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Educational Outcomes Vs the World New Industrial and Economical Demands: Jordanian Electrical and Mining Sectors as a Case Study

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Abstract: This paper presents a model linking the labour market with education. The aim of this model is to strengthen the link between the educational establishments, which graduate Engineers and technicians, and the industrial sector by forming a national committee consists of members from both sides with definite duties. A closed-loop model for goal achievement is suggested. It probably reduces the gap between the educational sector and the labour market and increases the proficiency of the Engineers and technicians. This paper highlights the problem of weak communication between the labour market and the education in the Middle East, particularly in Jordan. The reasons behind the weak link between the two end sides are determined and solutions are suggested. Electrical and mining sectors have been taken as an integrated case study. The proposed model may be generalized for any other technical and engineering branches.

Key Words: Educational Outcome, Economic Development, Efficiency, Input/Output Analyses, Modeling, Mining and Electrical Sectors

Introduction

The backbone of any industry is always presented by the quality of the educational establishments' outcomes, which therefore enhances the world economy. Matching of these outcomes with the present industrial and economical needs appears as an urgent unsolved problem, in the Middle East region, particularly in Jordan.

The development of the mining and electrical sectors largely depends on the graduates standard and level, which can be evaluated by their skills, innovation, performance and capability to solve any emerging operational problem, related to their respective sector.

The minimum required skills of the graduates are usually defined by a committee consists of a number of academics, who, in general, lack the necessary practical experience and the actual industrial demands. Instead, they may be highly experts in the educational field. Such committees may be on limited scale, for instance, faculty, department and even section. Thus, the skill level is highly variable from one educational establishment to another even in the same country, reflecting the lack of communication between various educational establishments on the one hand and the labour sector on the other hand.

The developed countries, however, show drastic trend in this aspect of communication. They intend to keep a strong and updated relationship between all the concerned educational establishments, industries, firms and research centers to achieve their goal in the light of clear objectives.

The present study highlights the main reasons behind the weak link between the educational sector and the Jordanian electrical and mining labour markets, which have been taken as a representative case study.

Educational Outcomes Analyses: To strengthen the relationship between the educational and mining and electrical sectors and to match the educational outcomes with the world new industrial demands, it is necessary to precisely state the goals and how to achieve them through strategic planning. Goal analysis should be implemented to clarify goals and methodology of achievement (Fig. 1). This can be done by adapting the following steps (Robert, 1997a): goal statement, strategic planing, implementation and evaluation.

Goal Statement: In this paper the main goal can be stated as follows:

"Graduate well trained and skilled Engineers and technicians to fulfill the world new industrial demands."

Strategic Planning: In order to achieve the above stated goal, the reasons behind the gap between educational and mining and electrical sectors must be carefully determined. Several reasons may be responsible for this gap. However, in this paper the main reasons are highlighted under two main categories, i.e., educational and industrial.

Educational Sector Issues

Teaching Staff: The teaching staff may be divided into three main categories, which may be summarized in Fig. 2.

In recent time category **A** is the most common, representing a highly qualified staff with no or very limited practical experience. Such category will influence the skill level of the graduates due to the lacking experience of the teaching staff with respect to real manufacturing processes, standard operating procedures, troublshooting procedures, quality management systems and maintenance.

Comparing categories **B** and **C**, both have a practical experience, but with different sequences, before and after postgraduate studies respectively (Fig. 2). However, category **C** is rare, yet category **B** is more preferable as it enhances the skill level with respect to industrial needs.

Tafila Applied University College (TAUC), which is a typical college representing 32 decentralized colleges under the umbrella of Al-Balqa' Applied University, has been chosen as an elaboration case study. The status of the TAUC teaching staff in mining and electrical engineering departments is given in Table 1.

It is clearly indicated (Table 1) that the highest percentage among teaching staff belong to category **A**. Regardless the specialization, the percentage of category **A**, **B** and **C** are almost similar in various Jordanian educational establishments, reflecting the absolute theoretical background of the major segment of the teaching staff.

