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Analysis of Market Requirements in the Field of Information Technology in Libya

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Abstract

Continuous changes in advanced information technology contribute to exacerbating the shortage of IT professionals in both the public and private sectors. The types of skills required from IT professionals are also directly affected by these technological changes. This study aims to identify the various skills demanded from IT professionals [1].

As part of this study, we conducted a comprehensive analysis of the Libyan labor market by distributing a set of questionnaires to Libyan state institutions. These questionnaires were designed to gather precise information regarding the market's needs for skills and expertise.

The results indicate significant challenges related to graduates' qualifications and the availability of training opportunities, necessitating the enhancement of training and professional development programs. Clear trends toward the use of specific technologies in various fields, such as artificial intelligence, data analysis, and information security, are also evident. These findings provide important insights for educational institutions and the job market, helping to improve the alignment of skills with market needs.

Therefore, it is essential to invest in the development of new training programs that align with rapid technological changes and meet the ever-evolving requirements of the labor market. Improving the quality of education and training in this field will enhance graduates' opportunities and increase their competitiveness in the job market.

Keywords: *University Education, Information Technology, Education, Libya.*

Introduction

Companies and governmental agencies in Libya face significant challenges due to the growing shortage of skilled workers in the field of information technology since the end of the last millennium. Countries that rely on advanced technology also struggle to find qualified professionals to fill essential positions. However, over the past ten years, universities and colleges have not been able to adequately prepare and train graduates to meet the needs of the IT industry [2].

Indeed, there is a clear gap between market demands and what educational institutions provide. The continuous changes in cutting-edge information technology contribute to the worsening shortage of workers in this field. In addition to accelerating the obsolescence cycle of current skill sets, the new technologies being implemented lead to changes in the fundamental ways organizations operate [1].

The skills demanded from IT professionals are directly affected by these changes. This is one of the main reasons why certified professionals in this field consistently participate in re-certification programs; employees at lower and mid-levels are returning to education to take

additional courses in computing and management to enhance their promotion opportunities. Many of these professional development opportunities are encouraged and funded by employers [4].

Problem Statement

Information technology serves as the driving force behind the restructuring of many contemporary and competitive organizations. As new innovations in IT are integrated into the workplace, there is a growing demand for new computing skills among IT professionals. Although universities have been asked to update their curricula in computer information systems (CIS) departments to align with these changes and have made several adjustments, a gap still remains [3].

Due to the shortage of skilled personnel in the field of information technology, many projects have been postponed or canceled. The quality of these projects has also significantly declined. This drop in quality is often attributed to the hiring of unqualified IT workers. Consequently, the impact of the skills shortage is clearly reflected in project outcomes. This situation poses a significant challenge for the sector.

From a broader perspective, this problem may have national implications. As e-business continues to grow and the global digital economy evolves, the shortage of skilled labor in information technology could impact the Libyan economy. Additionally, this shortage may threaten productivity and affect the growth of companies in the country.

Research Objectives

Advancements in computing hardware, software, and networks will continue to enhance the demand for skilled IT workers who can utilize modern technologies to address emerging business challenges. As new technologies enter the market, the skills required by companies are expected to evolve.

Nevertheless, the current skills that companies seek serve as important indicators of the types of skills that both current and future IT professionals should possess. Therefore, it is essential for graduates and professionals to continuously update their skills and adapt to new trends. This will enable them to maintain their competitiveness in an ever-changing job market [5].

Given the increasing competition, possessing the right skills becomes crucial for professional success. Thus, educational and training programs must align with industry needs to ensure that graduates are well-prepared.

The primary aim of this study is to identify the types of skills required for IT professionals. Specifically, the study examines the technical skills needed by new employees. The findings of this research will benefit human resources administrators, career counselors, corporate trainers, and information systems consultants [3].

Additionally, educators can use the results to design and develop new curricula that better prepare students for the job market. For students, this study is particularly valuable, as the identified skills can significantly influence their choices regarding elective courses and specialization tracks.

Methodology

- **Study Design**

A descriptive study design was adopted based on a quantitative approach, where data was collected from a wide range of institutions to create a comprehensive picture of the current needs of the Libyan labor market. A total of 38 questionnaires were distributed to 38 private and public institutions, with the questionnaires completed by human resources managers and heads of information technology departments.

