**Telecommunications Engineering Department**
**Yarmouk University**
**Tempus Project No. 511074**

# A workshop on

# Curriculum Development of Telecommunications Engineering Programs--An Industrial Perspective

## Amman

## 16/10/2011

## Report

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# Preface

This report presents the themes and the recommendations of the workshop which was organized by the Telecommunication Engineering Department at Yarmouk University on the local telecommunications market needs to the proposed Master programs.

The objective of the workshop is to understand the demand for the proposed programs in order to be able to specify the characteristics and attributes of a successful Masters program. The results of this workshop will serve as input to the curriculum development phase of the new programs. This report highlights the main characteristics of the proposed programs and identifies the characteristics of potential new programs suggested to fill the gaps in the market.


Khaled Gharaibeh, PhD
Chairman of the Organizing Committee
Yarmouk University

# Acknowledgment

The authors of this report would like to thank the Education, Audiovisual and Culture Executive Agency (EACEA) of the European Union for providing funding for conducting this study and for publishing this report[1].

The authors would also like to thank a number of people who made this study a reality. Special thanks go to department heads of Electrical Engineering and Management at Yarmouk University, University of Jordan, Mu'tah University, German Jordanian University, NY Institute of Technology, Princess Summaya University and Jordan University of Science and Technology, for providing information about their Masters Programs.

# Organizing Committee

| Name | Institution |
|------|-------------|
| Khaled Gharaibeh | YU |
| Hazem Kaylani | GJU |
| Mahmoud Khassaweneh | HU |
| Safwan Tarazi | GJU |
| Nathir Rawashdeh | GJU |
| Mohammad Bataineh | YU |
| Mohammed Oqla | YU |
| Awni Itradat | HU |
| Noel Murphy | DCU |
| Connan Brennan | DCU |
| Felipe Penaranda | UPV |
| María del Carmen Bas Cerdá | UPV |
| Haythem Bany Salameh | YU |
| Osama Badarneh | YU |
| Mohammed Shamekh Oqlah | YU |
| Mohammed Bataineh | YU |
| Mohammed Banat | YU |
| Asem Al Zoubi | YU |
| Ahmed Al Omari | YU |
| Zaid Otom | YU |
| Abdul Rahman Zageebeh | YU |

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# Executive Summary

The Telecommunications Engineering Department at Yarmouk University is in the process of updating the curricula of its Master degree program and introducing two new Master programs entitles: Master of Engineering in Telecommunications Technology and Master of Engineering in Telecommunications Management that address the needs of the local and regional telecommunications market. These activities will be conduced through the Tempus project (European Union) which was awarded to the Department in July 2010. The project consists of a number of activities that all contribute to the establishment of new programs which meet the local telecommunication market. One of these activities is a workshop on Telecommunication market demand which aims to provide an avenue for discussion between the academic staff of the Department and representatives of local telecom industries on the needs of the local telecommunication market and the required qualifications of graduates.

The main objective of this workshop to provide the curriculum development workgroup with a number of recommendations to serve as input to the curriculum development processes. In addition, the workshop aims to be an avenue for a number of EU academics from a number of EU institutions to get introduced to the current state of the Jordanian telecommunication industry and to share experience on the best approaches to bridge the gap between academia and industry.

# Program

**Curriculum Development of Telecommunications Engineering Programs**
**An Industrial Perspective**
**Under the Patronage of**
**His Excellency Mr. Atef Al Tell**
Minister of Information and Communications Technology
**Date:** Sunday 16/10/2011
**Time:** 9:00 am- 5:00 pm
**Venue:** Jerasia Hall**,** LeRoyal Hotel**,** Amman

| | | |
|---|---|---|
| **9:00-9:30** | **Registration** | |
| **Opening** <br> **9:30-10:30** | **Keynote Speeches:** <br> **Dr. Khaled Gharaibeh- Tempus Project Coordinator- Yarmouk University** <br> **HE Prof. Abdullah Al Musa- President Yarmouk University** <br> **HE Mr. Atif Al Tal: Minister of ICT** | |
| **Panel Discussion** | | |
| **Session 1** <br> **11:00-12:30** | Management Skills Required for a Successful Engineering Career in Telecommunications Industry-Towards a Master Degree in Telecommunication Management | **Session Chair**: Dr. Khaled Gharaibeh, Yarmouk University <br> **Speakers**: <br> 1. Mr. Mohammed Ta'ani- Jordan Telecommunications Regulatory Commission (TRC) <br> 2. Didier Lilievre- CTO- Orange Jordan <br> 3. Mr. Omar Rashdan- Cross Borders <br> 4. Mr. Ahmed Jaghob- CTO Umniah |
| **Panel Discussion** | | |
| **Session 2** <br> **12:45-13:45** | Advances in Telecommunications Technology- Education vs. Training. | **Session Chair:** Noel Murphy, Dublin City University, Ireland <br> **Speakers:** <br> 1. Mr. Yousef Abu Mutawee- CTO-Zain-Jordan <br> 2. Tharwat Al Khateeb-Huawei <br> 3. Dr. **María del Carmen Bas Cerdá** -Polytechnic University of Valencia (UPV) <br> 4. Conor Brennan- Dublin City University |
| **Panel Discussion** | | |
| **Session 3** <br> **14:00-15:00** | Towards a National Framework of Qualifications for Telecommunications Engineers in Jordan | **Session Chair:** Dr. Mohammed Banat, Yarmouk University <br> <u>**Speakers**</u>: <br> 1. Mr. Kossai Tarazi-Mada Telecom <br> 2. Noel Murphy –Dublin City University <br> 3. Brigadier General Hatem Majali- Royal Jordanian Air Force |
| **Panel Discussion** | | |
| **Closing** <br> **Remarks** <br> **16:00-17:00** | • Summary of Recommendations <br> • Formation of an industrial advisory committee for the Tempus project at the Telecommunications Engineering Department | **Session Chairs** |

## Biographies of Speakers

| Speaker 1 | Name | Excellency Eng. Mohammad Al Taani |
|---|---|---|
| | Institution | Telecommunications Regulatory Commission (TRC) |
| | Title | Chairman of the Board of Commissioners and CEO of the |
| | Biography | Mr. Taani holds a B.Sc. degree in Electronics Engineering from the University of Southampton -United Kingdom. With over 28 years of experience in telecommunications and information technology field both in public and private sectors; Eng. Al Taani has broad experience in areas of strategic planning, business financials, sourcing, and human resources management. |
| Speaker 2 | Name | Mr. Didier Lelievre |
| | Institution | Jordan Telecom Group- Orange Jordan |
| | Title | CTO of Jordan Telecom Group- Orange Jordan |
| | Biography | Mr. Lelievre has been the Chief Information Technology and Networks Officer Jordan Telecom Group (Orange – Jordan) since August 2009. From the beginning of the 80s, Mr. Lelievre held various positions within Orange France Telecom Group, primarily in the domains of Networks and Quality and as Chief Technical Officer of Telecom Argentina the Argentine subsidiary of Orange France Telecom (1994-2000). Mr. Lelievre also acted as a Senior Consultant for the International Quality Organization. Mr. Lelievre graduated from Sup Telecom Evry and holds an MSc degree in Network and IS, and has attended leadership and business programs at IMD (Lausanne). |
| Speaker 3 | Name | Eng OMAR AL-RASHDAN- |
| | Institution | Crossborder Telecom |
| | Title | General Manager of Crossborder Telecom |
| | Biography | Mr. Rashdan is a U.S graduate with a B.S.C degree in Electrical Engineering. He also holds a master degree in Engineering Management from the University of Jordan. He worked at Orange Jordan as a traffic Engineer then worked his way up until he became the head of International sector. He was the chairman of the Arab league focus group and Vice chairman of TAS group within the ITU. He also was a frequent lecturer in a number of Telecom events like, GTM, ITW, capacity middle-east, etc. Now he is the General Manager of Crossborder Telecom a Newly licensed wholesale Telecom company. |
| Speaker 4 | Name | **Engineer Ahmed Jaghoub** |
| | Institution | Engineering Director Umniah |
| | Title | Engineering Director Umniah |
| | Biography | Mr. Al-Jaghoub joined Umniah since the early days leading engineering functions and operations. Before that he worked in the mobile field in many countries including the USA, Saudi Arabia and Sudan. He holds a BSc degree in Engineering from the Arab Academy for Science and Technology, Egypt and an MBA from the University of Leicester, the UK. |

| Speaker 5 | Name | **Engineer Yousef Abu Mutawe** |
|---|---|---|

| | | |
|---|---|---|
| | *Institution* | Zain Jo |
| | *Title* | CTO of Zain Jo |
| | *Biography* | Mr. Abu Mutawei has 16 years of telecom and commercial experience in mobile and fixed telecom operations. He is the founder and designer of many solutions and services, and he is currently heading the engineering team at Zain who are responsible for the planning and operation of Zain Jo network. Mr. Abu Mutawei managed to rank Zain Network as the best network in the region in terms of quality and agility; he managed to modernize the whole network of Zain Jordan and to deploy in a record time a nationwide HSPA+ network in Jordan. |
| *Speaker 6* | *Name* | Tharwat Al Khateeb |
| | *Institution* | Huawei Technologies (Jordan Office) |
| | *Title* | |
| | *Biography* | |
| *Speaker 7* | *Name* | Dr.  María del Carmen Bas Cerdá - |
| | *Institution* | Polytechnic University of Valencia (UPV) |
| | *Title* | Professor |
| | *Biography* | Dr. Bas Cerdá obtained a Mathematical Science degree from the *Universitat d´Alacant*. Currently, she is working at the Centre for Quality and Change Management (CQ) as a researcher in different areas such as multivariate analysis, design and analysis of surveys, sample design, generation of data bases. She also has experience as a teacher in two courses organised by the *Universitat Politècnica de València* named "Survey Design and Analysis of University Management" and "Tools for Quality improvement in University services". <br> She participated in different European projects linked to Higher Education Management ("Evaluation of the determinant factors of the competencies profile of the Spanish graduate universities", "Good Practices in University- Enterprise Partnership (GOODUEP)",…) and "European Indicators and Ranking Methodology for University Third Mission (E3M)" where she is still participating on the statistical part. |

| Speaker 8 | Name | Hatem Majali |
| --- | --- | --- |
| | Institution | Royal Jordanian Airfornce |
| | Title | Brig. General |
| | Biography | |
| Speaker 9 | Name | Dr. Conor Brennan |
| | Institution | Dublin City University- Ireland |
| | Title | Professor |
| | Biography | Dr. Brennan received his PhD from Trinity College Dublin in 1998 and joined the lecturing staff of the School of Electronic Engineering, Dublin City University (DCU) in 2003.  He is a member of the Royal Irish Academy's Committee on Communications and Radio Science and is a reviewer for many international journals. His notable teaching and learning activities include being the DCU coordinator on the Telecommunications Graduate Initiative, an inter-institutional structured PhD programme, (and one of the first to be developed in Ireland), as well as leading the development within DCU of 5-year integrated MEng programmes in a number of disciplines including Information and Communications Engineering.  He has served on several Engineers Ireland accreditation review panels as well as being a member of DCU's Quality Promotion Committee. |
| Speaker 10 | Name | Dr Noel Murphy – Dublin City University- Ireland |
| | Institution | Dublin City University- Ireland |
| | Title | *Professor* |
| | Biography | Dr. Murphy has been Head of the School of Electronic Engineering in Dublin City University for the last four years, and before that the Associate Dean for Education in the Faculty of Engineering & Computing for 2½ years. He has been lecturing in the School of Electronic Engineering since 1986 and has experience on a range of committees in DCU including Budget, Research, QA/QI and Teaching. He is currently a member of the Accreditation Board of Engineers Ireland and has participated in or chaired at least 20 accreditation panel visits by Engineers Ireland to third-level institutions within Ireland. |
| Speaker 11 | Name | Engineer Kossai Tarazi |
| | Institution | Mada Telecom |
| | Title | Radio Network Manager |
| | Biography | Mr. Al Tarazi obtained his BSc degree in Electrical Engineering from Jordan University of Science and Technology in 2003 and his MSc degree from Wichita State University- the US in 2006. He is currently a Radio Network Manager at **Mada Communications.** |

# 1
# Introduction

The existing Masters program offered by the Telecommunications Engineering Department at Yarmouk University was started in 2004 and offers a Masters of Science (M.Sc.) degree in Wireless Communications. The program admits students who have a B.Sc. degree in Telecommunications Engineering or related disciplines. The program is operated by 17 faculty members most of which are PhD holders and have relevant academic experience.

The curriculum of this program was developed by the Department staff in 2003 and was approved by the Jordan Ministry of Higher Education (MOHE). The curriculum development was based on a survey of similar programs in Jordan, the EU and the USA, and was guided by program specifications mainly prescribed by both Ministry of Higher Education (MOHE) and the Department standards. These standards consist of a detailed list of necessary subjects, course contents and associated contact hours. Hence, the curriculum development process was input driven and the curriculum was based on compulsory core curricula expressed by core subjects, plus a variety of elective subjects that allow enhancement of the outcomes of the program.

One of the main shortcomings of the existing curriculum is that it was completely based on academic opinion and did not consider the needs of the local and regional telecommunications market. Furthermore, the curriculum did not have a periodic and formal procedure for obtaining or processing feedback from the industry and from its graduates. Therefore, it was necessary to reform and update the existing curriculum in accordance with the needs of local industry as well as with the best practices in EU partner universities. The objective of the curriculum reform process is to provide a new program with up-to-date curricula which address the needs of the local market and produce graduates who are competitive and can keep pace with dynamic labor market needs and advances in telecommunication industries.

In order to achieve this objective, the department sought funding from the EU through the Tempus Program in order to conduct curricular reform and to introduce new study tracks within the existing Masters program at the Department. The Department applied for Tempus funding in March 2010 and was awarded a grant in July 2010 for a project which addresses curricular reform of its Masters program. The project consists of a number of activities with the objective of reforming the existing curriculum and the introduction of new study tracks within the exiting Masters program which address the needs of the local and regional telecommunications market.

