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A Novel Equation for Quality in Education?

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ABSTRACT

Nowadays educational organizations are facing an increasing dependence of university budgets on the financial market and the application of new financial instruments so that the financial department has become the most powerful, especially in the university. Following Ginsberg [1] and Engelen et al [2], we can speak of a trend toward a kind of financialization of the university Universities have been increasingly concerned to demonstrate their contribution to the economic performance of their local and national economies. Worldwide, a big part of educational organizations is doing a major effort by examining students' services and creating student-friendly approaches that far exceed customer service. This trend is nominated 'the art of capturing audiences and entertaining them' following Arum and Roksa [3]. In this study, the authors aim to find out if factors related to industrialization and innovation can influence the quality of educational organizations, and if yes what is the equation that links all these factors. A questionnaire was administered to students, teachers, and guardians. Responses were analyzed using the linear regression model. Based on the statistical analysis, the authors create an innovative scientific equation that links all the significant factors that could affect the quality of educational services. This equation could be used by educational organizations to assess their quality level.

Keywords: Academic Capitalism, Industrialization, Quality, Business model, Innovation.

INTRODUCTION

The capitalist economy is characterized by competing businesses striving for profits and trying to gain competitive advantages over their rivals to secure monopoly rents. This is done by innovations protected by patents or by creating a brand that ties the customers in such a way that they do not even take a look at competing products. Most recent developments show an increasing dependence of university budgets on the financial market and the application of new financial

instruments so that the finance department has become the most powerful in the university. Hence Following Ginsberg [1] and Engelen et al [2] we can speak of a trend toward a kind of financialization of the university.

Educational organizations have been increasingly concerned to demonstrate their contribution to the economic performance of their local and national economies. In 2016 Richard Munch [4] presented a schematic concept of the academic capitalism "the triple helix".

Academic capitalism

Academic capitalism is located in the zone of the three components of the triple helix: science, politic, and economy. It is a hybrid that unites the scientific search for truth and the economic maximization of profits.

The first component is the science; the guardian of this component is the scientific community which will push to produce "knowledge" as a collective good because sharing resources is a prerequisite of progress knowledge. The other interface is knowledge capitalism that is the core of a knowledge-based economy where capitalist enterprises compete for the private utilization of knowledge and patents. The second and third are economy and politics. Funding for research by politics makes science and economy accountable in their collaboration toward stakeholders with an interest in innovation. Academic capitalism is located at the intersection of innovation policy and output control to produce knowledge as a private good.

Innovation

Since we are talking about innovation the authors consider in this study the 10 parameters of innovation following Swanger [5],

- Rewarding innovation, even if it fails
- Training faculty and staff in design for Innovation Techniques
- Fostering cross-departmental teams to solve problems
- Clearly defining problems that must be addressed
- Understanding your learners
- Providing time for unstructured time
- Not imposing too many rules
- Listening with an open mind
- Encouraging prototypes
- Using data and observation

Following shamas and Polonik [6], the degree of implementation of the 10 parameters differ. Some are effective, some are well implemented and few need development. In this study, the authors decided to consider all of them.

Industrialization

Academic capitalism does not mean only coupling between science and economy; it also includes following Barber [7], the transfer of economic capitalist practice elements to scientific practice. These are the typical features of this transfer.

- New circuits of knowledge by linking scientific knowledge production directly to the production of marketable goods, for example with increased patenting activities or copyrighting of instructional material for teaching;
- Enhanced managerial capacity of the educational organizations aiming at improving their external competitiveness and their internal controlling of business processes.
- Intermediating organizations for linking universities with industry.

In this study, the author takes into consideration the 4 criteria of educational industrialization, but in order to avoid any misunderstanding, it is important to define industrialization.

Following Levy and Slichter [8] Industrialization is the system of production that has arisen from the steady development, study, and use of scientific knowledge. It is based on the division of labor and on specialization and uses mechanical, chemical, and power-driven, as well as organizational and intellectual, aids in production. The primary objective of this method of organizing economic life, which had its genesis in the mid-eighteenth century, has been to reduce the real cost, per unit, of producing goods and services.

