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# The impact of workforce on industrialization in Algeria with the existence of expenditure in education as a variable mediator from 1970 to 2014

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**ABSTRACT**

This paper discusses the role of labor force in industrialization in Algeria by entering the spending in education as a mediator variable. From a theoretical point of view, there are good grounds for believing that labor force can play an important role in promoting industrialization, but if education had been incorporated in manufacturing, this will facilitate the conduct of manufacturing operations. At this, the authors will use the method of Path Analysis in order to calculate the impact of the labor force on industrialization in Algeria with the presence of education expenditure as a variable mediator during the period from 1970 to 2014. It is therefore concluded that education expenditure plays an important mediator role in the enhancement of workforce's capacity to strengthen manufacturing in Algeria during the study period.

**Keywords:** Industrialization, labor force, education expenditure.

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## INTRODUCTION

Industrialization in the context of industrialization policies occupies a prominent position in economics, for many developing countries and many researchers in this field. It is the essential foundation to support the structure of the economy, and achieve economic development goals as a link to the rest of the economic sectors. In the same theoretical context, it has been found that the industrialization strategies, according to the experience of many countries in industrialization as an instrument of perfect link between the objectives and goals of industrialization policies.

Algeria during periods of socialism and capitalism has pursued different industrialization strategies according to the orientation of industrialization policies, most notably the manufactured industries strategy under socialist orientation, and the expansion of investment and industrial network and the granting of loans under the same capitalist orientation. Hence, industrialization policy in Algeria is based on the presumption that economic development requires industrialization. At this place, industrialization in Algeria is seen as one of the determinants of industrialization policies.

In order to examine the impact on industrial performance in Algeria, the authors chose the informal sector as a strategy among other industrialization strategies. Here workforce is seen as a determinant of the informal sector determinants, and expenditure on education appears as a determinant of sectorial partnership in infrastructure investments which is considered as the sole factor in the formalization of the informal sector, and the possibility of showing the real contribution of the informal sector in achieving the objectives of industrialization policies in Algeria.

Through the Path Analysis method, we will study the impact of workforce on industrialization in Algeria with the existence of expenditure on education as variable mediator during the period from 1970 to 2014. This model contains 3 macroeconomic variables, of which 1 causal variable of the informal economy that is workforce proportion of the total employees in Algeria, and 1

variable as an indicator of industrialization policies which is the added value for industrialization in Algeria, and finally, 1 variable mediator for sectorial partnership in infrastructure investments which is the expenditure in education sector in Algeria. For that end, the problematic of this study is as follows:

What is the impact of the workforce on industrialization with the existence of expenditure on education as a variable mediator in Algeria during period from 1970 to 2014?

## LITERATURE REVIEW

### Industrialization and industrialization policies

Industrialization is recent; its use began to describe the situation of the state which takes economic and social development policy by relying on industry and industrial endemicity. Robinson (2009: 26) stated there are many reasons to the economic theory to believe that industrialization politics may be socially desirable being a "dynamic catalyst for economic growth and, economic development by stimulating industrialization"… In this context, industrialization is expressed by industrial output development where it becomes the most important source for national incomes. Thus, According to Kiely (2005:3), industrialization can be defined from three corners, first it is " the production of all goods and services that is not directly derived from the land", second is "the economic sector which includes mining, manufacturing and energy", and third, the most important definition which sees that industrialization is " a particular way of organizing production with assumption of a constant technical and , social change process which increases the ability of the community to produce a wide range of goods".

In the same context, Kitching (1982) in his book "Development and Underdevelopment in historical perspective (Populism – Nationalism – Industrialization" posited that in the context of specific disputes about development we must be careful to defend the viewpoint which says that "if you are interested in development, you should go for industrialization". This opinion of Gavin Kitching it is the most common to theorists of development in 1950 and 1960 (P.10). Whereas Chandra (1992) believes that industrialization "expresses the increase in the share of GDP due to its contribution to the manufacturing industry sector. It is a process that involves a change in the structure (or reconfiguration) of the economy", so industrial operation is "a social transformation process which includes economic, political and cultural changes" (P. 4). On the other hand, Ahmed (2002) sees that industrialization is "the process through which a non-industrialized country becomes an industrialized country" (P.15). Indeed, industrialization is a very complex process so it cannot be defined solely on the basis of quantitative changes only for many reasons. The most important of which is that there are numbers of activities classified under the title "Industrial, or Industrialization", in fact are limited to a simple change of an essential product, and this leads to exaggeration about the industrial part of activity. To overcome this difficulty, according to Abdelkader (2002), we cannot consider country to be an industrial one, unless the participation rate of manufacturing in GDP increases. For Bianchi and Labory (2006), the term of industrialization policies refers "to a range of measures taken by the government in order to influence the industrial performance of the country to achieve the desired goals" (P. 435).

