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## **Factorial analysis of the elements that compose the training in the small and medium enterprises of the Industrial sector**

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### **1. Introduction**

Any organization, regardless of its type, size or sector to which it belongs, has resources that give life and reason to its functioning; these can be tangible or intangible and internal or external assets. One of these assets is the human resource, which regardless of their previous preparation, selection processes and integration, at a certain moment will be immersed in the training process; as long as the organization wants its human capital to reach high levels of performance and productivity, or to specialize their staff in new tasks or positions (Díez and Abreu, 2009).

In recent decades, global markets have suffered economic, social, political and environmental crises, this has forced organizations to urgently seek competitive strategies that provide advantages over competitors (Porter, 2015; Rice, 2018). In order to achieve the optimum state that provides advantages over the competition, actions must be taken to enable the human capital to be prepared to meet the demands of the market. In the organizations, one of the actions that help to guarantee the fulfillment of these objectives is the training, because

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through this, one can acquire skills and knowledge that are necessary to respond to the working, organizational and commercial environment (López, 2011).

These crises have forced organizations to react contingently by reducing budgets in various functional areas. One of the most affected areas is the one that is referred to as human resources, specifically in the investment of the staff training (Sapién-Aguilar, Piñón-Howlet and Gutiérrez-Díez, 2014). However, according to Díez and Abreu (2014), companies still have the perception of modifying the focus of their job training programs, leaving behind the vision of the training that transforms the individual into the creation of a culture of organizational learning and to make knowledge a collective good where the best practices, innovations and experiences are shared.

In this context, organizations face a changing world where the ways of operating require modifications in their strategies, especially in the technological advancement and consequently to their employees. It is necessary to prepare them with the required knowledge, with the purpose of a performance that contributes to the business goals. Under these circumstances, companies need to adapt to globalization, and to generate greater knowledge and skills to staff through training courses about the new innovated tools to respond positively to these conditions.

According to Siliceo (1982), it is important to note that the training began since antiquity. The teaching was clear on the first occasions that it was needed to educate and share knowledge, as well as experiences in primitive groups. Since 2000 B.C., apprentices, guilds and communities had established an ancient fact of current teaching. From the so-called industrial era, during the first part of the XVIII century, many industrial schools emerged in order to obtain the necessary knowledge of the techniques and steps of activities, in the minimum time.

At present, teaching has developed in a great way. Around the year of 1915, a learning system was born in the United States that is applied directly to military training, known as the method of the four steps, which are: show, say, do and check. It is important to note that through the two wars that took place in that century, they opened the field to the development of intensive training programs, which have been adapted to the industrial zone. During 1940, it begins to understand that the training has to be planned and done in a systematized way, where the presence of the teaching takes a very important commitment.

## **2. Problem Statement**

More forceful actions need to be taken in small and medium-sized enterprises in Mexico; they have to support job training, moving from the vision that

considers training as an unnecessary expense to an investment that positions the company on its competitors (Sapién-Aguilar, Piñón-Howlet and Gutiérrez-Díez, 2014).

According to the current normativity in Mexico, among the employer's obligations is to provide training to the worker in the workplace in order to increase productivity; improve their living conditions; and reward for their time, effort and energy in such a way that the worker can improve his/her personal situation and his/her family (Reynoso-Castillo, 2007).

According to Zavala-Gamboa (2010), in the General Conference of the International Labour Organization (ILO), Mexico pledged to comply with Convention 187, which it seeks to solve problems related to the safety and the health of employees; among those who excel in training, it is the need to jointly develop programs with emphasis on employers because few companies have a genuine concern for them. This can be observed in the business results in Mexico because of 130,000 companies that do not survived the first two years, 66% of these were due to the lack of adequate and timely training (Morales, 2011).

According to Pain (1996), it is often found that training programs do not generate the expected impact in organizations, this is mainly due to not following all the training elements and aspects related to the areas of pedagogic, methodologic, content, etc., which can limit the result.