The first planned activity within the project was to conduct a review of the existing curriculum by academic as well as non-academic experts from Jordan and the EU in order to point out the weaknesses and strengths of the existing program and produce guidelines on the set of improvements required in the proposed curricula. The second planned activity is to establish a business case for the requirement and feasibility of the new tracks, and its consistency with the goals of YU. This step corresponds roughly to Workpackage 2 "Competition and Demand Analysis". The work package consists of conducting a competition analysis to compare the proposed program with other existing programs, a demand analysis of the proposed programs to determine the requirements of the labor market with regard to curriculum development and quality of graduates and holding a workshop to

discuss the demand and to draw a list of outcomes for the new programs. The results of these activities will serve as an input to the curriculum development process.

The workshop was held on Oct. 16th, 2011 at the LeRoyal Hotel in the city of Amman, Jordan and was attended by about 120 professionals from the telecom industry and relevant governmental institutions. A number of speakers delivered presentations on their views regarding the proposed Master programs and discussions were made on the outcomes of these programs.

In this report, recommendations drawn from presentations and discussions at the workshop are presented. These recommendations are then used to develop a list of program outcomes for each of the proposed programs.

The remainder of this report is organized as follows: Chapter 2 presents a summary of presentations, Chapters 3 presents the main recommendations of the workshop, Chapter 4 provides a list of program outcomes drawn from the recommendations and Chapter 5 consists of some conclusions and remarks.

## 1.1   The Telecommunications Engineering Department at YU

The Telecommunications Engineering Department at Yarmouk University was established in 1989. Located in the city of Irbid, Jordan, the department plays a vital role in providing the market of local and regional industries with high level engineering graduates. The Department offers both B.Sc. and M.Sc. degrees in Telecommunications Engineering and Wireless Communications Engieering. These programs are operated by 17 faculty members, of whom 90% are PhD holders. The offered programs attract outstanding students from Jordan and neighboring countries with an average class of around 150 per annum. Currently, there are around 850 students (800 at B.Sc. level and 50 at M.Sc. level) of which approximately 10% are from neighboring countries. The number of graduates has exceeded 2000 engineers who enjoy a high employability rate in Jordan and the region.  As well as this,  the Department  has distinguished itself by offering a training program for students that provides them with a "live" experience in leading companies in Jordan and abroad, which provided strong industry ties for the faculty members as well as enhanced employment opportunity for its graduates.

## 1.2 The Tempus Project

The main objective of the Tempus project is to modernize the existing Masters of Science program in Wireless Communications at the department and to introduce new tracks that provide strong linkage to local and regional industries and contribute to providing international recognition for our programs in the area of Wireless Communications.

The project consists of a number of activities, which will be conducted over a period of 3 years and range from review of the existing curricula to the establishment of new programs and building capacity at the Department. The project consists of 28 deliverables grouped under a number of work packages as shown in Table 1.

**Table 1: Tempus project work packages and deliverables.**

| WP No. | WP Type | Del No. | Deliverable Title |
|--------|---------|---------|-------------------|
| WP.1 | Development | 1 | Review of Existing Curriculum |
| WP.2 | Development | 2 | Competition Analysis |
| WP.2 | Development | 3 | Demand Analysis |
| WP.2 | Development | 4 | Local Market Needs |
| WP.3 | Development | 5 | Visits of Jordanian Partner Academic staff to EU |
| WP.3 | Development | 6 | EU Educational System Seminar |
| WP.4 | Development | 7 | Professional Development of Local Academic Staff |
| WP.4 | Development | 8 | Fully Prepared Curriculum Drafts |
| WP.4 | Development | 9 | Fully Prepared Course Material |
| WP.4 | Development | 10 | Curriculum Drafts Finalized |
| WP.5 | Development | 11 | Student Selection Criteria Implemented |
| WP.5 | Development | 12 | Student Evaluation Process Implemented |
| WP.5 | Development | 13 | Courses Taught by Local Staff |
| WP.6 | Quality plan | 14 | Quality Control Plan |
| WP.6 | Quality plan | 15 | Information System for QC of Curriculum |
| WP.6 | Quality plan | 16 | Progress Reports |
| WP.6 | Quality plan | 17 | Budget Review |
| WP.7 | Management | 18 | Memorandum of Understanding |
| WP.7 | Management | 19 | Coordination Meeting |
| WP.7 | Management | 20 | An Electronic Database |
| WP.8 | Dissemination | 21 | An Informative Web site |
| WP.8 | Dissemination | 22 | New Program Features Disseminated |
| WP.8 | Dissemination | 23 | Students Recruitment |
| WP.9 | Exploitation | 24 | Curriculum Approval and Accreditation |
| WP.9 | Exploitation | 25 | Collaboration with Local Telecom Industry |
| WP.9 | Exploitation | 26 | A network of Collaboration with EU institutions |
| WP.9 | Exploitation | 27 | Quality Control Unit |
| WP.9 | Exploitation | 28 | Lab Equipment |

## 1.3 The Proposed Programs

The Tempus project is intended to result in the reform of the existing M.Sc. program in Wireless Communications and the development of two new Masters programs; namely:

- a Masters of Engineering in Telecommunications Technology
- a Masters of Engineering in Telecommunication Management.

These new programs were proposed based on an initial study of the market needs in Jordan and on a number of studies conducted in the last few years on the relationship between the market needs and the curriculum development processes of engineering programs. In these studies, it was observed that graduates usually pursue their higher studies by selecting either the technical path to enhance their knowledge in certain engineering topics, or the management and business path to enhance their managerial skills. The new programs are expected to provide students with the skills and knowledge required to be successful in both paths and to provide the market with highly skilled graduates who can

take pace with the changing telecommunications market. The new programs are expected to be developed, accreddited and operated throughout the lifetime of the Tempus project at the Department. The proposed programs are expected to provide the Jordanian and regional markets with qualified Telecommunications engineers who are capable of working in the quickly-growing telecommunications market in Jordan and the region. Furthermore, these programs are expected to gain an international recognition by EU professional bodies given that the development of these programs will be done in cooperation with a number of EU educational institutions who are known for their experience in the development of such industry-oriented study programs.

This section outlines the essential characteristics of each of the proposed programs which were developed through the various project activities such as the curriculum review, awareness visits of the Department academic staff and the various meetings with representatives of local industry and with academic staff of EU partner institutions. Although the details of these programs will be developed through the curriculum development phase of the project, the developed description of these programs is used to set the stage to develop a detailed structure and contents of each program.

### A. Masters of Engineering in Telecommunications Management

To be successful in the business environment, it is important that engineers have good managerial, personal, and analytical skills, as well as the ability for decision making. The objective of the Telecommunication Management program is to prepare students to be managers in telecommunication business environments.

This program will provide students with knowledge in both telecommunications engineering and business administration disciplines, which are needed to progress in the telecom business industry. This program will target engineers working in the telecom industry, as well as fresh graduates who seek to improve their management and technical skills. The telecommunications management program will give students a broad educational background and skills that will allow them to be creative, entrepreneurial leaders and to move among telecom careers and disciplines.

As the program would be intended to focus, not only on theoretical knowledge, but also on business administration skills, this program would have a significant overlap with MBA programs which attract telecommunications engineers who wish to enhance their managerial skills.

### B. Masters of Engineering in Telecommunications Technology

The objective of this program is to provide students with the technical and professional skills needed to be successful in the technical side of the telecommunications business, including technical knowledge on latest telecommunications technology, as well as management skills. Courses offered by this program should focus on practical aspects of telecommunications technology and not on engineering science.

### C. Masters of Science in Wireless Communications Engineering

The objectives of this program are to provide students with sufficient background and research abilities to pursue education beyond Masters level. This program already exists at the Department and will be reformed through the activities of the Tempus project. The topics offered by this program include; mobile communications, digital communications, wireless networks, antennas and propagation, digital signal processing, communication networks, microwave engineering and probability & stochastic processes.

The objective of the curriculum reform process in this case is to redesign the curriculum of this program in order to offer an internationally recognized degree and to provide students with the research skills and knowledge required for a successful career in academia.

## *1.4   The Workshop*

The workshop on local market needs is part of Work Package 2 (WP2) on Competition and Demand Analysis. This work package consists of three deliverables, which are:

- Deliverable 2 - Competition Analysis

- Deliverable 3 - Demand Analysis

- Deliverable 4 - Workshop on Market Needs.

The following are the descriptions of the Work Package and the Deliverable 4 as stated in the project proposal:

### Description of work package

*"Conduct a competition analysis to compare the proposed program with other existing programs. This Includes collection of information about existing similar M.Sc. programs in Jordan including their program objectives, outcomes, teaching material, teaching methodologies, ability for credit transfer, target audience and employability of graduates. This analysis will serve as input to the design of the program curriculum and program structure.*
*Perform a demand and statistical analysis of the proposed program by forming joint committees with local industries to determine the requirements of the labor market with regard to curriculum development and quality of graduates.*
*A workshop will be held with participation from major telecommunication companies in Jordan in order to collect data on the needs of these companies with regard to telecommunications engineers and professionals.*
*The result of this analysis will serve as an input to the curriculum development process. YU, HU and GJU will be responsible of organizing the workshops and collection of the data and the EU partners will provide consultation on the methodology of analyzing the market demand."*

### Description of Deliverable 4

*A workshop will be held with participation of staff members of all project partners and representative of the major telecommunication companies to discuss the market needs and the quality of graduates and statistical data about the employability of graduates in the past years. This workshop will result in a number of recommendations which will be input to the curriculum development process.*

The objectives of the workshop can be summarized by the following:

1. To get introduced to the state of local telecom market and its needs
2. To understand the strengths and weaknesses of existing programs offered by YU and similar programs offered by other competing universities locally and in the region.
3. To draw a list of program learning outcomes and skills needed to meet local market needs and international best practices.
4. To help local project partners establish and implement their Masters of Science programs in telecommunications engineering at their own institutions.
5. To help EU project partners to learn about the telecommunications industry in Jordan and the region.
6. To establish a network of collaboration with local telecom industry which will contribute to the sustainability of programs offered by the Department.

The workshop is expected to result in the following outcomes:

1. A basis for the curriculum development of three Masters Program tracks: Wireless Communications, Wireless Networking Technology, and Telecommunications Network Management.
2. A list of program learning outcomes and skills needed for the development of the new programs
3. Suggested contents, objectives, outcomes, and other attributes for the proposed Masters degrees.
4. A network of collaboration with local telecom industry through the formation of an industry advisory committee.

## 1.5    The Work Group

The work group for Deliverable 4 consists of 18 faculty members from all project partners in addition to a number of supporting administrative staff. The work group was responsible for designing the workshop program including themes, topics and the choice of speakers as well as for the logistics of the workshop including publications, invitation letters and establishing a network with local industry.

The project partners played different roles to make the workshop a successful event. Given the experience of GJU in conducting market analysis in the past three years for its study program, GJU staff played a big role in determining the audience of the workshop. The role of the EU partners was focused on designing the workshop program and promoting the EU education approach to the audience of the workshop. Furthermore, the EU partners (mainly UPV) were also responsible of providing the JO staff with the tools to analyze the data gathered from questionnaires and discussions at the workshop and also writing this report given their experience in similar activities. This collective experience made the workgroup ideally suited to achieve the objectives of the workshop.

## 1.6    Target Groups

The target groups are experts from a broad range of potential stakeholder of the proposed programs. This includes the following:

- Major mobile operators such as Orange, Zain and Umniah
- Major internet service providers such as Mada Telecom, WiTribe,
- Telecom Equipment vendors: Huawei, Motorola, LG
- Government: Telecommunications Regulatory Commission (TRC), Ministry of ICT, HE Accreditation Commission, KADDB
- Military: Army, Air force, Civil Defense, Public Security and Intelligence Dept.
- Academic Institutions: Jordan University, German Jordanian University, Blaqaa University, Mutah University, Tafielah Technical University, Princess Summaya University and Hashemite University.
- Partner Academic Institutions from EU: DCU and UPV

Figure 1 shows the number of representatives from each of the above target audience.
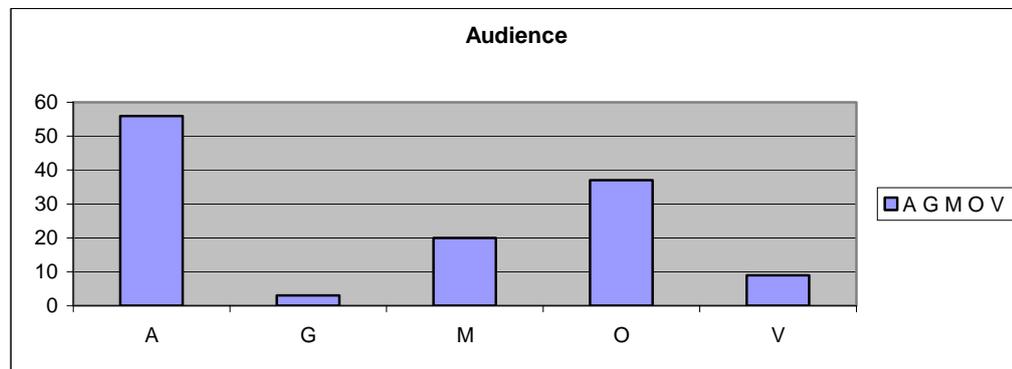
**Figure 1: Distribution of the workshop participants: A: academia, G: government, M: military, O: telecom operators and V: telecom vendors.**

## *1.7    Themes*

The workshop featured the following themes where discussions are confined to the following topics:

1.  Management Skills Required for a Successful Engineering Career in Telecommunications Industry-Towards a Master Degree in Telecommunication Management:

    *   Why the Jordan telecom market needs a master program in telecom management?

    *   Management of telecommunication services.

    *   Telecommunication network management.

    *   Considerations and thoughts for Master degree in Telecommunication Management

    *   How a Master degree in Telecommunication Management could improve the performance of engineers in management positions or influence their career path.