### Workforce and industrialization

In the last years, broad consensus appeared in order to emphasize the need to intensify human capital in economic and social development of nations. The concentration of human resources in the process of creating added value has established a new model, turned primarily towards the transformation of information to knowledge and skills within organizations, in which "human capital" expresses the launch of continuous revolution. According to Mohammed Bahloul (nd), Amartya Sen Nobel prize in economics in 1988 in his book "A new economic model for 2005", he confirms the decisive role of institutional heritage based on investment in human capital for " Maoist" period , the reason for the economic success of capitalism in China (P. 2). In this context, Garira (2006) declares that "human capital is the production capacity of the individual which he acquired through the accumulation of general or specific knowledge stocks, done through activities in the form of investments" (P 2). But, as for Schultz (1961) the intensification of workforce or human capital involves the accumulation of all previous investments in education – training during work and, other factors increase individual productivity and thus achieve more profits. Knowledge and skill, in his opinion, is the product of human investment, which translates eventually by adding an economy value (P. 2).

### Technological learning in industrialization

In most developed countries, industrialization is considered as "the transformation process from a traditional society to a modern society where science and technology play a critical role" (Linsu, 2001: 2). Via technological possibilities we should possess the ability to take advantage of technological knowledge in many fields, such as: the production – engineering – innovation to maintain the quality and competitive pricing capability.

These capabilities allow the company to accommodate – utilization – conditioning – modify existing technology, also allow it to use new technology and then develop new products, and new process to satisfy the needs of the changing economic environment. Through technology learning which is formed and accumulated, governments and companies should both increase competitiveness. Companies should include activities in this area within the company, and the government has the role to facilitate this through the provision of major infrastructure facilities. On the other hand, Hungerford and Wassmer (2004) has confirmed the existence of case dissatisfaction in the United State, resulting from the lack of education systems that have the ability to provide intellectual outputs – techniques – training in line with the possibility of achieving excellence in any field (P. 5). Miron (2010) also sees that expenditure in education, especially in the field of research and development requires revenues derived from renewable resource such as taxes, but if the spending is taken from non-renewable sources such as printing a money without any counterpart, it will generate inflation which will turn back negatively on the flexible nature for the conduct of economic activities including industrialization (P. 4). According to the theoretical framework, it is shown that the workforce has a role in facilitating the conduct of manufacturing operations, by providing spending in education as factor in industrialization as an intermediate mean for the transfer of the impact of workforce in industrialization. The relationship between the studied variables illustrated in Figure 1.

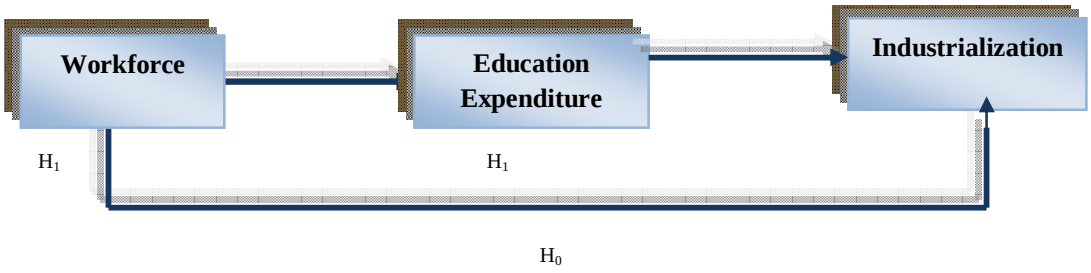


**Figure 1.** The study model – schematic diagram of process study variables path. Source: Prepared by the researchers based on previous studies.

## METHODOLOGY

### Definition of the study model

In keeping with the research problematic, we use the path analysis which is an extension of multiple regressions. Path analysis exceeds regression because it allows for the analysis of more complex models, where cases with many dependent variables can be studied (Streiner, 2005). According to what precedes, the method used in the study (Path analysis) is used to determine whether the designated model is the correct one, and to determine whether the data are consistent with the model. According to the first hypothesis ($H_0$) the workforce has a prominent role in facilitating the manufacturing processes, thus the workforce a direct impact an independent variable for manufacturing, and from it the workforce is an independent variable for industrialization. This is the form that appears at the bottom of Figure 1. However, the second hypothesis ($H_1$) supposes that the workforce has a prominent role in facilitating the industrialization processes, and then requires increased training and education in industrialization process. This in turn leads to facilitate industrialization operations, thus the workforce has an indirect impact on industrialization with the existence of the expenditure on education as the dependent variable for the workforce, and independent variable for industrialization. This is the model in the upper part of Figure 1.