Table 1: TAUC Teaching Staff Classification According to their Practical Experience

Department	With No Practical Experience (Category **A**)	With Practical Experience Before Postgraduate Study (Category **B**)	With Practical Experience After Postgraduate Study (Category **C**)
Mining Engineering	67%	11%	22%
Electrical Engineering	55%	22%	23%

Laboratories and Workshops in the Educational Sector: The laboratories and workshops mainly comprised of simulators, which usually do not reflect the real dimensions of the machines and devices used in the industrial sector. For instance the entire Jordanian electrical network is simulated in 16-m^2 laboratory using the electrical power simulator. However, the mining laboratories and workshops are equipped with research and development machines, which are rarely found in the Jordanian mining sector. This does not mean that the labroteries and workshops are not updated, in fact the management keeps on funding and upgrading the labrotories and workshops to cope with the new and advanced technology, but yet on an educational scale and for learning purposes only. The models and simulators available in most of the labrotories and workshops are used to acquaint the students with the components of the mechanism rather than dealing with certain practical applications or problems, reflecting the theoritical nature of the curriculums (syllabus) rather than the practical applications necessary for mining and electrical industrial sectors.

On the other hand, due to several resons beyond the scope of this paper, mining and electrical industries in Jordan are lacking behined in terms of advanced technology and information, creating a gap between what is actually existing and what is being taught.

Mining and Electrical Sectors Issues: The problems related to both sectors may be summarized as following:

a. Lack of Trust: Unfortunately, there is a lack of trust between the industrial and educational sectors. It has been observed that most of the national mining and electrical industries look forward to counsult foreign technical experts with extremely high expenses rather than approaching national technical experts. However, Jordan is known for its richness in human resources and presence of well-established research centers capable of dealing with various industrial practical problems. It is worth mentioning that many national experts are consultants for major international firms and industries.

b. Lack of Communication: Lack of trust is the other side of the coin, which weakens the bonds between the educational and industrial sectors. The main possible resons and results of such weak communication are:

A. The skill level of the graduates (employees) does not meet all the demands and needs required by the industrial sector, therefore creating doubt in the academic level and standards of the national educational sector. As a result conducting pre-employment engineering training programs by the labour market represents an extra overburden (Al-Saywan, 1988; Al-Jufout, 1999).
B. Weak decision-making to consult experts from national educational sector to deal with problems related to technical aspects.
C. Social and cultural influences, where most of the academics hesitate to offer their services to the industrial sector.
D. Lack of organized cooperation such as summits, conferences, brainstorming and field visits.
E. Theoretically oriented rather than applied research oriented articles usually published by the academics for career promotion rather than being directed to industrial advancement.
F. Weak training programs of the undergraduates, which is a compulsory requirements for graduation, where both the sectors share equal responsibility of the low efficiency of such programs.

For example, most of the training programs in cooperation with the industrial sector related to mining and electrical engineering are based on re-lecturing and see and do not touch.

Suggested Solutions: Based on the above-mentioned analyses and in order to overcome the early stated issues, measurable, achievable and time-bond solutions are suggested as follows:

- Concentrate on **B** and **C** categories of the teaching staff (at least 60 percent) and rehabilitate category **A** (Fig. 2) at the industrial sector for at least six months.
- Provide the laboratories and the workshops with posters and cutaways of real machines and devices and concentrate on the practical aspects.
- Update the curriculums by forming a national committee consists of experts from both industrial and educational sectors.
- Orient the graduation projects of mining and electrical engineering students to solve particular mining and electrical technical problems in cooperation with the technical departments of various national industrial sectors.
- Establish a comprehensive training program for the undergraduates supervised by a national committee from various stakeholders.
- Make the maximum use of the scientific research fund stated by the Government to solve any technical problem and enhance the operational processes.

The early mentioned solutions should help in establishing a link, if it doesn't exist, between the educational sector and the labour market or strengthen it, if it is already existing. This may be achieved by adopting the following proposed model: Most of the graduates have an idea about their probable employment destinations. These destinations must be carefully analyzed and the main required skills in these destinations should be pre-determined.

