|---|

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

     *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)*

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*

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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

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.

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*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*

*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. Goodc. 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 |
|---|---|---|---|---|---|---|

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

*b. University staff participation in entrepreneurial activities*

*c. Network of alumni*

*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*

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*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 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.**

Note: The Enterprise Survey and this report were coordinated by Professors Nebojsa Stojcic and Iraj Hashi (University of Dubrovnik, Croatia) and Professor Bassem Kaissi (Modern University of Business and Science, Lebanon).