    *   Suggested skills and fields of knowledge for a master degree in Telecommunication Management

2.  Advances in Telecommunications Technology- Education vs. Training.
    *   Approaches for dealing with new and emerging technologies with regard to training of engineers.
        o   Networks, and equipment,
        o   Support for next generation networks (NGN).
    *   How university degrees can address new technologies in their curricula.
    *   Requirements for engineering curricula that address the needs of telecommunication industry
    *   How a Masters degree in Telecommunication Technology could shorten the training cycle of telecommunications engineers.

3.  Towards a National Framework of Qualifications for Telecommunications Engineers in Jordan

    *   National framework of Qualifications for Telecommunications Engineers
    *   Current state of R&D in Telecommunications companies  in Jordan
    *   Role of universities in providing skilled engineers who can work in R&D

# 2
# Presentations and Discussions

The workshop featured 11 presentations by a number of experts from local telecom industry, academia and governmental officials. The following is a summary of the presentations.

## *Paper No. 1:*

**Title:** Management Skills for a Successful Engineering Career in Telecommunications Industry
**Speaker**: Mohammed Ta'ani- CEO of Telecommunications Regulatory Commission
**Main Points:**
1. Participation in the workshop aims to be part of a thematic input to the objectives of this event, through high level practical industrial perspective
2. Need to understand the enterprise business model

- *FINANCE:*
    o *Accounting*
    o *Capital*
- *PRODUCTION:*
    o *Sourcing*
    o *Making*
- *MARKETING:*
    o *Advertising*
    o *Selling*

**What is common to both external and internal views in the *Enterprise Objectives?***
- *Multiple functions*
- *Multiple  processes*
- *Interacting relationships*
3. **With this diversity and multiplicity of functions and relations, one can define management as:**

*"The need to utilise resources (people, time, capital and materialistic assets) in the most optimum manner run processes efficiently to fulfill the business objectives"*

**How do we build it: the path of the journey:**
- Learning
- Skill development
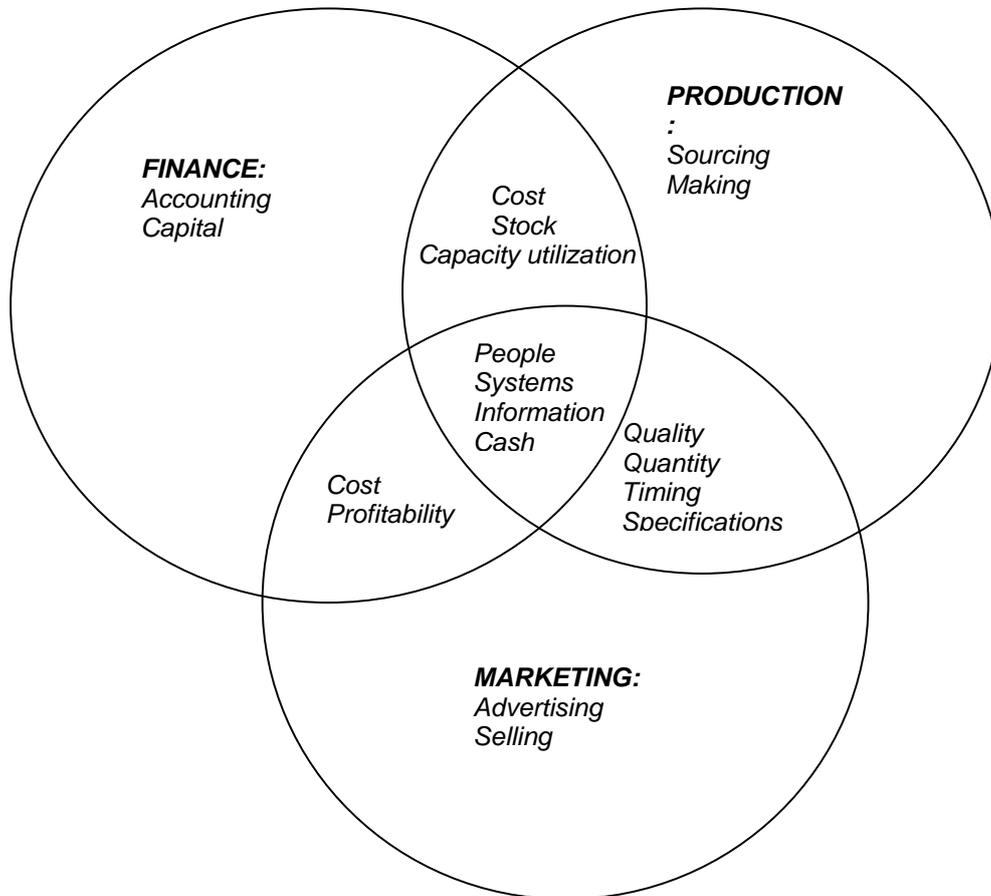- Expertise through practice

**Figure 2: Management in telecom business.**

## 4. Government Role

Within the context and scope of the ICT part relevant to this workshop, the government has a dual fold role:

- Setting ICT sector policy and associated strategies with objectives that will result in the creation of jobs in the sector.
- Inclusion of reference articles that will encourage the industry and educational institutes to work together while promoting R&D.

The 2007 policy as well as the new policy (under development) contains the above

*Quotes of the Statement of the Government policy of 2007 "relevant to the subject"*

- 75) Government encourages the TRC and all parts of the ICT Sector to invest in the specialist human resource skills, in particular in economics, which are necessary to maintain a proper debate on regulatory matters.
- (82) Government requires that IT contribute to the means by which the nation's human assets may be developed in educational and socioeconomic terms.
- (83) In that regard, Government will continue to support relevant programs and initiatives, including working with relevant stakeholders to support the Life Long Learning Initiative.
- (103) Government will encourage industry and educational institutions to work together to improve and maintain the suitability of university syllabi to match the requirements of the

Information Society, both in IT courses and to ensure appropriate IT awareness in other courses. In collaboration and coordination with the private sector, Government also will assist in encouraging the availability of advanced IT training to Jordanians throughout their careers, so that Jordanians may obtain and maintain the knowledge necessary to equip them for the broadest range of employment opportunities.

- (104) Government will encourage the IT industry to work with the universities and other R&D institutions to create R&D programmes to enhance the development of IT in Jordan and its capability for export, providing tax incentives where appropriate.

5. **National ICT Strategy goals**

- Internet usage penetration to reach 50% (from the 2007 rate of 11%).
- ICT sector revenues to reach USD 3 billion (from the 2007 revenues: USD 1.5 billion).
- ICT sector employment to reach 35,000 jobs (from the 2007 number of jobs: 16,000 jobs).

## *Paper No. 2:*

**Title**: The Technical needs of a Telco Company-A proposition from the ITN Excellence project
**Speaker**: Didier Lelievre-CTO Orange Jordan
**Main Points:**

1. Orange 2012: initiatives focused around 3 priorities
   - Simplicity: simplify the customer experience
   - agility: enhance the agility with which the Group carriers out its business
   - sustainability: ensure performance that is durable over time
2. Several business drivers for ITN evolution requiring refreshed architecture and infrastructure
   a. new architecture optimized for packet traffic and video services needed
   b. renovated information system, customer centric and modular
   c. use of APIs for internal & external interfaces
   d. "old" circuit switched technologies phase out needs to be prepared
   e. specific low cost solutions needed for low revenue or small size markets
   f. evolution towards green infrastructure
   g. need for new technologies with lower cost to serve
3. ITN vision for 2012
   - In developing markets
     o improve the cost structure in order to reach profitability over the largest proportion of the population
     o improving in particular backhaul and energy economics
     o introduce market-relevant services to develop usage of communication technologies
     o E.g. with broadband solutions adapted to these markets
   - In mature markets
     o develop once, deliver everywhere
     o a renovated IT infrastructure,
     o supporting a converged, access-independent service infrastructure using IMS
     o enhanced by a strong network storage offering enabling customers to store their personal production
     o accessed and delivered over a broadband infrastructure
     o associated with a leading international backbone, supporting advanced IP routing technologies
4. **ITN Job lines Cartography** in the Orange 2012 framework (See Figure 3):
   Needed Skills:
   - IS- Architecture
   - Service Platform
   - Wireless Access
   - Core Network
5. Need for Engineers who can deal with new technologies, mainly IP Technology since IT and Network are merging in order to support the Shift from TDM to IP Technology
6. Need for Engineers who have management skills and can communicate effectively between different levels of management (first and second level).

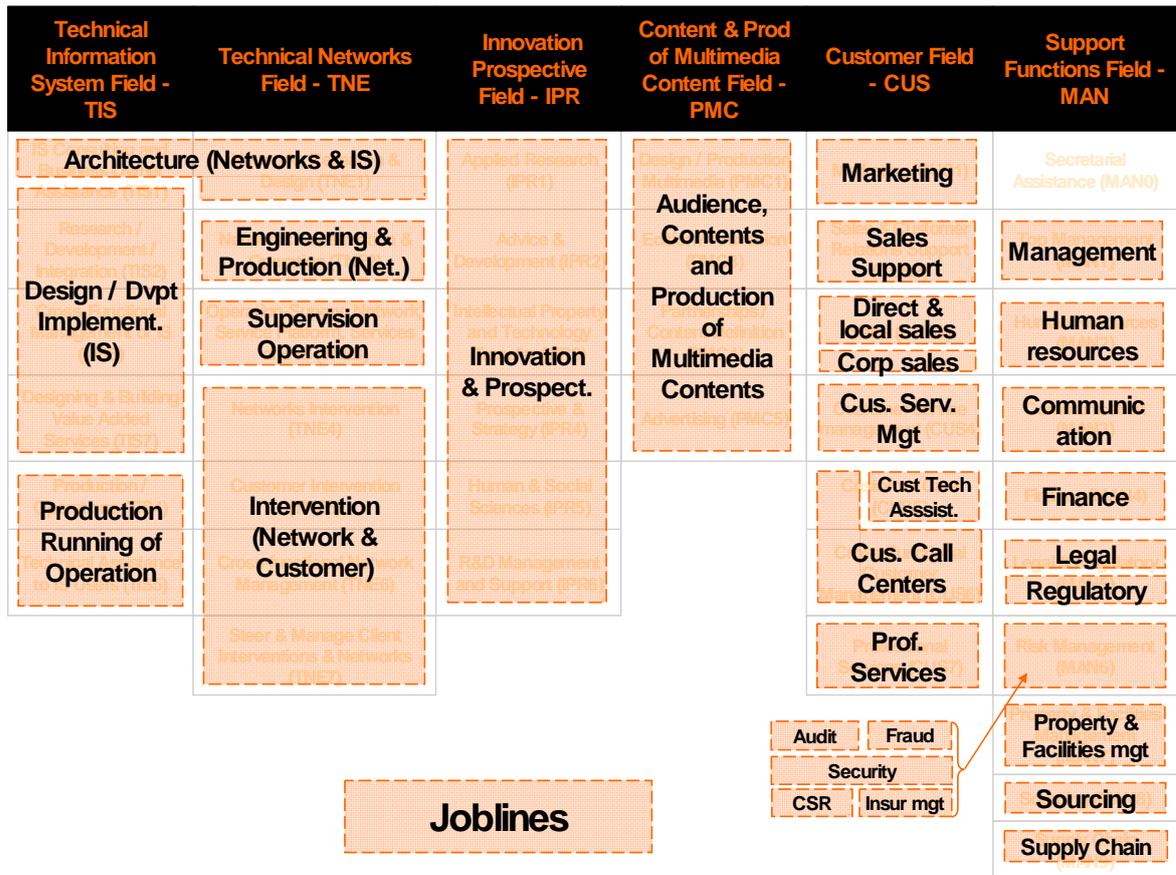| Technical Information System Field - TIS | Technical Networks Field - TNE | Innovation Prospective Field - IPR | Content & Prod of Multimedia Content Field - PMC | Customer Field - CUS | Support Functions Field - MAN |
|---|---|---|---|---|---|
| Architecture (Networks & IS) | | Applied Research (IPR1) | Design / Production Multimedia (PMC1) | Marketing | Secretarial Assistance (MAN0) |
| Research / Development / Innovation (TIS1) | Engineering & Production (Net.) | Advice & Development (IPR2) | Audience, Contents and Production of Multimedia Contents | Sales Support | Management |
| Design / Dvpt Implement. (IS) | Supervision Operation | Intellectual Property and Technology | | Direct & local sales | Human resources |
| | | | | Corp sales | |
| Designing & Building Value Added Services (TIS7) | Networks Intervention (TNE4) | Innovation & Prospect. | | Cus. Serv. Mgt | Communication |
| Production Running of Operation | Customer Intervention | Human & Social Sciences (IPR5) | Communication Advertising (PMC5) | Cust Tech Asssist. | Finance |
| | Intervention (Network & Customer) | R&D Management and Support (IPR6) | | Cus. Call Centers | Legal |
| | | | | | Regulatory |
| | Steer & Manage Client Interventions & Networks (TNE7) | | | Prof. Services | Risk Management (MAN6) |
| | | | | Audit   Fraud | Property & Facilities mgt |
| **Joblines** | | | | Security | Sourcing |
| | | | | CSR   Insur mgt | Supply Chain |

**Figure 3: ITN Job lines Cartography in the Orange 2012 framework**

## *Paper No. 3*

**Title**: Telecommunications Management- A Life Experience
**Speaker**: Omar Rashdan- GM Cross Border
**Main Points:**
1. **Telecom Management Concept Includes:**
   - People: Different disciplines are normally involved
     - Engineers
     - Business (Sales, Marketing)
     - Finance
     - Others

   *Managing people of different disciplines is an art*
   > *"It's always easier to make an engineer a manager than to make an administrative an engineer"*

   - Equipment : Software/hardware management, either (local or remote)
   - Products : Sales & Marketing  management
   - Finance: Companies Operate to Make Money , so basic financial knowledge is a must:
     - book keeping of  in/out spending
     - balance sheet
     - budget
   - Legal and Regulatory: Knowledge in the rules and regulation of the country of operation is a must for any business to succeed.