Based on these skills the curriculums of the practical courses and experiments in laboratories and workshops should be updated and upgraded by both the educational sector and the labour market. The proposed model is illustrated in Fig. 3.

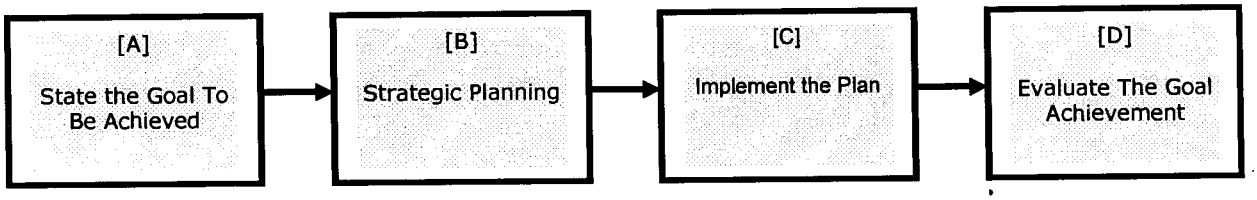

Fig. 1: The Steps Associated with Goal Achievement

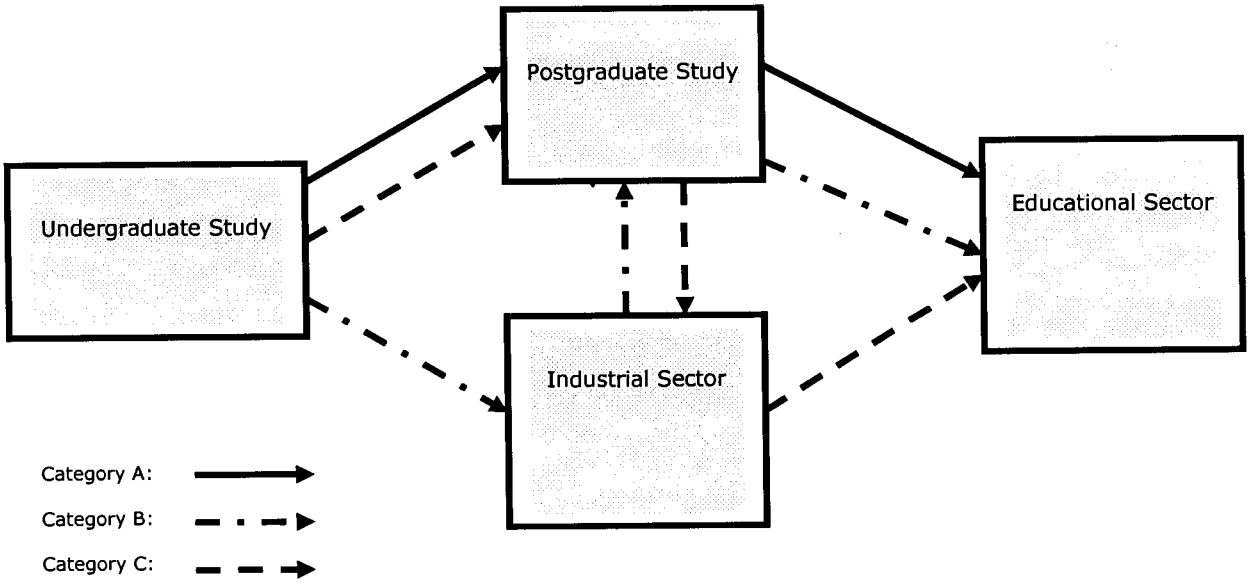

Fig. 2: Teaching Staff Classification

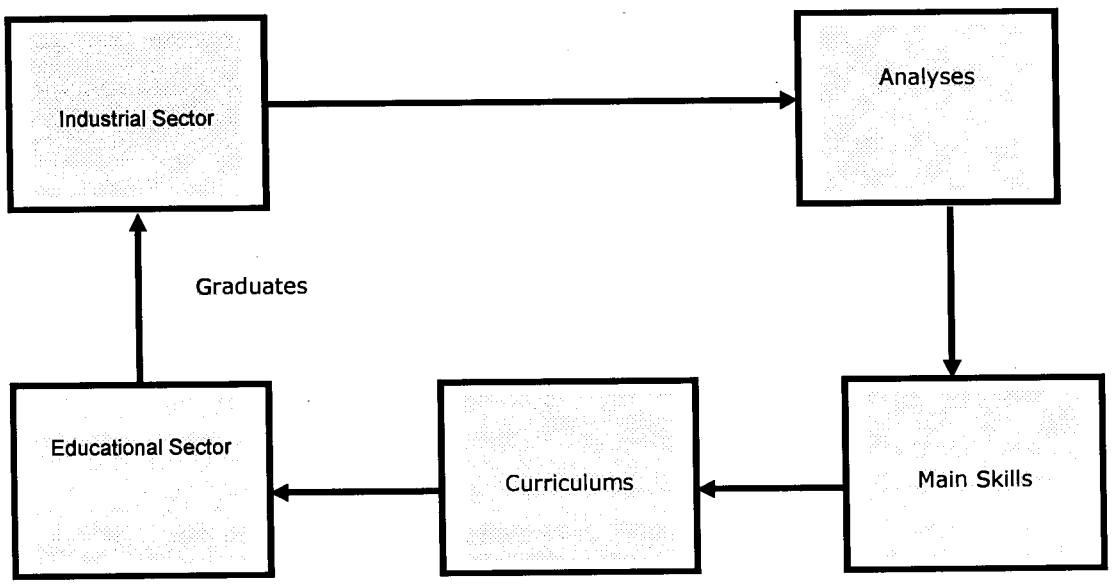

Fig. 3: Educational-Industrial Sector Link Model

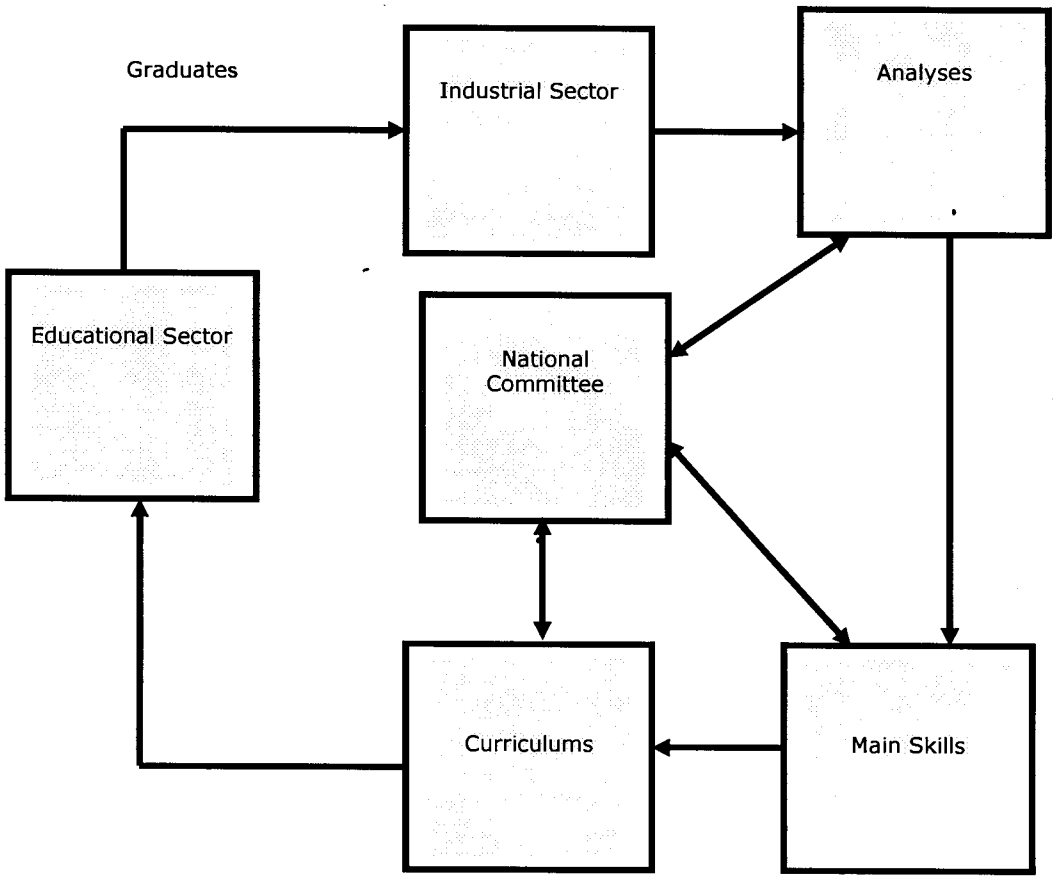

Fig. 4: Continuously Controlled Educational-Industrial Sector Link Model

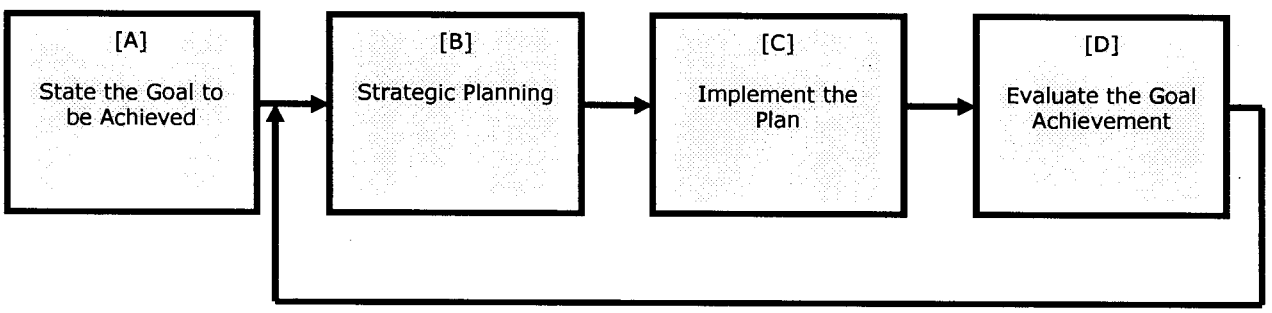

Fig. 5: Closed-Loop Goal Achievement Control

Recognition of the Goal Achievement: Strategic planning including environmental scan and analyses, goals, polices objectives and implementation is worth nothing without serious follow-up program to recognize the degree of achievement (Robert, 1997b).

Implementation follow-up in Jordan, unfortunately, fades in the background of the whole process. Thus, many of the significant and sound proposed plans become weak or completely collapse.