SMEs are developed in a socioeconomic environment. The environment is changing due to globalization, technology contributes to facilitate information; consequently, organizations are required to have qualified staff to cover a position, be competitive and in constant updating. However, the SME entrepreneur does not have the culture of training programs, according to López and Luna (2009).

Mexican companies need to look for mechanisms that guarantee successful results. In order to achieve this, it is essential to carry out the training efficiently and paying attention to all its elements; only in this way, it will become an efficient mean to transform the culture and to generate greater productivity and performance in the personnel, (Barragán, 2002).

Then, it raises the following question: What are the elements of training in small and medium-sized enterprises in the industrial sector?

### **3. Justification**

The training benefits the entire life cycle of the employer in the company. It effectively contributes to the required future employment positions and to perform well in the organization (Werther & Davis, 2000). It is mentioned that

it is one of the most important investments in the area of human resources and a source of prosperity for individuals. The changes in the outside, the methods in companies, the creation of new products or services, as well as the problems that arise from losses or low performance are examples of the new challenges, which can be addressed with training to staff, and without forgetting that this is the best investment.

With the training and its benefits, one of the main considerations will be the safety of the workers when they develop their activities. As they acquire new knowledge, it will help to their daily functions and decision making; consequently, it will have a positive effect on the organization and the performance.

The design of a training strategy, according to the elements that compose it, it will contribute towards the improvement of the performance in the SMEs; so, that through its implementation the increase in productivity and competitiveness will allow its permanence on the market. The strategy is a model to be followed by companies as it describes the suggested minimum steps and that any organization would require to train their staff (Mejía, Montoya & Vélez, 2010).

The strengthening of the SMEs' knowledge to train their human talents based on all their elements in the training programs generates organizational learning that will be reflected in greater productivity. The training can be done with the same members of the SME in order to achieve a better pedagogy and a considerable reduction of costs. The important thing is to choose the trainers and to specify the particular objectives and the form of the training; then, you can go to more qualified people to continue the training process (Salgado, 2017).

#### 4. Objective

To carry out a factorial analysis that identifies the optimal components of the training in the small and medium enterprises of the industrial sector.

Specific objectives:

- to calculate a matrix of communalities and correlations, in order to measure the degree of relationship between the elements that compose the training in the SME,
- to perform sphericity and significance tests,
- to determine the number of optimal components in which the training variables should be grouped,
- to evaluate the option of reducing the number of variables during the business training.

## 5. Literature Review

Training is considered a strategy towards productive improvement in companies, regardless of the sector to which they belong. It generates the strengthening of the knowledge of small and medium-sized enterprises by training their human resource; especially the resources are optimized by focusing specifically on the identified needs. The training of human talent allows companies to be at the forefront of the opportunities and needs of the environment; for this, it is necessary to have clear concepts, and that requires improvement; it is important to have an integral vision of training, and take into consideration strategic areas, supervisors and operators, according to Mejía, Montoya, Vélez (2010).

The training is directed to the technical instruction of the human resources of the organizations; so, it performs efficiently in the functions that are designated, produces quality results, gives excellent services to its clients, prevents and solves anticipated potential problems within the organization. Through training it is achieved that the human resource profile is adjusted to the needs of knowledge, skills and attitudes required in a job.

According to Pérez-Rodríguez and Coutín-Domínguez (2005), Conceptually the training is the implementation of the learning strategies and development of the human capital in the companies. Rojas (2006) describes it as the training provided by the organization to the people in order to benefit each other through the performance of the positions' exercised.

According to Pinto (1997), the training can be carried out under different processes; Systemic approach, the systems theory points out that the interrelation between the different systems is the condition for the existence of the system, and any change in the subsystem will affect the system in general; therefore, the person in charge of the training requires knowing all the areas (subsystems) of the organization to guide it in a timely and appropriate manner.

Structural approach, the organization has a regulation to follow, which legislates and rules the actions carried out by the manager of training, considering the legal, administrative and instructional; this being what is called the structural approach. Both, the systemic and structural approach cannot be explained one without the other.