   Management is *a mixture of managing people, equipment, products, services, finance, legal & regulatory, using common sense.*

2. **Regulation of Telecommunication Sector is management:**
   - In  Jordan, the TRC is an independent regulatory body which was e*stablished in 1995 according to Telecom Law No 13 to:*
     - Issues Licenses to operators.
     - Monitors licensees performance
     - Ensures fair competition
     - Regulates the market when needed in terms of prices …..etc
   - On the regional level, Jordan is a member of Arab League, and there is a body which looks after Telecom Sector there called: the *Arab Council of Telecom. Ministers.* This Body is responsible for :
     - Setting standards of Telecom sector in the Arab World.
     - Deciding on prices of services.
     - Mutual projects across the Arab world.
     - Deciding on the relation with other similar bodies.
     - Looking after Arabic continent on the internet.
     - Deciding on the collective measures which should be taken while discussing Telecom related matters in int'l forums.
   - On the Global Level, **ITU** was founded in Paris in 1865 as the "*International Telegraph Union*".
     - It took its present name in 1934, and in 1947 became a specialized agency of the United Nations. Although its first area of expertise was the telegraph, the work of **ITU** now

covers the whole **ICT** sector, from digital broadcasting to the Internet, and from mobile technologies to **3D TV**.

- o An organization of public-private partnership since its inception, **ITU** currently has a membership of 193 countries and some 700 private-sector entities.
- o **ITU** is headquartered in Geneva, Switzerland, and has twelve regional and area offices around the world.

3. **ITU Structure: Simple View**

- *Radio Communication Sector (ITU-R)*

Management of the radio- frequency spectrum and satellite orbits used by services such and fixed, mobile, broadcasting, space research, meteorology, global positioning system, environmental monitoring and safety of life at sea and in the skies.

- Telecommunication Standardization Sector (ITU-T)

Establish internationally agreed technical and operating standards "recommendations" for networks and services.

- *Telecommunication Development Sector (ITU-D)*

Assistance to developing countries to facilitate connectivity and access, foster policy, regulatory and network readiness, expand human capacity through training programs, formulate financing strategies and e-enabled enterprise in the developing countries.

4. **Internet Role**

- Easy Management either locally or remotely.
- Used as transmission media for Telephony.
- Reduced prices for making calls, and as a result increased in traffic volumes.
- Run more applications than just voice.
- Availability of portable services.
- Cheaper infrastructure.
- Widespread servers which provide better security.
- Reduced needed times for interconnections

5. **Recommendations:**

- We have to admit that we lack experience in **Telecom Management**

- Any Master degree in Telecom Management should include the various disciplines talked about earlier into consideration.

- There should be a practical part with real case studies of this program, before degree is granted.

- It would be nice and advisable if the program includes between now and then speakers from the market to widen practical knowledge.

- Visits to various entities in the course of the program is also advisable but with a check list of the things a student wants to know prepared in advance and should be the same to all student and all entities .

## *Paper No. 4*

**Title: Notes on Master for Telecom Management Engineering Department**
**Speaker**: Ahmed Jaghoub-Umniah
**Main Points:**

1. **Engineering Departments at Telecom Companies consists of the following functions:**
   o Core Networks
   o Radio Planning and Optimization
   o Transmission and Infrastructure
   o Projects Management
   o Performance
   o Operations and Maintenance
   o NOC
   o IP Networks
   o Managed Data Service and Networks
   o BSS
   o Telecom Implementation

2. **Required knowledge and skills**
- Self Motivation, Presentation Skills which can be achieved by coaching
- Technical skills:
   o Traffic Management
   o Performance Management
   o Transmission Techniques
   o IP Networks and Digital Switching Concepts

- Management skills:
   o Accounting for Managers
   o Telecom Civil Projects for non Civil Engineers
   o Local and International Regulatory Basics
   o Strategy Development and Management
   o Resource Management, People Management

3. **There is a need to a Management degree similar to MBA but no Marketing and Sales.**
- Suggestion for a possible title of such a degree: A Master in Telecommunications Management (MTA )
- Suggested ideas for such a degree:
   o Embed basic courses in the Undergraduate Curricula
   o To suit multi managerial levels, Major courses + Specialization and Theses in certain field of Telecom operations
   o Other Technical fields might be tackled like VAS, Billing, Presentation Skills
   o Vendors/Suppliers Management Skills, Negotiation Skills
   o Clear Awareness is necessary for Market and Industry
   o Entrant to the program must have at least 3 years of experience

## *Paper No. 5*

**Title:** Curriculum Development of Telecommunications Engineering Programs-An Industrial Perspective
**Speaker**: Tharwat Al Khateeb – Huawei
**Main Points:**

1. Telecom evolution is going exponentially, in the 20th Century the telecommunication was so difficulty and limited. And just limited people can enjoy these limited services, at the beginning 21st Century , life became faster, and a booing happen in the telecom industry, the new technologies have been created Voice, Video, Data and Mobility , and booming in the VAS.. The technologies became available for people, which make it one of the best investment fields in the Markets.

2. Telecom Evolution vs. Curricula evolution

Universities Telecom Curricula is Not Matching the telecom industrial evolution and the GAP is increasing- (See Figure 4).
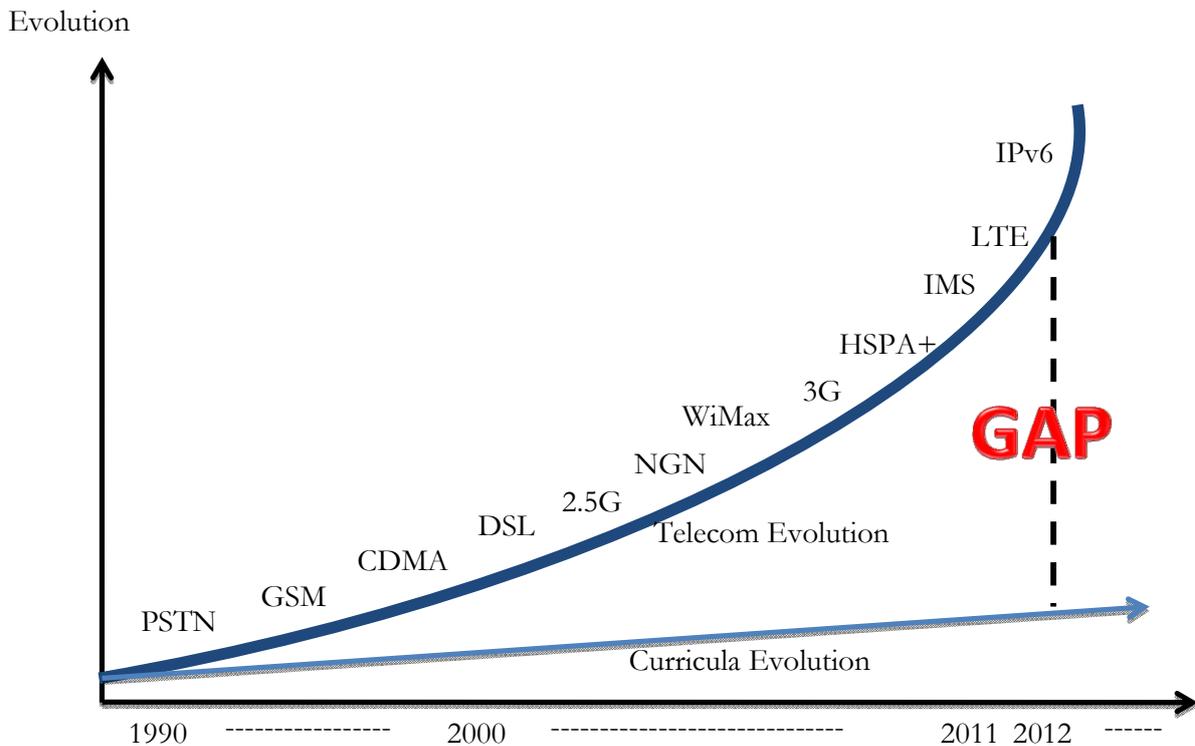


**Figure 4: Telecom evolution vs. curricula evolution.**

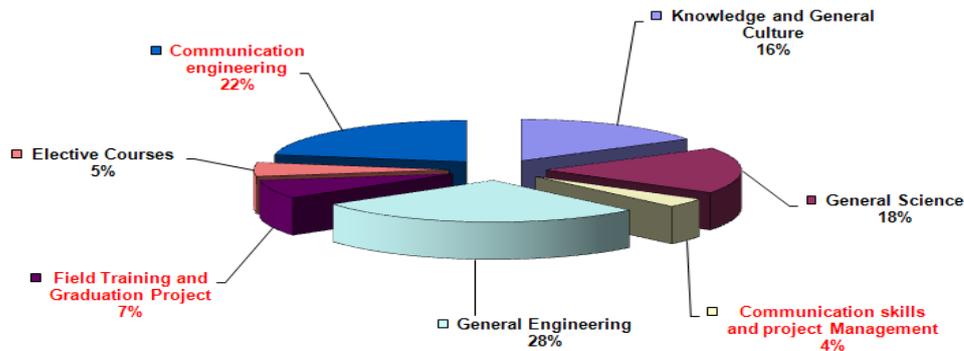Bachelor Telecom engineering Curricula Courses
Distribution



**Figure 5: Distribution of courses in a Jordanian program in telecommunications engineering.**

Graduated engineers graduating with a degree in Telecom Engineering have the following Pain Points

- No technical skills
- Unknown Competence
- Jobless
- Not Familiar with Technologies
- Saturated with Mathematics and fundamentals

## 3. What Can We Do?

Learning is one Possession no one can take a way from you.

- a. Understand the problem and the need of the change
- b. Determine the Main Target
- c. Build partnerships
- d. Create the Curriculum Development PIP
- e. Serious implementation and FOLLOW UP

## 4. What is The Main Target?

A. Graduate Qualified Engineers for the ICT Market

- Familiar with the technologies and their applications (UMTS, IMS, IPv6…)
- Familiar with  standard telecom protocols (ITUT &3GPP)
- Familiar with basic and standard telecom equipment, MSC, SGSN, RNC…
- Can design, analyze the basic telecom networks
- Have the basic technical engineering skills
- Self-confident
- Ability to search

## 5. Partnership

After determining the Project Target, its important to determine the project stakeholders and the partners is one of the important stockholders.

- Telecom VENDOR
- Telecom Operators
- EU institutions

Role of the Partners:

- Analysis and Forecasting
- Training centers and R&D
- Telecom Equipments
- Workshops
- Technical experts
- Support in the Labs

**Table 2: Challenges and solutions in telecom bussiness**

|    | Challenges | Solutions |
|----|------------|-----------|
| 1  | Fast Growing Bandwidth Needs. vs. Profitability | ALL IP Transformation |
| 2  | Full Service IP Ntwk vs. Telecom Capability | Telecom IP |
| 3  | 1B new Mobile Subs Size but Poor profitability | Low ARPU Solution |
| 4  | Ubiquitous BB vs. Huge Network Cost | Mobile Broadband Solution |
| 5  | Multiple Access， Ntwk Evolution vs. Tech. Revolution | Single RAN |
| 6  | Huge Traffic growth vs. Ntwk. Capability | Tera-Scale Bearer， CDN |
| 7  | Voice Contributes 70% Revenue vs. cont. declining ARPU | Voice Search |
| 8  | De-coupled Data Traffic & Revenue | Smart Pipe |
| 9  | Trillions US$ Internet info Service mkt. vs. positioning strategy | Content/Media/AD Transformation |
| 10 | Mass info processing vs. Poor Traditional IT cost-effectiveness | Next Generation Data Center |

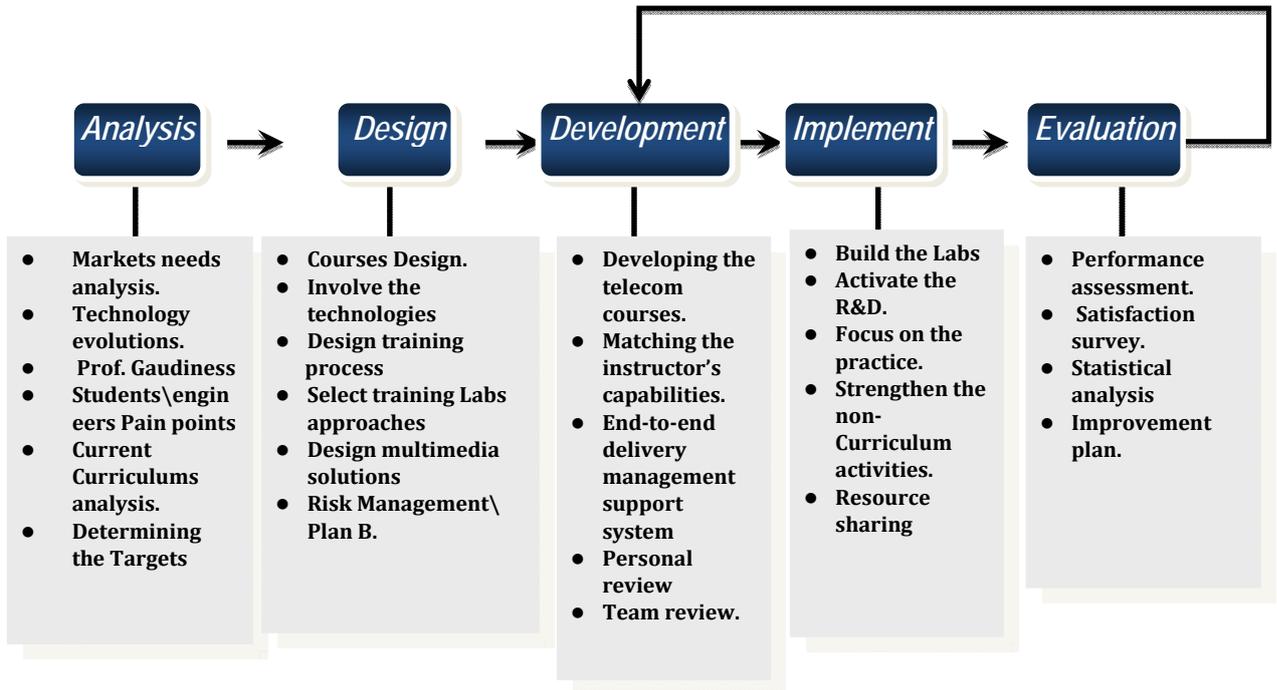**6.** Curriculum development performance improvement plan (PIP) (See Figure 6).