- **Data Collection Tool**

A questionnaire was developed that includes several key areas:

General information about the institution:

Such as the type of institution (private or public), the number of IT employees, and the sector it belongs to.

Required technical skills:

Identifying specific technological skills such as operating systems used, types of systems, programming languages, software development platforms, database management systems, network management, and others.

- **Sample of the Study**

A diverse sample of institutions was selected from various sectors, including:
Education: Universities and technical schools.
Healthcare: Hospitals and medical centers.
Industry: Factories and production companies.
Financial Services: Banks and insurance companies.
Information Technology: Startups and programming agencies.
The sample was strategically determined to ensure a good representation of all sectors.

- **Data Collection Procedures**

Distribution of Questionnaires: A number of questionnaires were distributed to a group of public and private institutions.
Timeline: A data collection period was set that lasted for four weeks, during which responses were monitored periodically.

- **Data Analysis**

Statistical analysis software such as Excel will be used to analyze the data.
Descriptive Statistics: Frequencies and percentages will be calculated to determine the prevalence of each skill or requirement.
Comparative Analysis: Data will be compared across different sectors to understand the differences in needs.

- **Interpretation of Results**

The results will be interpreted to identify the most in-demand skills in the Libyan labor market.
Skills Gaps: The results will be analyzed to identify gaps between what the market requires and what the education system provides.
Future Trends: Emerging trends in the field will be reviewed to guide educational institutions.

- **Recommendations**

The recommendations will include:
Curriculum Updates: The necessity to modify educational curricula to meet market needs.
Vocational Training Programs: Establishing training programs that target the identified skill gaps.
Public-Private Collaboration: Strengthening partnerships between educational institutions and companies to ensure alignment between the required skills and what is being taught.

Study Methodology

The study sample is one of the essential elements in scientific research, as it is used to provide an accurate representation of the phenomenon under investigation. The sample contributes to achieving the research objectives by gathering and analyzing data, allowing researchers to draw conclusions and generalize findings to the larger population.
In the context of this research, we distributed 38 questionnaires to a group of institutions in the Libyan state with the aim of gathering comprehensive data on the study topic. The questionnaires were carefully designed to ensure that we obtained accurate and reliable information that reflects the reality of the institutions. After the distribution process, we received 33 valid questionnaires for analysis, while 5 questionnaires were deemed unfit for analysis due to incomplete data or errors in the responses.
The technical skills were classified into the following main categories: programming languages, web development, databases, networking, and operating systems and environments. Each table displays the absolute number of times a specific skill was mentioned. The percentage represents the proportion of times the skill was mentioned within its category.
Having a recent degree in information technology provides the skills and capability to integrate into the job market.
Table 1: Reviews how recent graduates adapt to the demands of the job market based on the skills acquired in their fields of study.

	Number	Percent
YES	7	21.20%
NO	26	78.80%
Total	33	100%

Table 1: shows the analysis of the integration of recent graduates into the job market.

The table presents the distribution of participants' responses regarding the possession of skills qualified for the job market. It shows that 21.20% of graduates possess the required skills, while 78.80% do not.

This significant disparity indicates the challenges graduates face in becoming qualified for jobs in the labor market, highlighting the importance of focusing on training and professional development programs to enhance the necessary skills. The current situation necessitates improvements in curricula and training programs to meet market needs.

Organizations provide training opportunities for information technology graduates.

Table 2: Reviews the availability of various training programs designed to enhance the skills of information technology graduates.

	Number	Percent
YES	11	33.30%
NO	22	66.70%
Total	33	100%

Table 2: Shows the availability of training opportunities provided by organizations for information technology graduates.

The table presents the distribution of participants' responses regarding whether institutions provide training opportunities for graduates. It shows that 33.30% of participants believe that training opportunities are available, while 66.70% think these opportunities are not available.

This significant disparity indicates a general perception that institutions may not offer sufficient training opportunities for graduates, highlighting the urgent need to improve collaboration between educational institutions and the labor market. It is important to enhance programs that link education and employment, providing training and job opportunities for graduates to improve their employability in the job market.