Legal process, this is one of the aspects that should be taken care of in the companies and develop it according to the Federal Labor Law (FLL), coordinated with the Secretariat of Labor and Social Welfare; however, some companies consider training as a legal burden, without analyzing that it is fundamental

to the good performance of the workers with regard to their functions, and consequently in the productivity of the organization. The main function of the legal process is to comply with all the aspects indicated in the FLL.

Administrative process, it is essential that the person in charge of the training in the organization knows and implements the administrative functions: planning, organization, execution and evaluation.

In planning, it is determined in advance what it will be done in the training, the how, and all the necessary steps for its good development in the future. This will require the identification of training needs, the definition of objectives, the elaboration of plans and budgets.

The organization implies the organizational structure that will support the execution of the activities and the achievement of the objectives. It is essential to maintain the system to achieve the changes in the performance of the identified employees in the planning stage. To carry out the organization of the training, it must be established: structures, procedures, integration of people and material resources.

Execution, in this phase it is implemented the established agreements during the planning and the organization; besides, the leader of the training must supervise that all the provisions are fulfilled, and being supported in the following stages: hiring of services, development of programs, coordination of events and, administrative and budgetary control.

Evaluation, in this last function, the verification and modification of the established objectives is carried out, considering the following aspects: Macro- and micro-assessments, monitoring and adjustments to the system.

The last phase, according to Pinto (1997), is the instructional process, which is related to the teaching-learning process. It is completely focused to the changes of behavior of all the participants; the objectives that they wish to achieve; thematic; instructional techniques; and adequate and timely feedback. The phases involved in this process are: selection of instructors, course design, learning and monitoring conduction, and evaluation.

It is essential to meet the individual and organizational needs (Solft, 2007), so it is important to be clear that the training factors have a greater impact on the SMEs; based on this, it is required to work on these factors regarding the training.

## 6. Methodology

Taking into consideration the objectives of this analysis and the characteristics of the sample, it can be considered as a non-probabilistic research with a non-

experimental design and a convenience of a theoretical design. The instrument was developed based on established theories and it was applied to small and medium enterprises of the industrial sector. The purpose was to collect the leaders' perception of these companies in relation to the elements that determine the training.

Bearing in mind, the impact of the analysis, it is considered a descriptive quantitative and correlational scope with a non-experimental design since the data were not manipulated and processed as they were collected. In addition, considering the time in which the analysis was developed, it is considered as a cross-section because it only collects the perception of the business leaders in a single moment in time.

## 7. Operationalization of the variables

The proposed dimensions for measuring the business training are described in table 1.

**Table 1. Characteristics that describe the training**

<i>Variables</i>	<i>Description</i>	<i>Items</i>
<i>Training</i>	It refers to whether the company offers training programs according to its mission, vision and goals.	It comprises items from 1 to 16.
<i>Legal aspects about the training</i>	The employer has knowledge of the legal obligations to be fulfilled according the federal labour law.	It comprises items from 17 to 23.
<i>Training budget</i>	It refers to whether the company has a dedicated and exclusive budget to provide training.	It comprises items from 24 to 25.
<i>Instructors of the training course</i>	It refers to the internal or external instructors who teach the training courses.	It comprises items from 26 to 27
<i>Training culture</i>	It is the image that the entrepreneur creates on the importance of receiving training.	It comprises items from 28 to 30
<i>Seniority in the company</i>	It refers to the entrepreneur's loyalty to the company as a factor of implementing the training courses.	It comprises items from 31 to 34

**Source:** own elaboration

## 8. Statistical method

An analysis was conducted to determine whether the proposed elements to measure training were statistically significant and can represent reality. Besides determining whether they had characteristics that allow grouping them into a number of lower elements that facilitate the analysis and the compression, the reduction of the components of the training was the main objective of the study. If the analysed elements do not present homogeneity characteristics that allow them to regroup, then we would have the basis to establish that the 6 components are useful in the determination of the training.