| Analysis | Design | Development | Implement | Evaluation |
|---|---|---|---|---|
| • **Markets needs analysis.**<br>• **Technology evolutions.**<br>• **Prof. Gaudiness**<br>• **Students\engineers Pain points**<br>• **Current Curriculums analysis.**<br>• **Determining the Targets** | • **Courses Design.**<br>• **Involve the technologies**<br>• **Design training process**<br>• **Select training Labs approaches**<br>• **Design multimedia solutions**<br>• **Risk Management\ Plan B.** | • **Developing the telecom courses.**<br>• **Matching the instructor's capabilities.**<br>• **End-to-end delivery management support system**<br>• **Personal review**<br>• **Team review.** | • **Build the Labs**<br>• **Activate the R&D.**<br>• **Focus on the practice.**<br>• **Strengthen the non-Curriculum activities.**<br>• **Resource sharing** | • **Performance assessment.**<br>• **Satisfaction survey.**<br>• **Statistical analysis**<br>• **Improvement plan.** |

**Figure 6: Curriculum development performance improvement plan (PIP).**

Paper No. 6

**Title**: Advances in Telecommunications Technology
**Speaker**: Yousef Abu Mutawei
**Main Points:**

1. Jordanian Market
   - 36% of Jordan population are under 14 years old
   - Urban population is 78%
   - GDP (Purchasing power parity) GDP PPP is 33 billion USD
   - GDP (official exchange rate) 27.1 billion USD
   - GDP PPP per Capita is 5000 USD
   - Growth in GDP is 5.8%, 2.4% and 3.2 for the years 2008 to 2010
   - Mobile penetration is around 115%
   - 1.64M Internet users , 26% of the population
   - 43K Internet hosts (worldwide rank is 92)
2. Key Challenges
   - Severe drop in revenues
   - Addiction to new communication channels.
   - Competition between telecom operators
   - Building solid digital infrastructure.
   - Shift from being a network guarantor and business enable to be experience creator.
   - Moving from vertical organization to horizontal one ( convergence)
3. **Key business Challenges**
   Higher traffic and low revenue
4. Role of Universities:

Link the theory with the practical applications which might help the operators reduce their OPEX and CAPEX, this can be done by asking the M.Sc. Degree students to work in projects to solve one of the operators problems like:

   1. Introduce solutions that reduce the cost of implementing new technology with different frequency band by proposing a prototype to modify the used antenna's gain and band.
   2. Optimize the solar systems size and price.
   3. Develop Mobile Application especially Arabic mobile applications which might help to generate new revenues.
   4. M2M is growing rapidly in worldwide; Master student can work on end-to-end solution like cars tracking, security systems and medical Automation.
5. Ideas for Telecom Business School
   - Don't we have successes and failures in our region?
   - Can't we make them part of a business school similar to HBS?
   - Can't we make Jordan the main telecom business school for the gulf and the region taking into consideration that Jordan exports more than 5000 technical staff.
   - Does our educational system keep updating its curriculum to support not only studying these new means, but also to create the foundations for innovation and creation?

## *Paper No. 7*

**Title**: Telecom Engineers Needed Qualifications: A View from Inside
**Speaker**: Kossai Altarazi- Mada Communications
**Main Points:**
1. **Telecom Operators: Needs and Interests**
    a. RAN: Radio Access Networks:
        o New 4G air interface technologies
        o Radio planning and optimization
        o Planning tools
        o Optimization skills
        o End user equipment's qualifications
    b. Core Networks:
        o Certifications from industrial bodies to be included: Cisco, Juniper, Huawei, Ericsson
        o Open protocols
        o IP standardization
    c. Transmission Networks:
        o Fiber Technologies
        o International data carriers and data footprint over the world: Jordan as a hop.
        o Internet exchange points studies
        o Transmission equipment's
    d. Systems:
        o Billing systems
        o VAS systems
        o GIS related
        o World of contents: related languages and media convergence
    e. Legal and Regulatory
        o Relations with standards bodies and manufacturing eco-systems
        o Spectrum allocations and global trends
        o Align with local and regional operators for market studies and technological trends.
2. **R&D in Telecom Sector**
    • Relation between academia and telecom sector
    • Limited to commercial-driven agreements
    • Industry is looking for incentives
    • National program to support both parties
    • Challenges and opportunities:
    • Lack of fund
    • Efforts in different directions
    • Knowledge base and human resources
    • Toward a national center for R&D

## *Paper No. 8*

**Speaker**: Brig. Gen. Eng.  Hatem AL-Majali - Commandant of (PFTC) -RJAF
**Main Points:**
1. Generally the armed forces worldwide are the main technology drivers.
2. The RJAF runs a vast telecommunication systems, networks and services that mainly support the armed forces mission and extend to governmental and private sectors.
3. The telecommunication field is developing quite rapidly which in turn presses for the need to upgrade our academic qualifications techniques.
4. Graduates from local universities and institutes comprise our main recruits.  Hence, the focus on their qualification development shall enrich our level of productivity.
5. The RJAF feels that extra emphasis needs to be exerted in the following telecommunication fields during the academic undergraduate program and training that shall enhance the armed forces level of performance.
    - Fiber optics development and evaluation.
    - Radar systems
    - Networking, switching and routing
    - Path and profile losses
    - Avionics
6. Timely visits to industry in line with the on going curriculum
    - On Job training extensions
    - Field graduation projects
    - More supervised "Hands On" training
7. **Graduation Projects** must be:
    - Industry supported and driven.
    - Dual supervision from academic and field qualified engineers
    - Updated with technological developments
    - Private sector's funded graduation projects
    - Projects shall impact future job opportunities for graduates
    - Projects driven by actual encountered case studies
    - Allocation of associated funds
8. **Way ahead:**
    - Programmed periodic symposia.
    - Technology and experience transfer.
    - Coordination and co-op in the training field including OJT.
    - Continuous coordination between major telecommunication governing bodies

## *Paper No. 9*

**Title**: Benefits obtained from Graduate Surveys
**Speaker**: Conchado, A., Bas- UPV-Spain
**Main Points:**

1. Graduate surveys are useful for obtaining **global indicators** about the social, economic and cultural impact of the University in the region where it is located
2. Results can be used to prove the **effectiveness** and the repercussion of the institution in the context of the region
3. They can make the inclusion of the University in **international rankings** easier:
   - Attraction of the most brilliant students and professors
   - Increasing the academic prestige of the institution
   - Results provide objective statistics to our **potential or future students** (and their families) about the jobs they will be able to access after their studies **(employability)**
4. Why should we use questionnaires as a research tool
   - **Inexpensive** and **quick** data collection procedures
   - It does **not require** very **skillfully interviewers**
   - It can be applied simultaneously to a **high number of people**
   - The **comparison** between results from different regions and periods of time is easy of obtain
   - **Anonymity** and **confidentiality** can be guaranteed
   - Conclusions obtained from a sample of graduates can be extrapolated to the population it has been extracted, by applying **inference techniques**
5. Selection of the addressed population
   - **Who is going to be interviewed?**
     - All graduates?
     - Those who recently finished the studies?
     - Those who finished the studies some years ago? How many years ago?
   - Does it make sense to **compare the labour situation** of the newly formed graduates and those who started to work some years ago?
   - In Project REFLEX, we interviewed graduates who had finished the studies five years before
6. Writing the questionnaire
   1. **Recommendations about the questions**
      o **Easy to answer**: clear and short questions
      o Just **real situations**, not hypothetical
      o Everybody must **understand the same idea** when reading the question
   2. **Recommendations about the structure of the questionnaire**
      o From the most **general** questions to the most **related to the research topic**
      1. An **interesting first question at the beginning** to gain the attention of the interviewed
      2. **Personal data at the end** of the questionnaire
7. **A brief description of the Project REFLEX:**
   The Flexible Professional in the Knowledge Society

- **40.787 Higher Education graduates** from 13 European countries and Japan
- Precedent Project: **CHEERS** (*Careers after Higher Education–An European Research Study*)
- Successor Projects:
  - **PROFLEX** (El professional flexible en la sociedad del conocimiento: demandas en educación superior en América Latina)
  - **HEGESCO** (Higher Education as a Generator of Strategic Competences)

8. Getting in touch with graduates
   - Previously, it is needed to **collect information** about the graduates who will receive the questionnaire
   - This information is organized in a data base with the **names and addresses** (electronic email, phone number or even physical address)
   - This stage can appear to be trivial, but it will become a handicap if the institution has not keep this **information updated** during the last years
   - The **initial effort** required to develop this data base must be considered as an investment in the long term

9. **Collecting the data**
   - The handicap of low response rates: Usually, response rates are lower than 20%
   - Answers to this problem:
     - Sending the questionnaire to a high number of people and using reminders
     - Prizes / Rewards
     - Appealing text about the importance of their collaboration

## *Paper No. 10*

**Title**: Education versus training: Perspectives offered by Engineers Ireland's accreditation requirements
**Speaker**: Dr. Conor Brennan-School of Electronic Engineering-Dublin City University-Ireland
**Main Points:**
1.  Some perspectives from the warring parties….

    - "and will ultimately mean the transformation of higher education institutions into "knowledge factories" and "training camps", rather than centers for critical inquiry, research, teaching and learning"

        – Letter to Irish Times from several Irish academics September 14th 2011

    - "Education is good but too much education is a yellow light….. when I see a Ph.D. in computer science, I believe the probability *(.. of ending up with a successful employee)* goes down."

    - Perhaps the following is true: "Education is good but too much (poor quality) education (may be) a yellow light"

    - Training: Focused period of organised development intended to acquire well-defined skills and competences.

    - Often characterised by repeated practice of efficient (semi-automatic) pre-determined responses to set of input stimuli of limited variability.

    - "The top 10 in-demand jobs in 2010 did not exist in 2004. We are currently preparing students for jobs that don't exist yet using technologies that haven't been invented yet in order to solve problems we don't even know are problems yet"- Fisch, McLeod and Bronman "Did you know"
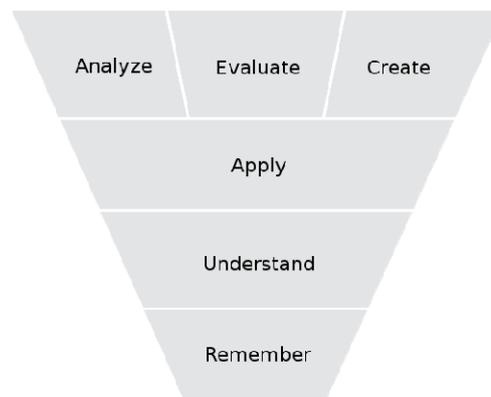


**Figure 7: Bloom's taxonomy.**

2.  Two observations from Bloom's taxonomy:

    - Lower order cognitive functions form an essential foundation for higher order cognitive functions. They are often acquired through training and their subsequent use is often automatic.

    - The *practice* of higher order cognitive functions is rarely routine or automatic and requires access to lower order skills. However there can (and should) be an element of training

in their acquisition.  E.g. research is complex but certain research skills can (and should) be acquired through training and their use should become reflexive and automatic.

3.  Engineers Ireland is the body which oversees the engineering profession in Ireland.
    o  One of its purposes is "setting up and maintaining proper standards of professional and general education and training for admission to membership of any category of membership of the institution"
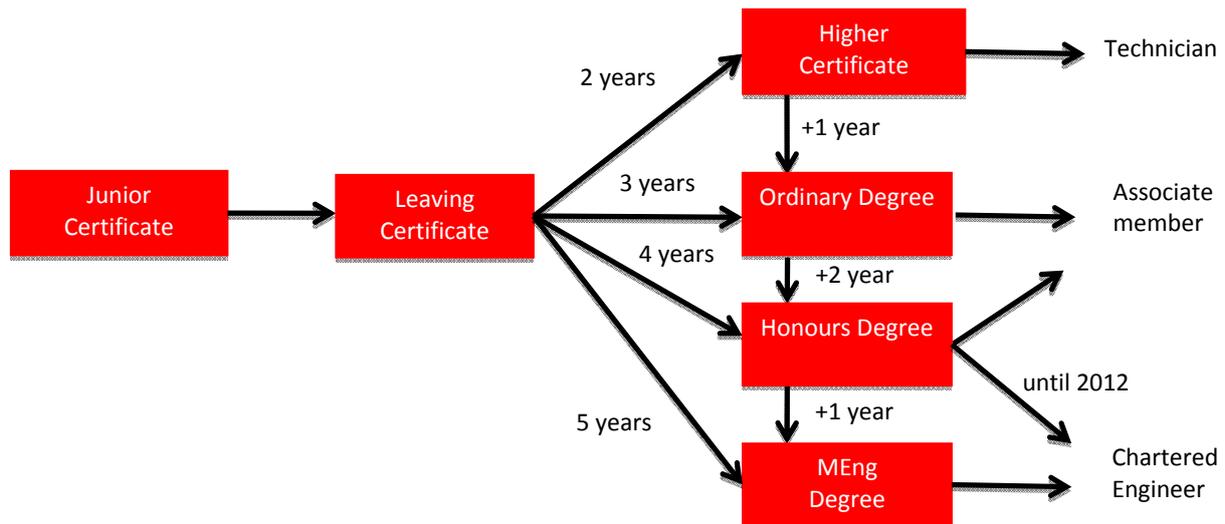


4.  **Telecom Engineering Program Outcomes:**
    **See Tables below.**
5.  Conclusions:
    - Training and education both have roles to play in engineer professional development
    - The relative emphasis depends on the level and the specific programme aims.
    - Higher order cognitive processes requires training both to provide raw material (knowledge, understanding, application) and to develop skills to support the practice of the higher order functions (i.e. training in research skills).
    - Engineers Ireland provide a framework for accrediting engineering programmes that helps articulate the difference between training and learning.
    - Personal perspectives were provided on strategies to successfully meet the higher requirements of an MEng.