Operating systems used by organizations.

Table 3: Reviews the different types of operating systems relied upon by organizations in their work environments.

System	Number	Percent
Linux	3	9.10%
Unix	3	9.10%
Windows	17	51.50%
Mac	7	21.20%
Others	3	9.10%
Total	33	100%

Table 3: shows the Operating systems used by organizations

The table presents the distribution of operating systems used in institutions among participants. It shows that the Windows operating system holds the largest percentage, being used by 51.50% of participants, indicating that it is the most common choice in work environments.
The remaining percentages are distributed between Linux (9.10%) and Unix (9.10%), while the Mac system accounts for 21.20% of the usage. The percentage for other systems indicates a diversity in system choices.
This diversity in operating systems reflects the flexibility of institutions in adopting different technologies; however, the significant focus on Windows may also suggest a need to enhance proficiency in the use of other operating systems. Employees could benefit from training on less common operating systems to increase skill diversity and foster innovation in work environments.

Applications

Table 4: Reviews the applications that are primarily relied upon in organizational work environments.

Application	Number	Percent
desktop application	14	42.40%
web application	7	21.20%
mobile application	4	12%
AI application	1	3%
network systems	3	9.10%
database systems	3	9.10%
data analyses systems	1	3%
others	0	0%
total	33	100%

Table 4: shows the most commonly used application in organizations.

The table presents the distribution of types of applications used in institutions among participants. The data shows that desktop applications represent the largest percentage, with 42.40% of participants using them, indicating a significant reliance on these applications in work environments.
Web applications rank second at 21.20%, followed by mobile applications at 12%. Meanwhile, artificial intelligence applications and data analysis systems each account for 3%, indicating limited use of these applications at the moment.

The remaining percentages are distributed between network systems and database systems, each recording 9.10%. Notably, 0% of participants reported the existence of other applications, which suggests a concentration of usage on the mentioned categories.
This distribution reflects institutions' tendency to rely on desktop applications and web applications, while the use of other applications, such as artificial intelligence and data analysis

systems, may require more attention and training to enhance innovation and efficiency in the workplace.

Desktop Programming languages.

Table 5: Reviews the programming languages primarily used to develop desktop applications in organizational work environments.

Desktop Programming languages	Number	Percent
VB.NET	10	30.30%
Python	5	15.20%
Delphi	2	6.10%
C#.NET	11	33.30%
Java	3	9.10%
others	2	6.10%
total	33	100%

Table 5: shows the most commonly desktop programming languages used in organizations.

The table presents the distribution of programming languages used in developing desktop applications among participants. It shows that the C#.NET language ranks first, with 33.30% of participants using it, indicating its significant popularity in software development environments.

VB.NET follows in second place at 30.30%, reflecting a notable reliance on it as well. Meanwhile, Python is used by 15.20%, suggesting an increasing trend in its application for desktop software.

The data also indicate lower usage for both Delphi (6.10%) and Java (9.10%), reflecting a decline in their popularity compared to the more widely used languages. Notably, 6.10% of participants reported using other programming languages, indicating additional diversity in the available options.

Overall, these results reflect a trend among institutions toward relying on more common programming languages such as C#.NET and VB.NET, while the use of less common languages like Delphi and Java may require further support and training to enhance their application in the future.

Web application (Frontend, Backend)

Table 6: Reviews the fields that are primarily relied upon in the development of web applications within organizations.

Technology	Number	Percent
Frontend	14	42.40%
Backend	19	57.60%
total	33	100%

Table 6: shows the most commonly web application field used in organizations.

The table presents the distribution of programming technologies used among participants in application development. It shows that backend technology holds the largest percentage, representing 57.60% of participants, indicating a strong focus on developing the backend of applications, which is essential for managing data and interacting with databases.
On the other hand, frontend technology accounts for 42.40%, suggesting the importance of user interfaces and user experience in applications.
This distribution reflects the current trend in software development, where the backend is vital for supporting applications in terms of performance and security. However, it is also important to enhance frontend skills to ensure a balance between the two aspects, contributing to the overall quality of applications and user experience.