A factorial analysis was applied to find homogeneous groups of variables from a large set of variables. These groups are formed from the proposed variables and whose correlation among them is high and significant. They are given the name of components and are initially intended to be independent of the variable's groups.

The main purpose of the factorial analysis is to reduce the number of elements or variables that are used to measure or represent the measurement of an element, with the purpose of making the analyses simpler; as a result, the factorial analysis is a technique of reducing the dimensionality of the data, whose ultimate purpose is to look for minimum numbers of dimensions that are able to explain to the maximum the information contained in the data.

The factorial analysis consists in four main phases: The calculation of a matrix that is capable of expressing joint variability of all the variables; the extraction of the optimal number of factors; the rotation of the solution to facilitate the interpretation; and the estimation of the subjects' scores in the new dimensions.

The matrix of variability contains the communalities that were initially assigned to the variables and the reproduced communalities by the factorial solution. The communality of a variable is the proportion of its variance that can be explained by the factorial model obtained. The final factorial model shows the result of the communalities of the variables, whose variance can reproduce in greater percentage the initial value; in other words, the matrix of communalities shows those variables that could be eliminated from the study since its representativeness in the data explanation is scant.

The extraction of the optimal number of factors allows extracting the number of optimal components whose explanation of the data is greater. The number of components shows the number of items in which the variables could be grouped, depending on the degree of correlation among them. For this specific case, the main components method is utilized as extraction method, whose purpose is

to extract components based on the auto-vectors of the matrix of re-escalated correlations

## 9. Participants

The participants subject to the study were small and medium enterprises of the industrial sector. For this, it was consulted the National Statistical Directory of Economic Units (DENUE) of the National Institute of Statistics and Geography ([INEGI], [http:// www.inegi.org.mx/default.aspx](http://www.inegi.org.mx/default.aspx)). It was considered a non-probabilistic sample and at the convenience of the companies, which they decided to answer the survey and fulfilled the characteristics and specifications indicated. As a result, a total of 63 instruments were applied.

## 10. Materials

The utilized instrument was a questionnaire that included general aspects of the business and aspects related to the training. The training-related aspects section is composed of items that measure the 6 variables: training, legal aspects of training, training budget, training course instructors, training culture and seniority in the company, with a total of 34 questions. It was used a Likert scale with 5 response options, ranging from 1) never, 2) rarely, 3) sometimes, 4) very often and 5) always.

## 11. Research procedure

1. Training-related variables were identified.
2. The instrument was designed to measure the 6 proposed variables, and then to receive feedback from two experts on the subject.
3. The instrument was applied to 63 SMES of the industrial sector.
4. Each survey was captured in the SPSS system, version 17.
5. The matrix of communalities was calculated.
6. The significance of the correlation matrix was calculated.
7. The sphericity test was performed.
8. The number of optimal components was determined by a method of extraction.
9. Quartimax orthogonal extraction was performed.
10. se estimaron las puntuaciones de las variables en los componentes estimados.
11. The scores of the variables in the estimated components were calculated.
12. The components were plotted.

## 12. Results

A series of results are presented, following the factorial analysis procedure.

The first tests performed are those of KMO (Kaiser-Meyer-Olkin) and Bartlett's sphericity; in order to determine if the value of the partial correlations is strong enough, so the factor analysis component reduction technique to be optimal in the analysis.

In this case, the KMO test shows a value above 70%, which indicates positive and acceptable correlations; while the Bartlett test rejects the hypothesis of correlational equality in the correlated matrix. Having a probability of 0.000 and a confidence level of 95%, it is allowed to ensure that correlations are different between the training components. The test results are shown in table 2.

**Table 2. KMO and Bartlett's test**

Kaiser-Meyer-Olkin simple adaptation measure		,789
Bartlett's sphericity test	Approximate chi-squared	233,697
	gl	15
	Sig.	,000

Source: own elaboration

Having positive evidence in the tests of KMO and Bartlett, it is important to do the correlation matrix to verify the significance. At a confidence level of 95%, all correlations are statistically significant, as shown in table 3.