The process described in Fig. 3 can't be implemented effectively without forming a national committee, representing experts from educational and industrial sectors, to continuously control and evaluate the overall process.

The implementation follow-up is the responsibility of the national committee (Fig. 4), who should control the matching efficiency between the educational sector outcomes and the industrial demands. Such control may be achieved by applying feedback using questionnaire techniques, site visits and supervision, as shown in Fig. 5. The results of such feedback should be subjected to extensive analyses in order to revise and update the curriculums, if required.

Finally, the responsibilities of the national committee are as follows:

- Analyses of the industrial sector.
- Determination of the main skills for different destinations in the industrial sector.
- Updating the curriculums of the practical courses and students' compulsory training program in the educational sector.
- Continuously control of the matching efficiency between the educational sector outcomes and the industrial sector needs.

Conclusion

It is obvious that the strength of the relationship between the educational sector and the labour market is a sign of any country civilization. Such strong link is a mutual responsibility of both link-end sides.

A committee with definite responsibilities and duties to be formed on a national level. The members of the national committee should be selected with caution from both educational and industrial sectors.

The aim of this committee is to match the demands and needs required by the labour market with the educational outcomes by implementing regular analysis, skill level determination, revision of the curriculums and finally to follow-up and control, on the basis of individual specialization.

Implementation of this model reduces the expenses of pre-employment training, which financially overburden the industrial sector and increases the proficiency level of the graduates, leading to trust in the educational sector and enhance the economic growth. The proposed model is applicable to any applied field where the practical skills are the main consideration.

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