

A formative approach to the relation of the university to companies: Beyond obtaining resources

N. T. Álvarez Aguilar, J. A. Castillo Elizondo, A. Torres Bugdud, J. A. Cupich Guerrero

Universidad Autónoma de Nuevo León, México

Abstract: In Mexico the linking of universities to companies has traditionally been intended to obtain resources and little attention has been given to its formative dimension. The relation university- companies has been renewed at the Faculty of Mechanics and Electric Engineering to foster the formative contribution of professional practice. Nevertheless, as a dynamic and multifactorial process, it requires permanent monitoring and improvement of students' training. This paper is aimed at analyzing the effect of linking university faculties to companies on the education of would-be engineers. The findings include the foundations and assessment of the formative approach resulting from a theoretical inquiry and gathering opinions of professors, students and managers by means of interviews and other techniques. The study proved that a comprehensive strategy oriented to the students' education is needed to influence upon social development.

Keywords: formative approach, linking process; education of engineers

Introduction

The main social responsibility of the university is the training of the students with human high values and a comprehensive education that allows them to be agents of changes and development once graduated.

Mexican universities, and in particular the “Universidad Autónoma de Nuevo León” has kept a permanent contact with companies to join efforts in attaining the fulfillment of their main functions. Nevertheless, a lack of clarity and general consensus in relation to the links between universities and companies is still present. The need to face such problem demands going beyond obtaining profits and resources by giving priority to the formative dimension.

Castillo and Cols (2013) consider that the resources generated by the diverse models or linking means should be used in the universities to assist the necessities that contribute to their mission. However, the general practice indicates that the economic criterion prevails and the formative potentials of students' involvement in production is currently underestimated.

Consequently the strengthening of formative actions in the linking process is needed. The solution might be to introduce a formative approach *that develops the orientation of the linking process toward student's education both as citizen and professionals*. Following these ideas, this paper is aimed at analyzing the potentials of the linking process for the training of students, aside from the economic resources it eventually produces. The findings, resulting from a research project of the Faculty of Mechanics and Electric engineering, include the foundations of the formative approach to the university and the companies linking process.

Methods

The population under study was made up company professionals, and university professors and students belonging to the Faculty of Mechanics and Electric Engineering

of the “Universidad Autónoma de Nuevo León”. The sample includes only agents involved in the linking process, organized in representative and proportional strata, on intentional bases corresponding to the regional context and the relations set among the different agents. In selecting the size of the sample (“n”) the following equation was used.

$$n = \frac{NZ_{\alpha}^2 pq}{d^2(N-1) + Z_{\alpha}^2 pq}$$

Where

N = Size of the sample.

Z = Trust level.

P = Success probability, or expected proportion.

Q = Failure probability.

D = Precision, (margin of proportional error).

The population comprises 689 students, 518 university professors, 64 university directives and 120 company directives, making a total of 1389. The sample includes a total of 123 subjects corresponding to the same categories (62 students, 26 professors, 10 university directives and 25 company personnel).

Quantitative and qualitative methodologies were combined in doing the research, in a range going from statistical procedures to essay writing technique. Data arrangement was facilitated by setting four categories related to the linking process that influence the formative dimension in one way or another. These categories are the following;

Category 1: Interrelation level of the agents in the linking process.

Category 2: Level of recognition of the linking process significance in students' education.

Category 3: Level of satisfaction of different agents.

Category 4: Level of contribution of different agents to the linking process.

Results and Discussion

Framework

During the first decade of the XXI century the topic of the linking of the university to the company has been the object of discussion in forums with increasingly frequency, the topic has become an important aspect of the higher education calendar. However, Martínez describes a tendency to reduce the linking process to the relation of the university with the productive sector of society, without taking into account how it impacts in a precise way in the education of the would-be engineers (2000).

The conception of the National Association of Institutions of Higher Education (ANUIES) shows a transcendent appreciation of the linking process by understanding such relations of university institutions with the productive sectors as a mechanism to positively contribute to education and upgrading students and scholars in facing local, regional and national problems. This conception favors the pedagogic training of the university staff, the innovation and improvement of the processes that take place in both

places, as well as the effective insertion of students in the cultural community life (ANUIES, 2000).