The industrialization concept is not restrictive to manufacturing, services such as transportation; communication, and education are subject to industrialization. Following Meier [9], the universities have become entrepreneurial

The 4 main criteria of industrialization following Hayes, Wynyard and Mandal [10] are:

- Efficiency
- Predictability
- Control
- Calculability

Efficiency

Efficiency means enrolling more and more students. In other term, it is called massification. This approach is underpinned by a significant rise in debt levels required to support the student loan systems. The university Efficiency is done by replacing the formal and final examinations by more varied modes of assessment, Portfolios, blogs, videos. On some undergraduate programs there are now no formal examinations. The result is grade inflation with more students getting an upper second- and first-class degree.

Predictability

It means the restructuring of degree programs in order to shift them to a highly structured training programme full of 'learning objectives', 'learning outcomes', 'marking criteria', and 'level criteria'. If a student meets the derided outcomes so he passed the new programs.

Calculability

Means league tables. Calculability gone from strength to strength. Universities are spending huge time focusing on moving up a few places on the growing number of league tables. Universities used ranking to influence student enrolment and retention. In addition, we arrived at a point where universities can closed if it is at the bottom of the league tables

Control

In a form of review meetings that monitor the progress of target achievement. One of the main Examples of control is The Academic Workload Planning (AWP), where each instructor has one thousand six hundred hours to complete divided between administrative, lecturer, research, student assistance. A teacher is accounted for every hour. Following the author, it is the crudest 'industrialization' of the academic as a worker.

Business Model framework

In order to understand the business model of educational organization, the authors referred to the 9 factors mentioned by Osterwalder et al. [11]

- Customer Segments
- Value Propositions
- Customer Channels
- Customer Relationships
- Revenue Streams
- Key Activities
- Key Resources
- Key Partners
- Cost Structure

Quality Requirements

The authors try to understand the impact of these parameters on quality factors. This is why it is important to define quality. As mentioned above many references exist, in this article, the authors refer to the international standard ISO21001:2018 that specify the requirements that should be implemented in educational organizations to implement a quality management system. (Educational Organizations — Management Systems for Educational Organizations — Requirements with guidance for use, 2018) [12]

The definition of quality mentioned in ISO 9000:2005 "is the degree to which a set of inherent characteristics fulfils requirements (Quality management systems - Fundamentals and vocabulary, 2005) [13]

The quality management system requirements mentioned in ISO 21001:2018 are regrouped in 23 categories.

- Understanding the needs and expectations of interested parties
- Focusing on learners and other beneficiaries
- Developing a quality policy
- Communicating the policy to stakeholders
- Setting additional requirements for special needs education
- Identifying organization objectives and planning to achieve them
- Planning of changes
- Taking actions to address risks and opportunities
- Evaluation of satisfaction of learners, other beneficiaries, and staff
- Conducting internal audit
- Developing a management review

- Assure continual improvement
- Provide support for organizational knowledge
- Provide support for human resources
- Provide support for the environment for operating educational processes
- Provide support for facilities
- Building capacity
- Control of delivery and changes of the educational products and services
- Determining the requirements for the educational products and services
- Communicating the requirements for the educational products and services
- Control of the educational nonconforming outputs
- Design and development of educational products and services
- Teaching the transferrable skills (taking initiatives, taking responsibilities,
- communication skills, cooperation, teamwork, leadership, and problem analysis)

METHODOLOGY

This study is based on studying the filled surveys from 3 categories of stakeholders covering the following categories of educational organizations:

- Public and private Vocational School
- Public and private School
- Public and private Universities

In this study, students, teachers, and guardians' responses are analyzed using a linear regression model to find the relationship between the factors. The quality of education in the Lebanese educational organization would be described in function of innovation factor, industrialization factor, impact factor, and business model factor. The variables are divided into:

- Dependent variable which is the total quality factor score.
- Independent variables which are the total innovation factor score, total industrialization factor score, impact factor, and business model factor.