Frontend (Libraries, Frameworks, Programming Languages)
Table 7: Reviews the most widely used technologies for developing user interfaces within organizational work environments.

Frontend Technology	Number	Percent
JS	14	42.40%
React	2	6.10%
Angular	7	21.20%
Vue	3	9.10%
JQuery	6	18.20%
Swift	0	0%
Others	1	3%
Total	33	100%

Table 7: shows the most commonly frontend technology used in organizations.

The table presents the distribution of frontend technologies used among participants in application development. It shows that JavaScript is the most widely used language, representing 42.40% of participants, indicating a significant reliance on it as a fundamental tool for developing user interfaces.
Angular ranks second at 21.20%, reflecting its popularity among developers seeking a robust framework for application development. React accounts for 6.10%, which is also a well-known framework, suggesting its increasing usage.
Vue records 9.10% and jQuery 18.20%, reflecting the diversity in developer preferences. Notably, Swift was not used by any participants, indicating that the focus in frontend development is centered around web applications rather than mobile apps.
The remaining percentage (3%) indicates the use of other technologies, suggesting additional options are available. Overall, these results reflect a strong trend toward using JavaScript and its associated frameworks in application development, with a need for more focus on other frameworks like React and Vue to enhance developer skills and diversify available options.
Backend Programming languages.

Backend Technology

Table 8: Reviews the technologies that are primarily relied upon in developing the backend of organizational applications.

Backend Technology	Number	Percent
C#.NET	12	36.40%
VB.NET	4	12.10%
PHP	14	42.40%
Python	2	6.10%
Ruby	0	0%
Others	1	3%
Total	33	100%

Table 8: shows the most commonly backend technology used in organizations.

The table presents the distribution of backend technologies used among participants in application development. It shows that PHP holds the largest percentage, representing 42.40% of participants, indicating its significant popularity in web application development.

C#.NET ranks second at 36.40%, reflecting a notable reliance on it for software development, especially in work environments that use the Windows operating system. Meanwhile, VB.NET accounts for 12.10%, indicating its use in specific projects.

The data also show lower usage for Python (6.10%), while no participants reported using Ruby, which may suggest a decline in its popularity in this context.

The remaining percentage (3%) indicates the use of other technologies, suggesting additional diversity in the available options. Overall, these results reflect a strong trend toward using PHP and C#.NET in backend application development, with a need to enhance the use of other programming languages like Python and Ruby to increase skill diversity and innovation in development environments.

Mobile Application

Table 9: Reviews the most widely used technologies for developing mobile applications within organizational work environments.

Mobile Application	Number	Percent
C#(MAUI)	8	24.20%
Dart(Flutter)	13	39.40%
Java	9	27.30%
Swift	0	0%
React native	2	6.10%
Others	1	3%
Total	33	100%

Table 9: shows the most commonly mobile application technology used in organizations.

The table presents the distribution of mobile application development technologies used among participants. It shows that Dart (Flutter) ranks first, representing 39.40% of participants, indicating its increasing popularity in cross-platform application development.

Java comes in second place at 27.30%, reflecting its continued traditional use in mobile application development, especially on the Android platform. Meanwhile, C# (MAUI) accounts for 24.20%, suggesting a growing reliance on this technology for mobile app development.

Notably, there were no reports of Swift being used by any participants, which may indicate a lack of reliance on developing iOS applications using this language within this sample. React Native records a usage rate of 6.10%, reflecting its adoption as a cross-platform development option as well.

The remaining percentage (3%) indicates the use of other technologies, suggesting additional available options. Overall, these results reflect a trend toward using Dart and Java in mobile application development, with a need to enhance the use of Swift and React Native to broaden skill sets and meet market demands.

Database systems

Table 10: Reviews the most widely used database management systems in organizational work environments.

Database systems	Number	Percent
MYSQL	6	18.20%
MICROSOFT SQL SERVER	11	33.30%
ORACLE	10	30.30%
FIREBASE	3	9.10%
MongoDB	3	9.10%
Others	0	0%
Total	33	100%

Table 10: shows the most commonly Database systems used in organizations.

The table presents the distribution of database systems used among participants in application development. It shows that Microsoft SQL Server ranks first, representing 33.30% of participants, indicating its wide adoption in work environments, particularly in organizations that require managing large and complex data.