There are evidences of implementations of several linking models with the productive sectors in Mexico. Nevertheless, these models are usually copycats of those devise for the North American context, in such a way that the obtained results are far from the level of success achieved in North American universities, operating high budgets derived from the linking to companies or foundations (Arocena and Sutz, 2001). This reality indicates the necessity to outline alternatives suited to the national context which will naturally allow giving an answer to social requirements in each moment.

The modern social and professionals demands are challenging the design of the curriculum of universities studies in all branches of sciences, namely in engineering and technology. Hence, the authors agree with the idea of (Shigwara,) *that raising the university education demands an integrate system and interactive with the transformational governorship and leadership* (2014).

The linking process is frequently conceived as a way for getting mutual benefits for the company and the university, as a way for finding financial support to university process leading to subordinate projects to company interests and distracting the attention from the formative process.

To go step further the linking process conception has to be renewed. Consequently, the authors has defined it *as a net of relationships between the university, the government, the company and the society to coordinate efforts for common benefits allowing to favor the formative process of the students, as well as obtaining resources through different coordinated projects under the leadership of the university*. This definition subsumes former models of the linking process but at the same time excel them for its students-centered-approach, the priority given to the formative process and the leading role of the university in society. The proposed model correspond to the already mentioned formative approach.

The state of art of the linking process at the Faculty of Mechanics and Electric Engineering

Category 1: Interrelation level of the agent in the linking process.

The following is a description of the information gather by means of the interviews given to each group of subjects.

The level of interrelation between the Faculty of Mechanics and Electric Engineering and companies (Table 1) was regarded as “high” by the majority of the subjects, 88,9% of professors graded it as high, 62,9% of students give the same answer, but 50% of companies personnel valued it only as average. Apparently, these findings are satisfactory and suppose there is an area of opportunities for the interrelation of agents. However, it seems recommendable to monitor the criteria of companies permanently.

Table 1. Valuation of interrelation level between agents of the linking process

<i>Agents</i>	<i>High</i>	<i>Average</i>	<i>Low</i>
Professors	88,9 %	-	-
Students	62,9 %	-	-
Managers	-	50,0 %	-

Category 2: Interrelation level of recognition of the linking process significance in students' education

To go deeper into the evaluation of the level of recognition of the linking process significance, managers and professors were asked to write an essay under the title "Present and future of the linking of the university to the companies". Most of those implied in the technique carried out a favorable valuation about the importance of the linking, they also manifested critical judgment on what the linking process should be.

The most representative expressions of managers are the following:

- 1) "The linking process is very important for all and we should promote a higher level of participation."
- 2) "Society will be more capable of facing its problems if the interrelation between university and companies were perfected."
- 3) "The linking process might be a source of social and economic initiative to increase the quality of life."
- 4) "The linking process should be more clear, tenacious and effective to achieve better results".
- 5) "To fulfill the objectives innovative technology should be introduced in the linking process".
- 6) "The lack of systematic arrangement should be avoided in the linking process.

On the part of professors the most interesting opinions were the following:

- 1) "Innovation in any service should surpass the triple propeller model".
- 2) "The linking process should be regarded as an important function to be developed at the university".
- 3) "A definition of joint working criteria should lead to the synergy of different levels".

Category 3: Level of satisfaction of different agents

An important aspect to value the current state of this category is knowing the degree of students' satisfaction in relation to the linking process. The findings are shown in table 2. Professors, and students are included at the average level of satisfaction (55.6% and 53.2% respectively), whereas 65% of managers presents a low level of satisfaction.

Table 2. Agents satisfaction in relation to the linking process.

Agents	Satisfy	Half-satisfy	Low-satisfaction
Professors	55,6%,	87,9 %	12,1 %
Students	53,2%	-	-
Managers	25 %	10 %	65%

Category 4: Level of contribution of different agents to the linking process

The finding shows there are difficulties in the enrolment of different actors in the linking process. Almost a half (48.4%) of the students consider their participation is low. On the contrary, approximately the same proportion (45%) of managers qualify it as average; whereas a large part of the professors (66.7%) consider their participation is high. Nevertheless, this result should rather be interpreted as an aspiration; in practice professors show little interest for the linking process.