In our study, we want to explain the quality factor in the function of the other four factors.

Study Design

This study is based on quantitative linear regression analysis

Study Location

All categories of educational organizations across the country

Study Duration

The study has been done during the Academic Year 2019/2020.

Sample size

1660 responses divided into 625 students, 585 teachers, and 450 guardians.

Sample size calculation

The sample size was determined using the Yamane formula [14]

$$n=N/1+N\alpha 2 \qquad (1)$$

Where α is the desired level of precision. With a 95% confidence level and 5% precision;

A New Quality Equation

Each of the mentioned above parameters related to innovation, industrialization, business model and quality is identified by β. In this model, we have 48 parameters (β0, β1… β47) to be estimated using the least squares method To explore the relationship between the independent variables and total quality score, we first applied multiple regression analysis. Thus, the general regression model has the following general:

$$\begin{aligned} &Total\ Quality\ Score \\ &= \beta 0 + \beta 1 total\ innovation\ score + \beta 2 total\ impact\ score + \beta 3\ 1\gamma 1 + \beta 4\ 1N1 \\ &+ \beta 5\ 1\gamma 2 + \beta 6\ 1N2 + \beta 7\ \ 1risk\ assessments + \beta 8\ 1Academic\ workload\ planning \\ &+ \beta 9\ 1lecturer\ working\ hour + \beta 10\ 1ethics\ committee\ approval \\ &+ \beta 11\ 1learning\ objectives + \ \beta 12\ 1learning\ outcomes + \beta 13\ 1\ marking\ criteria \\ &+ \beta 14\ 1\ level\ criteria + \beta 14 \\ &+ i \sum_{i=1}^{10} \left(\frac{Q1}{modality\ i}\right) + \beta 2 + i \sum_{i=1}^{5} \left(\frac{Q2}{modality\ i}\right) + \beta 29 + i \sum_{i=1}^{6} \left(\frac{Q3}{modality\ i}\right) \\ &+ \beta 35 \\ &+ i \sum_{i=1}^{2} \left(\frac{Q4}{modality\ i}\right) + \beta 38\ \ 1\left(\frac{Q5}{modality\ i}\right) + \ \beta 38 \\ &+ i \sum_{i=1}^{5} \left(\frac{Q6}{modality\ i}\right) + \ \beta 43 + i \sum_{i=1}^{2} \left(\frac{Q7}{modality\ i}\right) + \beta 46\ teacher \\ &+ \ \beta 47\ guardian \end{aligned}$$

ANALYSIS OF DATA

Data Set

Firstly, we apply a regression analysis to estimate the parameters βj for j = 0; _ _ _; 47.
The regression tables can be divided into three components:

- Analysis of Variance (ANOVA): provides the analysis of the variance in the model to test the significance of the regression model.
- Regression statistics: provide numerical information on the variation and how well the model explains the variation for the given observations.
- Outliers: provide unusual observations in the data.

Results

Table 1 shows the results of the ANOVA test. The hypotheses to be tested are:

- H0: All parameters are equal to zero: $\beta 1 = \beta 2 = _ _ _ = \beta 47 = 0$
- H1: There is at least one parameter different to zero: $\exists j/\beta j \neq 0$

P-value for the Anova test is equal to 0 which is smaller than 0.05 thus, we can be extremely confident that there is a significant linear relationship between the Total Quality Score and the other variables.

Table 1. The results of the ANOVA test.

Model	Sum of Squares	Degrees of freedom	Mean Square	F-statistic	Significance
Regression	788526.300	47	16777.155	47.058	.000b
Residual	573995.223	1610	356.519		
Total	1362521.523	1657			

Table 2 shows the value of R2 (R Square) which represents the power of a model. R2 is approximately 58%, which implies that the independents' variables can explain 58% of the variation in the Total Score Quality.

Table 2. The results of Model Summary.

Model	Sum of Squares	R Square	Adjusted R Square	Std. Error of the Estimate
1	.761a	.579	.566	18.882

Outliers: Cook's distances were calculated to assess outliers. Obtained values for this criterion suggested the presence of outliers, which led to data reduction to remove all outliers.