### Descriptive statistics for the variables of the study

From Table 1, it is noted that there are no missing values, that is, the number of time periods in this study is 45 years. The table also shows the arithmetic average values, the standard deviation as well greater value and smallest value, as for the results of sprains coefficients it was sandwiched between [-1, 1], for kurtosis modulus values it is not a much distant from zero, that is the evidence that the variables of the study follow a normal distribution.

### Correlation between the study variables

Through Table 2, it is noted that there is a negative correlation between: (Education expenditure and Industrialization), (Education expenditure and Workforce), (Industrialization and Workforce) in Algeria during the period from 1970 to 2014.

**Table 1.** Statistical analysis of the study variables.

| Variables | Obs | Mean | Std. Dev | Min | Max | Sprains Mod | Kurtosis Mod |
|---|---|---|---|---|---|---|---|
| Industrialization | 45 | 4.525556 | 2.247907 | 0.61 | 8.7 | 0.9897 | 0.1267 |
| Education expenditure | 45 | 4.593556 | 2.992123 | 4.2 | 5.8 | 0.00000 | 0.0005 |
| Workforce | 45 | 34.72444 | 5.632824 | 25.0 | 45.5 | 0.4841 | 0.1661 |

Source: Presented by Researchers Using Stata V12 Output.

**Table 2.** Correlation between study variables.

| Variables | Industrialization | Education expenditure | Workforce |
|---|---|---|---|
| Industrialization | 1.0000 | -0.3119 | -0.1500 |
| Education expenditure | | 1.0000 | -0.2225 |
| Workforce | | | 1.0000 |

Source: Presented by Researchers Using Stata V12 Output.

***Modeling with using the path analysis***

After doing the process of building the proposed theoretical model in this study, we tried by relying on the path analysis method, to clarify the relationship between the different variables of the study. (Figure 2)

**Direct impact of the study variables**

From Table 3, it is noted that:

1. The existence of a negative non-significative impact of the workforce on education expenditure in Algeria and estimated at -0.0118203 during the period from 1970 to 2014, explained the nature of the negative relationship between the workforce as a percentage of the total number of workers, and expenditure on education as a percentage of the total participation of the public sector in education expenditure, what education system in Algeria offers does not comply positively with what economic side requires. This is illustrated by a study of Hungerford and Wassmer (2004), which confirmed the existence of a state of dissatisfaction by individuals for what educational organizations offer in the United States of output, it does not display an acceptable level of excellence in any field.
2. The existence of a significative negative impact of education expenditure on industrialization in Algeria estimated at -2.729421 during the period from 1970 to 2014, explained the nature of the negative relationship between education expenditure as a proportion of total public expenditure in education and industrialization as an additive proportion in GDP. According to the study by Miron (2010), the spending in education process requires especially in research and development (R&D) on return for tunnels, it is either taxes or borrowing in the future, but if the spending from non-renewable resources such as printing money without any return, as it happened in Algeria throughout the study period, it will generate inflation which dates back negatively on the flexible nature for the conduct of economic activities including industrialization; which does not fit with the nature of the technical changes in the current international environmental ( P. 4).
3. The existence of a non-significative negative impact of workforce on industrialization in Algeria and estimated at (-0.0921246) during the period from 1970 to 2014, explained the nature of the negative relationship between the workforce as a percentage of the total number of workers, and industrialization as a additives proportion in GDP, in the light of economic trends and the large number of economic reforms pursued, Algeria has not been able to create backward and forward linkages of the economy by achieving industrial development backed by a strong industrialization sector an enhanced with a skilled labor, this was confirmed by Begga (2014) that Algeria in share of the extensive economic reforms has not been able create a flexible manufacturing industry which is considered the backbone of modern economies, which led to lower productivity and decline in the share of non-hydrocarbon exports.

**Indirect impact of the study variables**

From Table 4, it is noted that the existence of an indirect positive effect but not significant for the workforce on industrialization, with the existence of education expenditure as a variable mediator in Algeria during the period from 1970 to 2014. The positive nature of the relationship between the workforce and industrialization with the existence of education expenditure as variable mediator shows the transformation of the negative direct relationship for each of the workforce and education expenditure on industrialization, to a positive impact by introducing a spending variable in education as variable