A formative approach to the linking process

The analysis of the antecedents and the gathering of data just discussed contributed to the construction of a framework and a new model of the linking process for the Faculty of Mechanics and Electric Engineering. The management of the linking process should be aimed at the education of engineer students, without disregarding other objectives and functions. As it is described in figure 1, the linking process has two fundamental focuses that are guided to the improvement of the student's professional and social training. The dynamic of the relationship between them depends on the potentials and necessities of each of the agents involved in the process of linking. The proposed model takes the formative function as the central focus or main function, and considers the rest as subsidiary functions.

Figure 1 contributes to a general vision of the linking process. The formative process makes emphasis on the participation in the social development, the development of personal and professional competencies and the preparation for the future labor context, taking into account several objectives shown in the figure.

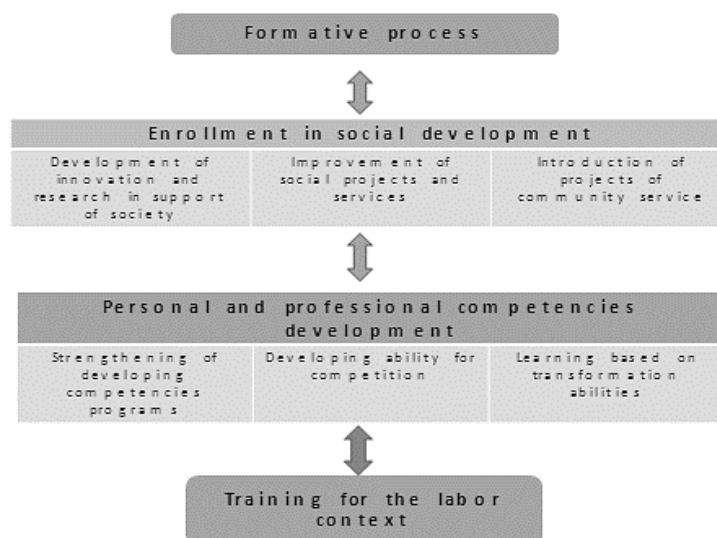


Figure 1. The formative approach of the linking process (Castillo, Álvarez, Cupich, 2014.)

Those approaches related to obtaining results, or traditional models of linking, include a number of objectives that contribute to students' education in one form or another, as well as to other processes that are related with it. However, as it has been previously explained that little attention is given to its educative potentials.

The linking process as way of obtaining resources

The foundations of the formative approach constitute a theoretical platform for designing strategies to carry out the linking process and pursuing definite objectives. The general practice proved that the process is usually performed following certain routinized actions and patterns. Additionally the agents tend to be only partially involved. This is clearly expressed when surveyed agents declared that their enrollment is insufficient.

It is widely known that the linking process is a way of obtaining resources for the development of the university. These resources are beneficial to the infrastructure, the professors' staff and the students. These resources are usually invested in the creation or improvement of facilities, in updating technology, creating new academic areas, carrying out new research projects, developing programs for professors' development, offering scholarships, creating social services for the students and other incentives programs for the staff.

Conclusions

The data gathered in this study show areas of opportunities and potentials for the satisfaction of the different agents taking part in the linking process. For these reason the authors reach at the conclusion that the interrelation among these agents needs to be perfected. One solution might be a comprehensive strategy allowing the increase of the efficiency of the linking patterns oriented towards the training of students, this focus on students' education produces not only the traditional source of resources but the development of professional competencies, creating conditions for successful performance in the future labor context and its corresponding favorable impact on social development.

Similarly, the authors observed the necessity of strengthening the process of the student's education and in writing this paper has coined it as *the formative approach* to the linking process. In a general sense, the following strengths and weaknesses are highlighted.

Strengths: There are favorable conditions for the interrelation of all the agents of the linking process and a positive valuation of the potential of the linking process for the student's formative process.

Weaknesses: The professor's insufficient participation in the linking process and the agents' poverty of arguments on the importance of the linking process for the engineering student's integral education.

Opportunities: The possibility of increasing the interrelation between the agents of the linking process, together with the capacity of the university to design the necessary strategies and to exert a leadership in the relations with companies and society in general.

Two different approaches to the linking process are clearly identified in this paper. The possibility of following a *formative approach* contributing to would-be engineers'

education, without disregarding the university need to obtain resources proved that the design of a comprehensive strategy is viable. The linking process may and should go beyond obtaining resources.

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