Oracle comes in second place at 30.30%, reflecting its common use in applications that demand high performance and reliability. Meanwhile, MySQL accounts for 18.20%, demonstrating its popularity as an open-source option for application development.

Firebase and MongoDB each register 9.10%, suggesting their use in specific scenarios, possibly for web applications or applications requiring real-time interaction.

Notably, 0% of participants reported using other systems, indicating a concentration of usage on the mentioned systems. Overall, these results reflect a trend toward significant reliance on Microsoft SQL Server and Oracle in application development, with a need to explore additional options to enhance diversity and innovation in database management.

Artificial Intelligence fields

Table 11: Reviews the main AI application fields relied upon by organizations in their operations.

AI fields	Number	Percent
ROBOTS	3	9.10%
MACHINE LEARNING	7	21.20%
EXPERT SYSTEMS	5	15.60%
NEURAL NETWORK	15	45.50%
Others	3	9.10%
Total	33	100%

Table 11: shows the most commonly AI fields used in organizations.

The table presents the distribution of artificial intelligence fields used among participants in the study. It shows that neural networks rank first, representing 45.50% of participants, indicating a significant reliance on this technology in AI applications due to its ability to process and analyze data in complex ways.

Machine learning comes in second at 21.20%, reflecting the growing interest in this field, which is a core component of AI technologies. Expert systems account for 15.60%, demonstrating their use in specific applications that require knowledge-based decision-making.

Robotics records 9.10%, suggesting that its use remains limited within this sample, while the remaining percentage (9.10%) indicates other fields, showing the diversity of available options in artificial intelligence.

Overall, these results reflect a trend toward focusing efforts on neural networks and machine learning in AI applications, with a need to enhance the use of other areas such as robotics and expert systems to foster innovation and meet market demands.

Network systems

Table 12: Reviews the most commonly used network systems relied upon by organizations in their work environments.

Network systems	Number	Percent
HUAWEI	10	30.30%
CISCO	21	63.60%
JUNIPER	0	0%
Others	2	6.10%
Total	33	100%

Table 12: shows the most commonly Network systems used in organizations.

The table presents the distribution of network systems used among participants in the study. It shows that Cisco ranks first, representing 63.60% of participants, indicating its clear dominance in the network systems market and its reliability as a primary choice for many organizations.

Huawei comes in second at 30.30%, suggesting a growing interest in its technologies, although it is still less utilized than Cisco. Notably, no participants reported using Juniper, which may indicate its limited presence in this context.

The remaining percentage (6.10%) indicates the use of other systems, showing some diversity in the available options. Overall, these results reflect a strong focus on utilizing Cisco technology in network systems, with a need to explore and enhance the use of other options like Huawei and Juniper to foster innovation and meet market demands.

Summary of the Study

This study analyzes data extracted from questionnaires distributed to 33 participants from various institutions.

1. Technical Skills: Results showed that 21.20% of graduates possess the skills required for the job market, indicating a significant gap that needs to be addressed through training and professional development programs.
2. Training Opportunities: 33.30% of participants indicated that institutions provide training opportunities for graduates, reflecting challenges in providing adequate training.
3. Operating Systems: Data revealed that Windows is the most widely used operating system (51.50%), followed by Linux and Unix.
4. Programming Applications: The results indicate that desktop applications are the most commonly used (42.40%), with an urgent need to adopt other applications such as artificial intelligence.
5. Programming Languages: The most commonly used programming languages are C#.NET and VB.NET, reflecting a preference for development environments associated with Windows.
6. Backend Technologies: PHP and C#.NET topped the list of backend technologies used, indicating a strong trend towards these options.
7. Artificial Intelligence Fields: Usage concentrated on neural networks and machine learning, with a need to enhance the use of other areas like robotics.
8. Network Systems: Cisco is the most popular choice in network systems (63.60%), followed by Huawei, reflecting Cisco's dominance in this field.

Overall, the results indicate significant challenges in graduate qualification and the provision of training opportunities, requiring a boost in training and professional development. They also reflect clear trends toward the use of specific technologies in various fields, providing important insights for both educational institutions and the job market.

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