**Table 3: Engineering program outcomes in Ireland.**

| PROGRAM OUTCOME | FEATURES | ENGINEERING TECHNICIAN-MORE TRAINING FOCUSED | CHARTERED ENGINEER -MORE EDUCATION FOCUSED |
|---|---|---|---|
| A | More advanced does not mean "better" | 1. Knowledge and understanding of the basic mathematics, sciences, engineering sciences and technologies related to the particular branch of engineering"<br>2. Basic mathematical and scientific formula and techniques to solve well-defined engineering problems.<br>3. Basic scientific techniques and how they apply to their branch of engineering. | Knowledge and understanding of the mathematics, sciences, engineering sciences and technologies underpinning their branch of engineering"<br>1. The advantages and limitations of a range of established and relevant mathematical techniques<br>2. The empirical and theoretical bases of the relevant engineering technology sciences. |
| B | • Competition works<br>3. Emphasis on problem solving<br>4. Unfamiliar complex open-ended problems: end result specified<br>5. Students identify the techniques needed and integrate knowledge from the course and other modules.<br>6. Develop their own code<br>7. Element of competition – novelty required | 1. Ability to identify, formulate and solve well-defined problems in the particular branch of engineering"<br>2. Ability to apply an appropriate mathematical/analytical method to a well-defined engineering problem.<br>3. Knowledge and understanding of basic problem-solving techniques | ability to identify, formulate and solve engineering problems"<br>1. Identify and use appropriate mathematical methods for application to new and ill-defined engineering problems.<br>2. Integrate knowledge, handle complexity, and formulate judgments with incomplete and limited information. Create models by deriving appropriate equations and by specifying boundary conditions and underlying assumptions and limitations.<br>3. Develop software tools including numerical techniques to solve engineering problems. |
| C | • Fourth year project is an opportunity to showcase design skills.<br>Student must satisfy client specifications<br>Often complex, ill-defined, involving other Disciplines<br>• Must integrate existing knowledge<br>(don't expect novelty | 1. Ability to contribute to the design of components, systems and processes to meet specified needs"<br>2. Knowledge and understanding of the basics of the design process and method.<br>3. Ability to contribute to the design processes within a well-defined sub-domain.<br>4. Basic knowledge and understanding of codes of practice and industrial standards. | ability to design components, systems or processes to meet specific needs"<br>1. Knowledge and understanding of design processes and techniques and the ability to apply them in unfamiliar circumstances.<br>2. Ability to apply design methods to unfamiliar ill defined problems possibly involving other disciplines.<br>3. Knowledge and understanding of codes of practice and industry standards and the need for their application. |
| D | What is an MEng project?<br>• 30 credit year-long project<br>• Receive explicit training in research skills<br>• Number of interim deliverables including literature search<br>• Primary deliverable is a short paper demonstrating novel research or intellectual property | 1. Ability to conduct well-defined investigations to facilitate the solution of problems within the particular branch of engineering"<br>2. Ability to conduct experiments and collate analyse present and interpret basic engineering technology data sets.<br>3. Ability to gather basic data from codes of practice, databases and other sources and to generate data using a range of laboratory and workshop equipment. | ability to design and conduct experiments and to apply a range of standard and specialised research tools and techniques."<br>1. Design and conduct experiments and to analyse and interpret data.<br>2. Extract through literature search or experiment information pertinent to an unfamiliar problem<br>3. Evaluate critically current problems and new insights at the forefront of the particular branch of engineering.<br>4. Contribute individually to the development of scientific/technological knowledge |
| E | • Soft skills – showing the relevance<br>• Seamless treatment of engineering principles, economics, technology, regulation | 1. understanding of the need for high ethical standards in the practice of engineering, including the responsibilities of the engineering profession towards people and the environment"<br>2. Awareness of social and environmental factors during their participation in the design process.<br>3. Knowledge of the potential health safety and risk | understanding of the need for high ethical standards in the practice of engineering, including the responsibilities of the engineering profession towards people and the environment<br>1. Knowledge and understanding of the social, environmental, ethical, economic, financial, institutional and commercial considerations affecting the exercise of their engineering discipline |

| | | | |
|---|---|---|---|
| | | issues of engineering projects. | 2. Knowledge and understanding of the health and safety and legal issues and responsibilities of engineering practice and the impact of engineering solutions in a societal and environmental context.<br>3. Ability to reflect on social and ethical responsibilities linked to the application of their knowledge and judgments. |
| F | • Train students to reflect<br>• Work placements are a useful activity<br>• To get the most from them – need structure.<br>• Students must be sensitised to what we are trying to instill in them.<br>• Pre-placement seminars<br>• Final report explicitly asks the student to reflect on how they<br>  ▪ Performed in team situations<br>  ▪ Showed initiative<br>  ▪ Interacted with non-engineers<br>  ▪ Undertook self directed learning<br>  ▪ Dealt with having nothing to do<br>  ▪ Dealt with having made a mistake<br>  ▪ Dealt with a difficult situation | 1. ability to work effectively as an individual and in teams, together with the capacity to undertake lifelong learning "<br>2. Ability to undertake continuing professional development to improve their knowledge and competence<br>3. Ability to work effectively as a member of a team | the ability to work effectively as an individual, in teams and in multidisciplinary settings together with the capacity to undertake lifelong learning"<br>1. Ability to plan and carry through<br>2. self-directed continuing professional development to improve their own knowledge and competence<br>3. Knowledge and understanding of group dynamics and ability to exercise leadership<br>4. Ability to consult and work with experts in various fields in the realisation of a product or system. |
| G | • There is more to communication than report writing<br>• Thesis in three<br>• Discussion forums<br>• Verbal versus non-verbal<br>• Cultural differences | 1. "the ability to communicate effectively with the engineering community and with society at large"<br>2. Ability to describe succinctly the relevant advantages and disadvantages of their chosen engineering discipline to a lay audience.<br>3. Ability to write technical reports. | "the ability to communicate effectively with the engineering community and with society at large"<br>6. Describe succinctly the relevant advantages and disadvantages of the various technologies to a lay audience.<br>7. Write technical papers and reports and synthesise their own work and that of others in abstracts and executive summaries.<br>8. Communicate effectively in public, national and international contexts. |

## *Paper No. 11*

**Title**: What is a Masters standard in engineering?" Tools for determining the level-appropriateness of courses and projects at Masters level in engineering

**Speaker**: Dr. Noel Murphy-School of Electronic Engineering-Dublin City University-Ireland

**Main Points:**

1. What is a Masters in Engineering?

   - A master's degree is an academic degree granted to individuals who have undergone study demonstrating a mastery or high-order overview of a specific field of study or area of professional practice.

   - Within the area studied, graduates are posited to possess advanced knowledge of a specialized body of theoretical and applied topics; high order skills in analysis, critical evaluation and/or professional application; and the ability to solve complex problems and think rigorously and independently."

2. Conference of Engineering Societies of Western Europe and the United States of America (EUSEC)

   - A Chartered Engineer is competent by virtue of his/her fundamental education and training to apply the scientific method and outlook to the analysis and solution of engineering problems.

   - He/she is able to assume personal responsibility for the development and application of engineering science and knowledge, notably in research, design, construction, manufacturing, superintending, managing and in the education of the engineer.

   - His/her work is predominantly intellectual and varied and not of a routine mental or physical character. It requires the exercise of original thought and judgement and the ability to supervise the technical and administrative work of others.

   - His/her education will have been such as to make him/her capable of closely and continuously following progress in his/her branch of engineering science by consulting newly published works on a worldwide basis, assimilating such information and applying it independently.

   - He/she is thus placed in a position to make contributions to the development of engineering science or its applications

   - His/her education and training will have been such that he/she will have acquired a broad and general appreciation of the engineering sciences as well as a thorough insight into the special features of his/her own branch.

   - In due time he/she will be able to give authoritative technical advice and to assume responsibility for the direction of important tasks in his/her branch.

3. Bologna Process - Dublin descriptors
   - Developed by the Joint Quality Initiative in a series of meetings held in Dublin in 2002-2004.
   - adopted by Bologna process as a Framework of Qualifications for the European HEA at Bergen (2005)

- intended to facilitate comparisons between qualifications awarded at the end of two main HE cycles, within the various Bologna states
- identifying the academic and other requirements that, as the outcomes of study, characterise and distinguish between Bachelor's and Master's
- subsequently enlarged to include the doctoral and short cycle qualifications
- Could be described as a common denominator approach – derived inductively from the process of identifying common features of graduates across disciplines and countries for the various levels of award.
- Heavily influenced by existing exemplars of generic descriptors, especially the UK Framework for HE Qualifications (FHEQ), an attempt to identify the defining characteristics of higher education graduates.
- FHEQ descriptors are of the form:
  - "an award holder will have demonstrated knowledge and understanding … [of some kind] … and typically will be able to … [perform some tasks, including communication and further learning] … and have qualities and transferable skills required for employment requiring … [specified demands, including decision making]".

4. Irish National Framework of Qualifications award-type descriptors
   - developed by the National Qualifications Authority of Ireland (NQAI) in a process of drafting and consultation and published in 2003
   - part of a larger qualifications framework to recognize *all learning* (broader than the EHEA)
   - starting top-down from legislation, which described learning as "knowledge, skill or competence"
   - further parsed learning into eight sub-strands
   - analysis drew on a number of different intellectual traditions, ancient and modern,
   - intended to be coherent and intelligible and acceptable to a wide variety of stakeholders
   - definition of/differentiation between levels came first, then development of level indicators
   - devised to cover all levels of learning, not just higher education and training
   - do not focus on the distinguishing characteristics of those who have received higher education awards in the way the Dublin descriptors do

5. Both sets of descriptors:
   - describe HE qualifications in terms of generic learning outcomes
   - intended to be comprehensive (all disciplines/fields of learning)
   - assume that all the qualifications described hold significant elements in common
   - assume that the different qualifications can be reliably differentiated by cycle/level
   - refer to typical rather than threshold (or indeed maximal) achievement
   - are couched in outcomes terms and *avoid* reference to curriculum, duration or methods of reaching those learning outcomes

6. Dublin descriptors have five strands:
   - knowledge and understanding;
   - applying knowledge and understanding;
   - making judgements;
   - communications skills;
   - Learning skills.

Strands were not explicitly identified or labelled during development, and not all strands are represented in the third cycle
Strands in the EHEA Framework have to be inferred from the descriptors themselves.

7. Irish descriptors have eight sub-strands:
    - knowledge-breadth;
    - knowledge-kind;
    - know-how and skill-range;
    - know-how and skill-selectivity;
    - competence-context;
    - competence-role;
    - competence-learning to learn;
    - competence-insight

8. HETAC is required
    - to determine standards of knowledge, skill or competence to be acquired by learners on programmes leading to HETAC awards
    - to ensure that providers establish fair and consistent procedures for the assessment of learners
    - to carry this out in the context of the National Framework of Qualifications (NFQ)

    - HETAC
        o is setting the overall standards of the awards through the award-types and their descriptors
        o by elaboration of the generic descriptors of the NFQ award-types defined in terms of knowledge, know-how and skill, and competence.
        o Fields of learning: Art & Design, Business, Computing, Engineering, Nursing and Science.
    - According to HETAC, the award standards are:
        o the expected outcomes of learning, inclusive of all education and training if full advantage is taken of the learning opportunities provided
        o attributes and capabilities that those achieving particular award-types **should possess and should be able to demonstrate**
        o learning outcomes at the point of achievement of an award
        o statements of what a learner will have learnt if the **requirements of the award-type have been satisfied**
        o a conceptual framework, based on the **threshold standard,** that gives a specific field of learning its coherence and identity
        o not defined in terms of inputs or processes
    - The point here is that the combination of these highlighted points are an *over-extension* of the standards required and go significantly beyond the original Irish NFQ principles – hence we would not use these to determine appropriate standards
9. According to HETAC, the award standards

- are general standards (for a level in the framework, or an award-type)
- are specific standards for fields of learning
- are not programme specifications or the totality of the curriculum
- identify the intellectual capability and understanding that should be developed through the study of the particular field of learning
- also the techniques and skills associated with developing an understanding of the field of learning and the level of demand and challenge which is appropriate to the particular award-type
- not expected that all programmes will include all learning outcomes identified in a standard
- is expected that many programmes will include learning outcomes that are not included in the relevant Standard.

# 3
# Summary of Recommendations

1. Any Master program in telecommunications Engineering must produces graduates who possess the following qualifications (EU standards)

   • To be competent by virtue of his/her fundamental education and training to apply the scientific method and outlook to the analysis and solution of engineering problems.

   • He/she is able to assume personal responsibility for the development and application of engineering science and knowledge, notably in research, design, construction, manufacturing, superintending, managing and in the education of the engineer.

   • His/her work is predominantly intellectual and varied and not of a routine mental or physical character. It requires the exercise of original thought and judgement and the ability to supervise the technical and administrative work of others.

   • His/her education will have been such as to make him/her capable of closely and continuously following progress in his/her branch of engineering science by consulting newly published works on a worldwide basis, assimilating such information and applying it independently.

   • He/she is thus placed in a position to make contributions to the development of engineering science or its applications

   • His/her education and training will have been such that he/she will have acquired a broad and general appreciation of the engineering sciences as well as a thorough insight into the special features of his/her own branch.

   • In due time he/she will be able to give authoritative technical advice and to assume responsibility for the direction of important tasks in his/her branch.