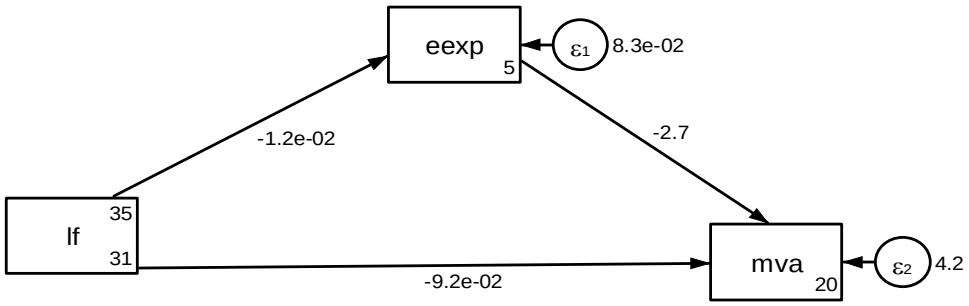


**Figure 2.** Modeling with using the path analysis. Source: Presented by researchers using Stata V12 output.

**Table 3**. Direct impact of each variable.

| Variables | Coef | Std. Err | Z | P>z | [95% Conf. Interval] | |
|---|---|---|---|---|---|---|
| Workforce on education expenditure | -0.0118203 | 0.00772 | -1.53 | 0.126 | -0.0269513 | 0.0033107 |
| Education expenditure on industrialization | -2.729421 | 1.060355 | -2.57 | 0.010 | 4.80768 | -0.6511628 |
| Workforce on industrialization | -0.0921246 | 0.0563254 | -1.64 | 0.102 | -0.2025205 | 0.0182712 |

Source: Presented by researchers using Stata V12 output.

**Table 4.**Indirect impact of the study variables.

| Indirect impact | Coef | Std. Err | Z | P>z | [95% Conf. Interval] | |
|---|---|---|---|---|---|---|
| Workforce on industrialization | 0.322626 | 0.0245172 | 1.32 | 0.188 | -0.0157901 | -0.0803154 |

Source: Presented by researchers using stata V12 output.

mediator in the study model. Many studies have shown that, it is through the previously mentioned studies by the acquisition of technological knowledge we can charge individual capacities in many fields most notably the industrialization field. Moreover, by using new knowledge – new capabilities – new resources and equipment, we can develop new products, and thus facilitating the conduct of industrial operations in the light of a changing international economic environment (Linsu, 2001). The changing of the direct negative impact of variables to positive indirect impact in Algeria during the period from 1970 to 2014, demonstrates the importance of strengthening the human capacity in education spending, in order to launch a continuous industrial revolution (Bahloul, nd), and building a new economic model of manufacturing consistent with the technical changes.

## Model quality indicators

From Table 5, it is noted that the chi–square value of the index amounted to 9.49 and significant but not statistically acceptable. it is supposed to range between 2 and 5, this explains that the flaws of this indicator is its sensitivity to the size of the sample, as for each of the other indicators of (RMSEA – CFI – TLI), its acceptable values and this is what confirms the quality of matching study model.

**Table 5.** Model quality indicators.

| Indicators | Probability |
|---|---|
| Chi-Square | 0.023 |
| RMSEA | 0.000 |
| CFI | 1.000 |
| TLI | 1.000 |

Source: Presented by researchers using Stata V12 output.

## FINDINGS

From using path analysis technique, we found that:

i) Workforce has a direct and negative effect on education expenditure in Algeria.
ii) Education expenditure has a negative a direct effect on industrialization in Algeria.
iii) Workforce effects negatively and directly the

industrialization in Algeria.
iv) With the existence of education expenditure as intermediate factor, the workforce effect positively and indirectly industrialization.
v) This study has shown the importance of education expenditure in the enhancement of the workforce's capacity to strengthen and facilitate the manufacturing processes, in line with the international changes in the economic environment; this was confirmed by many previous studies on the subject of the search.
vi) There must be consistency between educational curricula and internal and external economic environment requirements in Algeria.
vii) Education expenditure for industrialization must be based in Algeria, on renewable resources to ensure the continued support and does not cause an imbalance in the economic structure.

## Conclusion

This study has attempted to show how the education expenditure as a mediator variable has an important role to ensure the effectiveness of the workforce for manufacturing. Through our analysis of study results and using the path analysis method, it is shown that the workforce does not have a positive impact on industrialization in Algeria during period of study (1970 to 2014), because Algeria has not been able to create backward and forward linkages of the economy by achieving industrial development backed by a strong industrialization sector an enhanced with a skilled labor (this has been pointed out before), but entering of the education expenditure in the equation influential, this impact not positive has turned into indirect impact positive with education expenditure as a mediator variable. In the same context, this indirect impact positive in Algeria of the workforce on industrialization with education expenditure as a mediator variable, because owning the acquisition of technological knowledge we can charge the individual capacities in many fields most notably the industrialization field (Many previous studies are proving this). In addition, the process of building technological capacity by increasing learning is achieving in the end the new products and innovate processes in the context of continuous technological change.

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