Table 3 shows that after deleting 90 observations, the data from 1660 to 1570, and R2 increase to 74:7% (as shown in) which is a good result that indicates a good regression model.

Table 3. The results of Model Summary after deleting the outliers

Model	Sum of Squares	R Square	Adjusted R Square	Std. Error of the Estimate
1	.864	.747	.739	13.653

By checking the p-value of each parameter only the significant variables are entered into the model. By re-modeling the regression model with the significant variables, we obtain the result in Table 5 that include the coefficients which are statistically significantly different from 0 using alpha of 0.05 are:

- Innovation (Total Innovation Score)
- Impact (Total Impact Score)
- Parameter related to make efforts to grow better and bigger and to enroll more students
- Parameter related to the efforts done to emphasize national and international rank
- Parameter related to Lower price
- Parameter related to Learning objectives
- Parameter related to Value driven
- Parameter related to Variable costs

- Parameter related to Problem solving, knowledge management and continuous training
- Parameter related to Production, deliver products or services
- Teacher
- Guardian

Table 4. Linear Regression model results after deleting no significant variables

	Unstandardized Coefficients		Standardized Coefficients		
Model	**B**	**Std. Error**	**Beta**	**t**	**Sig.**
(Constant)	-10.082	1.625		-6.202	.000
Impact	.889	.104	.128	8.561	.000
Innovation	1.741	.038	.700	45.882	.000
IndQ1_1	2.637	1.085	.039	2.429	.015
IndQ2_1	4.282	1.019	.066	4.204	.000
IndQ4_1	2.625	.906	.041	2.898	.004
BusQ1_7	2.767	.815	.045	3.395	.001
BusQ7_2	4.645	.822	.083	5.648	.000
Guardian	2.300	.925	.038	2.486	.013
Teacher	2.935	.863	.053	3.401	.001
BusQ6_2	2.460	.764	.043	3.222	.001
BusQ6_4	2.118	.836	.033	2.535	.011
BusQ7_1	2.337	.837	.039	2.793	.005

CONCLUSION

Based on the statistical results of the multiple regression analysis, general conclusions can be made concerning the direct relations between the independent variables, and the Total quality Score.

The regression equation that the authors called "CAP" equation is given as:

$$\begin{aligned} \boldsymbol{CAP\ Score} = {} & -10.082 + 1{,}741\text{Total Innovation Score} + 0.889\ \text{Total Impact Score} \\ & + 2.637\ 1\text{make efforts to grow better and bigger and to enroll more students} \\ & + 4.282\ 1\text{make efforts to emphasize your national and international rank} \\ & + 2.7671\text{Lower price} + 2.625\ 1\text{Learning objectives} + 2.460\ 1\text{Value driven} \\ & + 2.118\ 1\text{Variable costs} \\ & + 4.645\ 1\text{Problem solving, knowledge management and continuous training} \\ & + 2.337\ 1\text{Production, deliver products or services} + 2.935\ 1\text{Teacher} \\ & + 2.3\ 1\text{Guardian} \end{aligned}$$

It is confirmed that the innovation factor and impact factor influences the quality factor and the impact of innovation factor is higher than that of impact factor. Consequently, it can be established that the efforts made by the educational organizations to grow better and bigger and to enroll more students and to emphasize their national and international rank increase the quality of education.

In addition, a focus on learning objectives for rebuilds degree programs increase also the quality of education. Concerning the business model factor, a lower price is the kind of value propositions that the organization intended to serve to students which affects positively the quality of education.

Moreover, the most important costs inherent in the educational model and increase the quality score are value-driven (focus on value creation) and the variable costs. Additionally, Production, deliver products or services and Problem-solving, knowledge management, and continuous training are the two key activities of the educational organizations that create the services they provide which improve the education quality of their organizations.