**Table 3. Correlation Matrix**

		Training	Legal aspects	Training budget	Course instructors	Training culture	Seniority in the company
Correlation	Training	1,000	,597	,707	,691	,639	,324
	Legal aspects	,597	1,000	,668	,740	,647	,458
	Training budget	,707	,668	1,000	,591	,822	,217
	Course instructors	,691	,740	,591	1,000	,468	,421
	Training culture	,639	,647	,822	,468	1,000	,254
	Seniority in the company	,324	,458	,217	,421	,254	1,000

Sig. (Unilate- ral)	Training		,000	,000	,000	,000	,005
	Legal aspects	,000		,000	,000	,000	,000
	Training budget	,000	,000		,000	,000	,044
	Course instructors	,000	,000	,000		,000	,000
	Training culture	,000	,000	,000	,000		,022
	Seniority in the company	,005	,000	,044	,000	,022	

Source: own elaboration

As a method of extraction, the Principal Components analysis was used. The matrix of communalities was calculated, which it shows that in its majority, the components of the business training are high in the degree of explanation of the variance. In this sense, the variable of legal aspects is the one that reproduces in greater percentage the initial value of the variance. It is important to mention that if you want to dispense any of the elements as a factor that determines the training, should be the "seniority of the company", since is the one that fails to reproduce the variance in this extraction method. The results are presented in table 4.

**Tabla 4. Communalities**

	Initial	Extraction
Index_Training	1,000	,714
Index_Legal _ aspects	1,000	,754
Index _ Training_ budget	1,000	,751
Index _ Course_ instructors	1,000	,681
Index _ Training_ culture	1,000	,677
Index _ Seniority_ company	1,000	,251

*Extraction Method: Principal Components Analysis*

Source: own elaboration

Table 5. shows the total variance explained and the number of optimal components in this extraction process.

**Table 5. Total Variance Explained**

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3,828	63,796	63,796	3,828	63,796	63,796
2	,934	15,566	79,361			
3	,523	8,712	88,073			
4	,387	6,450	94,523			
5	,183	3,057	97,580			
6	,145	2,420	100,000			

*Extraction Method: Principal Components Analysis*

**Source:** own elaboration

The variance matrix shows that the number of optimal components is 1. The component 1 manages to reproduce in 63,79% the total variance explained in the training. Table 6 shows the matrix with the only component that was extracted.

**Table 6. Component Matrix<sup>a</sup>**

	Component
	1
Index _Training	,845
Index _Legal _aspects	,868
Index _Training_ budget	,866
Index _Course_ instructors	,825
Index _Training_ culture	,823
Index _Seniority_ company	,501

*Extraction Method: Principal Components Analysis*

*a 1 extracted component*

**Source:** own elaboration

When only one component is extracted, it is impossible to perform a rotation method; therefore, it is also irrelevant to calculate a component graph.

Being the “seniority of the company” the training characteristic or variable who less manages to reproduce the variance, it was calculated a new matrix of variance; however, it was eliminated that variable from the analysis. The new matrix shows that the percentage of initial explanation went from 63,79 to 74,179. The results are shown in table 7.

**Table 7. New Total Variance Explained**

Com- po- nent	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Va- riance	Cumulati- ve %	Total	% of Va- riance	Cumulati- ve %
1	8,344	74,179	74,179	8,344	74,179	74,179
2	1,482	13,177	87,356			
3	,661	5,876	93,232			
4	,465	4,137	97,370			
5	,296	2,630	100,000			

*Extraction Method: Principal Components Analysis*

**Source:** own elaboration

### 13. Discussions

When the social, individual and organizational interests are integrated, a competitive advantage is generated for the company, where its main characteristic is that it must be unique and not easy to imitate; therefore, Ramírez, Díaz and Rodríguez, (2009) consider “so important to pay special attention to the training with a comprehensive vision of what as a process represents” (p. 18). In the same way, they mention that it must be a systematic and evaluated process; and not only measured in the economic terms, but also in the individual and organizational repercussions; and especially in the impact on society. It is important to assume a correct procedure that combines the organizational and individual aspects and that the generated knowledge benefits all the members of the company.