2. Key Challenges that face telecom engineering education:
   a. Telecom Curricula in Jordan are not evolving at the same pace as telecom industry and the GAP is increasing. This gap is expected to keep existing but the objective of the curricular reform process is to stop the gap from expanding by time.
   b. Curricula does not support entrepreneurship, innovation and creation
   c. Link the theory with the practical applications which might help the operators reduce their (Operational Expenditure) OPEX and CAPEX (Capital Expenditure)
   d. Graduates have the following Pain Points
      • No technical skills
      • No management skills
      • Unknown Competence
      • Not Familiar with new and future Technologies such as IP technology, Traffic, network performance, switching, etc.
      • Not familiar with the international business environment
      • Saturated with Mathematics and fundamentals

- Not aware of Market and Industry
3. Key Challenges that face telecom industry where education has a role:
    a. Building solid digital infrastructure
    b. Shift from being a network guarantor and business enabled to be experience creator
    c. Moving from vertical to horizontal organization (convergence)
    d. High cost of staff training on new technologies and management
4. Skills required by graduates for **the ICT Market**
    a. Familiar with the technologies and their applications (UMTS, IMS, IPv6…)
    b. Familiar with  standard telecom protocols (ITUT &3GPP)
    c. Familiar with basic and standard telecom equipment, MSC, SGSN, RNC…
    d. Can design \ analyze the basic telecom networks
    e. Having the technical engineering skills related to technology
    f. Ability for lifelong learning
    g. Soft skills (which can be achieved by coaching):
        - Self-confidence
        - self motivation
        - presentation skills
    h. Management skills: Need for Engineers who have management skills and can communicate effectively between different levels of management (first and second level).
        - Accounting for Managers
        - Telecom Civil Projects for non Civil Engineers
        - Local and International Regulatory Basics
        - Strategy Development and Management
        - Resource Management, People Management
5. Major fields of knowledge required by graduates for jobs at Telecom Operators
    a. RAN: Radio Access Networks
        o New 4G air interface technologies
        o Radio planning and optimization
        o Planning tools
        o Optimization skills
        o End user equipment's qualifications
    b. Core Networks:
        o Certifications from industrial bodies to be included: Cisco, Juniper, Huawei, Ericsson
        o Open protocols
        o IP standardization IP Networks and Digital Switching Concepts
    c. Transmission Networks:
        o Fiber Technologies
        o International data carriers and data footprint over the world: Jordan as a hop.
        o Internet exchange points studies
        o Transmission equipment's
    d. Systems:
        o Billing systems
        o VAS systems
        o GIS related
        o World of contents: related languages and media convergence

    e. Legal and Regulatory
- Relations with standards bodies and manufacturing eco-systems
- Spectrum allocations and global trends
- Align with local and regional operators for market studies and technological trends.

6. Role of Master Degree graduates in industry is to work in projects to solve one of the telecom industry problems like:
   - Introduce solutions that reduce the cost of implementing new technology with different frequency band by proposing a prototype to modify the used antenna's gain and band.
   - Optimize systems size and price
   - Develop mobile application (especially Arabic mobile applications) which might help to generate new revenues
   - Machine to Machine (M2M) technology is growing rapidly in worldwide; Master student can work on end-to-end solution like cars tracking, security systems and medical automation.

7. Suggested processes for curriculum development for programs that meet industry needs:
   a. Understand the problem and the need of the change
   b. Determine the Main Target
   c. Determine the project stakeholders: Telecom vendors and telecom operators
   d. Build partnerships with stakeholders and EU institutions in order to:
      - Analysis and Forecasting
      - Training centers and R&D
      - Telecom Equipments
      - Workshops
      - Technical experts
      - Support in the Labs
   e. Create the Curriculum Development PIP
   f. Serious Implementation and FOLLOW UP

8. Telecom Management
   a. There is a need for engineers who have management skills and can communicate effectively between different levels of management (first and second level).
   b. With the diversity and multiplicity of functions and relations in the telecom business, management is defined as:" the need to utilize resources (people, time, capital and materialistic assets) in the most optimum manner to run processes efficiently and to fulfill the business objectives".
   c. Telecom Management includes management of:
      - Equipment : Software/hardware management, either (local or remote)
      - Products : Sales & Marketing management
      - Finance: Companies Operate to Make Money , so basic financial knowledge is a must:
         - book keeping of in/out spending
         - balance sheet
         - budget
   d. Legal and Regulatory: Knowledge in the rules and regulation of the country of operation is a must for any business to succeed.

9. There is a need for a telecom management degree similar to MBA but no marketing and sales. The relative emphasis on the skills and knowledge in such a degree depends on the level and

the specific programme objectives. However, any Master degree in Telecom Management must have the following features (Suggested ideas for such a degree)

    **a.** To suit multi managerial levels, major courses + specialization and theses in certain field of Telecom operations

    **b.** Tackle other technical fields such as VAS, Billing, presentation skills

    **c.** Provide vendors/suppliers management skills, negotiation skills

    **d.** Provide clear awareness for market and industry

    **e.** Entrant to the program must have at least 3 years of experience

    **f.** A practical component with real case studies of this program, before degree is granted.

    **g.** Include speakers from the telecom industry to widen practical knowledge.

    **h.** Visits to various entities in the course of the program is also advisable but with a check list of the things a student wants to  know prepared in advance and should be the same to all student and all entities .

    **i.** Embed basic courses in the Undergraduate Curricula

# 5
# New Programs Outcomes

Based on the discussions made at the workshop, it was possible to draw a list of program outcomes for the proposed programs:

A.        Masters of Engineering in Telecommunications Management

B.        Masters of Science in Wireless Communications

C.        Masters of Engineering in Telecommunications Technology

In the following tables, suggested program outcomes are listed. In addition, a list of program modules (courses or topics) is suggested to achieve those outcomes.

**Outcomes of the Proposed Program-Master of Engineering in Telecommunications Technology (Non-thesis)**

| Program Outcome | Tools | Outcome Description |
|---|---|---|
| **A**<br>**Basic Sciences** | • Engineering Mathematics which include system modeling and identification, system optimization tools, etc. | "Knowledge and understanding of the mathematics, sciences, engineering sciences and technologies related to Telecom Engineering"<br>• Mathematical and scientific formulas and techniques to solve well-defined telecom engineering problems.<br>• Scientific techniques and how they apply to telecom engineering. |
| **B**<br>**Problem Solving** | • Structure of the telecommunications network –wired and wireless<br>• Mobile services development and management (GPS, Multimedia services, etc.)<br>• Practical issues of telecommunication network including network deployment, network performance, traffic, signaling protocols, etc.<br>• IP Technology and the design of the transition from TDM to IP, Next Generation Networks (NGN)<br>• Radio planning and optimization | "ability to identify, formulate and solve engineering problems"<br>4. Identify and use appropriate engineering methods for application to well-defined problems in telecommunication network deployment, operation and maintenance.<br>5. Integrate knowledge, handle complexity, and formulate judgments with incomplete and limited information.<br>6. Create models for telecom network to evaluate performance using the underlying assumptions and limitations.<br>7. Develop software applications to solve telecom network problems<br>8. Knowledge of problem solving techniques |
| **C**<br>**Design** | 4. Telecommunication network standards-wired and wireless<br>• Telecommunication network management and services<br>• Core network- switching<br>• Radio planning and optimization<br>• Design and simulation processes of communications systems | "ability to design telecom networks to meet telecom market specific needs"<br>4. Knowledge and understanding of telecom network design processes<br>5. Ability to apply design methods to well-defined problems including the choice of technology and possibly involving other disciplines such as IT and civil engineering projects.<br>6. Knowledge and understanding of telecommunications system standards and technologies and the need for their application. |
| **D**<br>**Practical Aspects and Labs** | • Master level project<br>• Design and simulation processes of communications systems<br>• Wireless communications lab | "Ability to conduct well-defined investigations to provide practical solutions of problems within current and future telecom technologies"<br>4. Ability to conduct practical and computer experiments and collate analyse present and interpret telecommunication technology data sets.<br>5. Ability to gather data from codes of practice, databases and other sources and to generate data using a range of laboratory and workshop equipment.<br>6. Ability to apply telecom engineering solutions in practical situations |
| **E**<br>**Ethics, Regulation and social issues** | • Ethics and codes of practice in telecom engineering context<br>• Telecom in the business environment and market research<br>• Regulation of Telecommunication services and policies<br>• Telecommunication network management and services<br>• Seminar on telecom engineering practice and social issues<br>• Entrepreneurship in the telecom business | "understanding of the need for high ethical standards in the practice of engineering, including the responsibilities of the engineering profession towards people and the environment"<br>4. Knowledge and understanding of the social, environmental, ethical, economic, financial, institutional, commercial and energy considerations affecting the exercise of telecom engineering.<br>5. Knowledge and understanding of the health and safety and legal issues and responsibilities of telecom engineering practice and the impact of engineering solutions in a societal and environmental context.<br>6. Knowledge and understanding of telecom regulation issues and policies and their business, technological, and social implications.<br>7. Ability to reflect on social and ethical responsibilities linked to the application of their knowledge and judgments. |
| **F**<br>**Lifelong Learning** | • Ethics and codes of practice in telecom engineering context<br>• Masters Project<br>• Term projects (teaching methodology)<br>• Seminars/ workshop on research tools | "the ability to work effectively as an individual, in teams and in multidisciplinary settings together with the capacity to undertake lifelong learning"<br>1. Ability to plan and carry through<br>2. Self-directed continuing professional development to improve their own knowledge and competence<br>3. Knowledge and understanding of group dynamics and ability to exercise leadership<br>4. Ability to self-evaluate and take responsibility for continuing academic/professional development.<br>5. Ability to consult and work with experts in various fields in the realisation of a product or system.<br>6. The ability of using research tools including market and technology research in the field of telecommunications management |
| **G**<br>**Soft skills** | • Soft skills: report writing, Thesis writing, Discussion forums, Verbal versus non-verbal, Cultural differences | "the ability to communicate effectively with the telecom engineering community and with society at large"<br>2. Describe succinctly the relevant advantages and disadvantages of the various technologies to a lay audience.<br>3. Write technical papers and reports and synthesize their own work and that of others in abstracts and executive summaries.<br>4. Communicate effectively in public, national and international contexts.<br>5. Take significant responsibility for the work of individuals and groups; lead and initiate activity. |

**Outcomes of the Proposed Programs-Master of Engineering in Telecommunications Management**

| Program Outcome | Tools | Outcome Description |
|---|---|---|
| **A** <br> **Basic Sciences** | • Operations Research <br> • Organization Behavioral <br> • Service flow/logic <br> • Total Quality Management <br> • Accounting and Financial Management <br> • Project Management <br> • Marketing | "Apply the principles of math, statistics and management sciences to solve telecommunication management problems" |
| **B** <br> **Problem Solving And decision making** | • Structure of the telecommunications network –wired and wireless <br> • Mobile services development and management (GPS, Multimedia services, etc.) <br> • Telecommunications in the business environment <br> • Telecom Network management and operations | "ability to identify, formulate and solve telecom management problems" <br> 1. Knowledge of appropriate engineering methods for application to well-defined problems in telecommunication network deployment, operation and maintenance. <br> 2. Ability to integrate people, knowledge, telecom technology, equipment and resources, and formulate judgments with incomplete and limited information. <br> 3. Create models for telecom network to evaluate performance using the underlying assumptions and limitations. <br> 4. Ability for practical thinking processes to develop leadership and management skills. <br> 5. Develop software applications to solve telecom management problems |
| **C** <br> **Design** | • Telecommunication network standards-wired and wireless <br> • Telecommunication network management and services | "ability to design processes to meet telecom industry needs" <br> 1. Knowledge and understanding of processes and techniques and the ability to apply them in unfamiliar circumstances. <br> 2. Ability to apply design methods to unfamiliar ill defined problems including the choice of technology and possibly involving other disciplines such as IT and civil engineering projects. <br> 3. Knowledge and understanding of codes of practice and industry standards and technologies and the need for their application. <br> 4. Ability to integrate systems of people, technologies, information, materials, equipments and energy |
| **D** <br> **Practical Aspects and Labs** | Management software and processes | "Ability to conduct well-defined investigations to provide practical solutions of problems within telecom engineering" <br> 1. Ability to conduct experiments and collate analyse present and interpret telecommunication technology data sets. <br> 2. Ability to gather data from codes of practice, databases and other sources and to generate data using a range of laboratory and workshop equipment. <br> 3. Ability to apply engineering solutions in practical situations <br> 4. Use up to date analytical, experimental and implementation tools to improve telecom services. |
| **E** <br> **Ethics, Regulation and social issues** | • Ethics in telecom context <br> • Telecommunications in the business environment <br> • Regulation of Telecommunication services and policies <br> • Telecommunication network management and services <br> • Seminar on telecom engineering practice and social issues <br> • Entrepreneurship in the telecom business | "understanding of the need for high ethical standards in the practice of engineering, including the responsibilities of the engineering profession towards people and the environment" <br> 1. Knowledge and understanding of the social, environmental, ethical, economic, financial, institutional and commercial considerations affecting the exercise of telecom engineering. <br> 2. Knowledge and understanding of the health and safety and legal issues and responsibilities of telecom engineering practice and the impact of engineering solutions in a societal and environmental context. <br> 3. Ability to reflect on social and ethical responsibilities linked to the application of their knowledge and judgments. |
| **F** <br> **Lifelong Learning** | • Telecom in the business environment and market research <br> • Masters Project <br> • Term projects (teaching methodology) <br> • Seminars on research tools | "the ability to work effectively as an individual, in teams and in multidisciplinary settings together with the capacity to undertake lifelong learning" <br> 1. Ability to plan and carry through <br> 2. Self-directed continuing professional development to improve their own knowledge and competence <br> 3. Knowledge and understanding of group dynamics and ability to exercise leadership <br> 4. Ability to self-evaluate and take responsibility for continuing academic/professional development. <br> 5. Ability to consult and work with experts in various fields in the realisation of a product or system. <br> 6. The ability of using research tools including market and technology research in the field of telecommunications management |
| **G** <br> **Soft skills** | • Soft skills: report writing, Thesis writing, Discussion forums, Verbal versus non-verbal, Cultural differences | "the ability to communicate effectively with the telecom engineering community and with society at large" <br> 1. Describe succinctly the relevant advantages and disadvantages of the various technologies to a lay audience. <br> 2. Write technical papers and reports and synthesize their own work and that of others in abstracts and executive summaries. <br> **6.** Communicate effectively in public, national and international contexts. <br> **7.** Take significant responsibility for the work of individuals and groups; lead and initiate activity. |