To visual this relationship, path analysis is applied to assess the final research model
By referring to regression results given in table 4 and especially the column of Standardized Coefficient Beta, the output path diagram looks like Figure 1

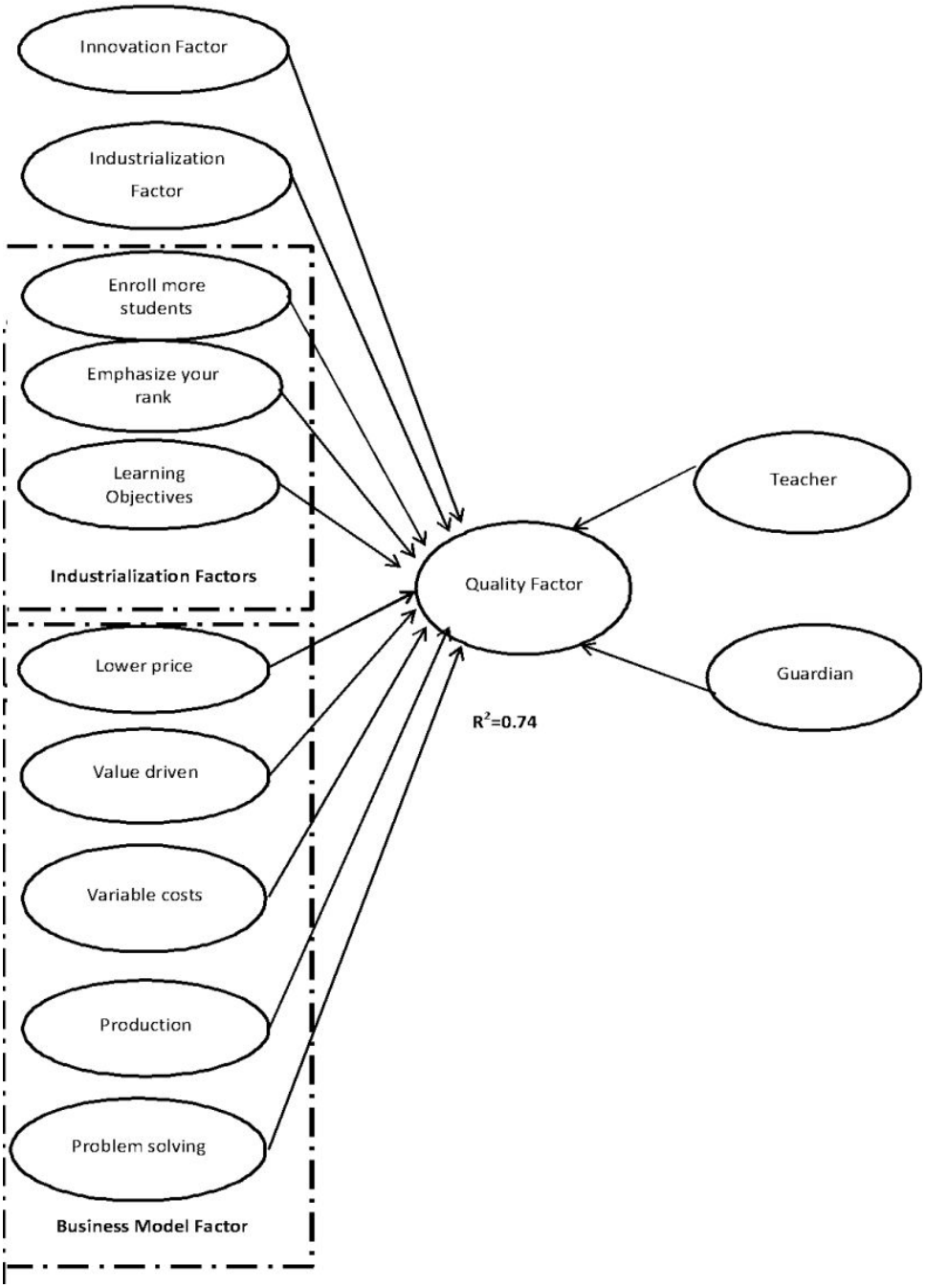


Figure 1. The output path diagram

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