**Outcomes of the Proposed Programs-Master of Science in Wireless Communications**

| Program Outcome No. | Tools | Outcome Description |
|---|---|---|
| **A**<br>**Basic Sciences** | • Engineering Mathematics<br>• Probability and Random Processes | 'Knowledge and understanding of the mathematics, sciences, engineering sciences and technologies underpinning wireless communications engineering"<br>3. The advantages and limitations of a range of established and relevant mathematical techniques<br>4. The empirical and theoretical bases of the relevant engineering technology sciences. |
| **B**<br>**Problem Solving**<br>**And decision making** | • Wireless Communications<br>• Mobile Communications<br>• Wireless Networks<br>• Simulation tools for wireless communications | ability to identify, formulate and solve engineering problems"<br>1. Identify and use appropriate mathematical methods for application to new and ill-defined engineering problems.<br>2. Integrate knowledge, handle complexity, and formulate judgments with incomplete and limited information. Create models by deriving appropriate equations and by specifying design constraints and underlying assumptions and limitations.<br>3. Develop software tools including numerical techniques to solve engineering problems. |
| **C**<br>**Design** | • Wireless Communications<br>• Mobile Communications<br>• Wireless Networks<br>• Digital Signal Processing for communications<br>• Antenna design for wireless<br>• MSc thesis | "ability to design components, systems or processes to meet specific needs"<br>1. Knowledge and understanding of design processes and techniques and the ability to apply them in unfamiliar circumstances.<br>2. Ability to apply design methods to open and ill defined problems possibly involving other disciplines.<br>3. Design of wireless systems to meet quality of service requirements subject to limitations in power, bandwidth and cost. |
| **D**<br>**Practical Aspects and**<br>**Labs** | • Simulation tools for wireless communications<br>• Wireless communications lab<br>• Antenna Lab<br>• Digital Signal Processing lab<br>• Networking lab<br>• Master thesis | "ability to design and conduct experiments and to apply a range of standard and specialized research tools and techniques to verify proposed solutions to research problems in wireless communications."<br>5. Evaluate critically current problems and new insights at the forefront of wireless communications.<br>6. Design and conduct experiments and to analyse and interpret data.<br>7. Extract through literature search or experiment information pertinent to research problems<br>8. Contribute individually to the development of scientific/technological knowledge |
| **E**<br>**Ethics, Regulation and**<br>**social issues** | • Ethics in scientific research | understanding of the need for high ethical standards in engineering research, including the responsibilities of the engineering research towards people and the environment<br>1. Knowledge and understanding of the social, environmental, ethical and economic implications of their research in local and global context.<br>2. Knowledge and understanding of the research ethics related to intellectual property and related issues. |
| **F**<br>**Lifelong Learning** | • MSc thesis<br>• Term projects (teaching methodology)<br>• Seminars/ workshop on research tools | "the ability to work effectively as an individual, in teams and in multidisciplinary settings together with the capacity to undertake lifelong learning"<br>1. Ability to plan and carry through<br>2. self-directed continuing development to improve their own knowledge and research abilities<br>3. Knowledge and understanding of group dynamics and ability to exercise leadership<br>4. Ability to consult and work with other researchers in the field of interest. |
| **G**<br>**Soft skills** | • Master thesis<br>• Term projects (teaching methodology) | "the ability to communicate effectively with the academic community and with society at large"<br>1. Describe succinctly the relevant implications of their research to a lay audience.<br>2. Write technical papers and reports and synthesise their own work and that of others in abstracts and executive summaries.<br>3. Communicate effectively in public, national and international contexts. |

# 5
# Conclusions and Remarks

## 2.1   Remarks

Considering the information collected from the presentations and discussions at the workshop, and in order to make the proposed programs unique and attractive, the following general ideas and recommendations have been drawn:

- It is important to establish links and partnerships with the stakeholders of the new programs. This can help in the following:
    - o Some of the students admitted to these programs will come from industry. Having links with Telecommunications companies will encourage their employees to join Masters programmes at YU.
    - o Conducting joint projects with the industry will enrich the program. This will keep the faculty up-to-date and exposed to new technologies in telecommunications, and in addition, will help in planning future changes in curriculum accordingly.
    - o Get practical expertise in teaching through having industry participate in teaching part of the program courses
    - o Take measures to enhance the industrial experience of teachers in order to help academic staff demonstrate the link between theoretical knowledge and its applications in the classroom so that students grasp the theory and have better understanding of the importance of the topics which they study.
    - o Faculty will be able to conduct research in areas that can be of interest to the industry and will have opportunity to solicit funding for their research.

- It is important to benefit from the European experience in curriculum development. Similar programmes, like the one at Queen Mary University of London and the one at Dublin City University can be considered when designing the new programs.

- It is important to get proper accreditation for the proposed programs. The accreditation process should start during the Tempus project and continue till all programs are being accredited. This process is part of the Quality Assurance activities and will guarantee acceptable quality level of the program. It will also give credibility and recognition of the program, and it will also give a competitive edge since very few Masters programmes in Jordan are internationally accredited.

- Establish a career center in cooperation with telecommunications industry to help graduates find job opportunities and at the same time keep records of employability of each program. On the other hand, this process will enable the Department to collect information regarding employability of the graduates and on the competencies they need to gain.

## 2.2   Formation of an Industrial Advisory Committee

The closing session featured formation of an industrial advisory committee of the following industry representatives:

1.      Mr. Yousef Abu Mutawei-Zain

**2.** Mr. Didier Lilievre-Orange

**3.** Mr. Ahmed Jaghoub-Umniah

**4.** Mr. Hussein Shhadat-Umniah

**5.** Mr. Tharwat Alkhateeb-Huwaei

**6.** Mr. Omar Rashdan-Crossborder

**7.** Mr. Mohammed Noor Quraan-RJAF

**8.** Dr. Rami Wahsheh- Public Security

**9.** Mr. Asim Bataineh- LGE

**10.** Mr. Mahmoud Haboub-Motorola

**11.** Mr. Wesam Ramaden-TRC

The responsibilities of the committee shall be

1. Help identify the telecom industry needs with regard to qualifications of graduates, curriculum contents, study models, teaching methodologies and nomination of teaching staff for the new programs.

2. Provide feedback on the quality of graduates and be part of the QC processes which will be developed through the project activities.

3. Participate in future events related to the tempus project at the department.

4. Promote the new programs to a wider audience and contribute to the sustainability of the programs.

# Appendix

**Questionnaire**
**Telecommunication Industry Demands**

| Data | Interview partner | | |
|---|---|---|---|
| Company: | | | |
| City: | | | |
| Contact person: | Name: | | |
| | Position: | | |
| | Phone: | | |
| | E-mail: | | |
| Interviewer: | | | |
| Date: | | | |

## A.        Company Profile Data

| | Question | Answer | | Comment |
|---|---|---|---|---|
| 1.1 | What is your telecom business? | Fixed phone service | | |
| | | Mobile phone service | | |
| | | Internet service provider | | |
| | | Equipment Manufacturer | | |
| | | Research and Development | | |
| | | Other | | |
| 1.2 | What is your company's market orientation? | national | | |
| | | international | | |
| | | both | | |
| 1.3 | Is your company owned by national or international | national | | |
| | Shareholders? | international | | |
| | | both | | |
| 1.4 | Do you use external subcontractors for | yes | | |
| | Operation, Maintenance, installation of equipment? | no | | |
| 1.5 | Does your company have a dedicated a research and development department? | yes | | |
| | | no | | |
| 1.6 | How many employees do you have in your company? | 0-50 | | |
| | | 50-200 | | |
| | | 200-500 | | |
| | | 500-1000 | | |
| | | more than 1000 | | |
| 1.7 | How many engineers do you have in your company? | 0-50 | | |
| | | 50-200 | | |
| | | 200-500 | | |
| | | more than 500 | | |
| 1.8 | What is the educational level of all technical | Vocational level [%] | | |
| | staff in your company? | Bachelor [%] | | |
| | | Master [%] | | |
| | | PhD [%] | | |
| 1.9 | Indicated the  percentages of engineers who perform: | Management Tasks [%] | | |
| | | Technical Tasks [%] | | |

| | | Other Tasks [%] | | |
|---|---|---|---|---|
| | | | | |

## B.  **Employment of Graduates**

| | Question | Answer | | Comment |
|---|---|---|---|---|
| 2.1 | Are you satisfied with the skills of the graduates of engineering schools in Jordan at the <u>Bachelor</u> level? from 1= not satisfied to 5= very satisfied | 1 | | |
| | | 2 | | |
| | | 3 | | |
| | | 4 | | |
| | | 5 | | |
| 2.2 | Are you satisfied with the skills of the graduates of engineering schools in Jordan at the <u>Master</u> level? from 1= not satisfied to 5= very satisfied | 1 | | |
| | | 2 | | |
| | | 3 | | |
| | | 4 | | |
| | | 5 | | |
| 2.3 | Do you have problems finding well educated and skilled technical staff in the local labour market? | yes | | |
| | | no | | |
| 2.4 | If yes, which educational level? | Vocational level [%] | | |
| | | Bachelor [%] | | |
| | | Master [%] | | |
| | | PhD [%] | | |

## C.  **Master Degree in Telecommunication Management**

| | Question | Answer | Mark | Comment |
|---|---|---|---|---|
| 3.1 | Is there a need to improve managerial skills of telecom engineers at your organization? | yes | | |
| | | no | | |
| 3.2 | Have you enrolled or considered enrolling in an MBA program? | Yes | | |
| | | No | | |
| 3.3 | Do you think that a Master degree in Telecommunications Management would be of interest to you and your engineering staff? | yes | | |
| | | no | | |
| 3.4 | Do you think that such a program would be better for engineers | Yes | | |

| | | | | |
|---|---|---|---|---|
| | than a traditional MBA program ? | No | | |
| 3.5 | Do you think that a Master degree in Telecom management | yes | | |
| | could solve problems in your company ? | no | | |
| 3.6 | Do you think that such a degree would shorten the training | Yes | | |
| | cycle required for engineering staff at your company ? | no | | |
| 3.7 | Would you enroll in such a program ? | Yes | | |
| | | No | | |
| | If yes, please answer the following questions : | | | |
| 3.8 | Would like to see a field training component in such a | Yes | | |
| | program ? | No | | |
| 3.9 | Which studymodel would you prefer ? | Full time-regular class | | |
| | | Full time-Distance Learning | | |
| | | Part time-regular class | | |
| | | Part time-Distance Learning | | |
| 3.10 | What is the avergae duration of study that you prefer | 3 years | | |
| | | 2 years | | |
| | | less than 2 years | | |
| 3.11 | Where do you prefer to join the program ? | Irbid | | |
| | | Amman | | |
| | | Does not matter | | |
| 3.12 | Which of the following topics would you like to see in such a degree program? Rate the topics according to their importance from 1= not important to 5= very important | Competition and regulation issues | | |
| | | Management of Telecom Network | | |
| | | Service flow and logic | | |
| | | Soft skills: communication and negotiation, marketing, strategic thinking | | |
| | | Knowledge on future telecom industries | | |
| | | Language skills – English | | |
| | | Management, project management, team management | | |
| | | Regulations and policies | | |
| | | Financial and admin management | | |
| | | IT and computer skills | | |

| | | |
|---|---|---|
| Telecom market knowledge | | |
| Organization theory and how to develop market creativity | | |
| Planning and optimization | | |
| Research methodology | | |
| Human Resource Management | | |
| Total Quality Management | | |
| Accounting, Economics, Finance | | |
| Entrepreneurship | | |
| Business Technology Strategy | | |
| Marketing and Financial Management | | |
| Other, please specify | | |

## D.    Master of Engineering Degree in Telecommunication Technology

| | Question | Answer | Mark | Comment |
|---|---|---|---|---|
| 4.1 | Is there a need to improve technical skills of telecom engineers<br><br>at your organization | Yes | | |
| | | No | | |
| 4.2 | Have you enrolled or considered enrolling in a Master<br><br>program in communications engineering ? | Yes | | |
| | | No | | |
| 4.3 | Do you think that a Master degree in Telecommunications<br><br>technology would be of interest to you and  your engineering staff? | yes | | |
| | | no | | |
| 4.4 | Do you think that such a program would be better for engineers<br><br>than a traditional Master of Science  programs ? | Yes | | |
| | | No | | |
| 4.5 | Do you think that a Master degree in Telecom Technology<br><br>could solve problems in your company ? | yes | | |
| | | no | | |
| 4.6 | Do you think that such a degree would shorten the training<br><br>cycle required for engineering staff at your company ? | Yes | | |
| | | no | | |
| 4.7 | Would you enroll in such a program ? | Yes | | |
| | | No | | |

|  |  |  |  |  |
|---|---|---|---|---|
|  | If yes, please answer the following questions : |  |  |  |
| 4.8 | Would like to see a field training component in such a program ? | Yes |  |  |
|  |  | No |  |  |
| 4.9 | Which studymodel would you prefer ? | Full time-regular class |  |  |
|  |  | Full time-Distance Learning |  |  |
|  |  | Part time-regular class |  |  |
|  |  | Part time-Distance Learning |  |  |
| 4.10 | What is the avergae duration of study that you prefer? | 3 years |  |  |
|  |  | 2 years |  |  |
|  |  | less than 2 years |  |  |
| 4.11 | Where do you prefer to join the program ? | Irbid |  |  |
|  |  | Amman |  |  |
|  |  | Does not matter |  |  |
| 4.12 | Which of the following topics would you like to see in such a degree program? Rate the topics according to their importance from 1= not important to 5= very important | Mobile Communications Technology |  |  |
|  |  | Wireless Network Technology |  |  |
|  |  | Microwave and RF Technology |  |  |
|  |  | Antenna Technology |  |  |
|  |  | Entrepreneurship |  |  |
|  |  | Digital Broadcasting |  |  |
|  |  | Switching Technology |  |  |
|  |  | Business Technology Strategy |  |  |
|  |  | Planning and Optimization |  |  |
|  |  | Project Management |  |  |
|  |  | Regulations and policies of Telecom services |  |  |
|  |  | Other, please specify |  |  |