The reality of the SMEs is that they are largely those who support the economy of developed and developing countries; Mexico could not be the exception, Vásquez, Wendlandt and López (2016) commented that they represent the source of families income; consequently, its importance is high and they require to be at the forefront, constantly preparing for the vertiginous challenges of the global world to which they face.

In this sense Salgado-Cruz, Gómez-Figueroa and Juan-Carvajal (2017) mention that the «cognitive needs of human capital are increased to give answers to the new demands in their professional performance, which imposes greater demands on their training» (p. 154), especially concerning to the training of the staff in a «responsible, committed and creative participation in social transformations» (p. 155). All these under a strict code of ethical conduct, regulating business and education management, to all who in one way or another are part of society. Solf (2007) considers that companies are faced with the urgency of dealing with this highly competitive working environment in which they are immersed; therefore, he agrees that these demand proposals for a strategy in relation to the training, which it confronts the challenges of keeping the staff ready; this is considered in a logical way from the perspective that it is the only resource that can grow on its own.

Organizations require actions that allow the competences that were acquired in the universities match with the ones of the business environment; hence, it is fundamental the linkage made during the training of the students, especially the active participation of the professors that do some research (company-student-teacher), this in order to lead them to be learning organizations.

On the other hand, Salgado-Cruz et al. (2017) consider that in the organization there is a formal training plan, where all employees can freely participate regardless of the position they occupy, i.e. it is essential to involve staff at all levels, as well as to carry out evaluation of these training plans. In this sense, Ramírez et al. (2009) considers that it is indispensable to know what the desired competitive advantages are; a diagnosis of training needs; and the probability of achieving them, executing the training and finally, evaluating it.

## 14. Conclusions

From the results, a series of conclusions were generated that allow meeting the raised objectives, these conclusions are listed below:

1. The KMO and Bartlett's test of sphericity makes it possible to corroborate that the factorial analysis method is useful to reduce the number of variables

and the grouping in components of the business capacity; it is statistically significant and presents a correlation close to 80%.

2. The analysis of communalities allows you to observe that of the six variables that compose the training, the one that produces lower percentage of variance is the seniority of the company. Therefore, this variable could be dispensed as a component of training.
3. When calculating the correlation matrix, the results of the KMO and Bartlett's test can be corroborated.
4. The matrix of variance explained determines the number of optimal components, in which the variables should be grouped; being in this case, a single component that manages to reproduce the variance by 63,796%.
5. Being a single optimal component, it is impossible or redundant to perform a rotation method, so this procedure was eliminated from the analysis.
6. By eliminating the variable of "seniority in the company" and recalculating the communalities and the matrix of variance explained, we obtain the explanation percentage, which it increases from 63,796 to 74,179%.
7. In general, it can be concluded that with five of the six proposed elements to measure the training in the small and medium industrial enterprises in Ciudad Obregon, Sonora, México, it is possible to reproduce the variance by 74,179%. These results are statistically significant to a level of confidence of 95%; it represents the reality, so the proposed instrument for measuring training can be generalized for all SMEs in the industrial sector.

One of the main contributions of the research is to be able to present the necessary factors to establish a proposal to the small and medium-sized enterprises with regard to the training, which is a fundamental element for the growth and permanence of the organization, the preparation and productivity of the human resource, and thus the growth of intellectual capital.

If this is closely analyzed, it will largely be the stability of any country, since it contributes to the generation of employment, families with the economic resources to solve their needs; therefore, a society in harmony.

## Summary

### **Factorial analysis of the elements that compose the training in the small and medium enterprises of the Industrial sector**

The most important factor in small and medium-sized enterprises is undoubtedly the training; intellectual capital directly impacts the growth and productivity of the organization, so the preparation given to employees is vital. The study carried out a factorial analysis

to identify the components to be considered in the training of the SMEs in the industrial sector of Ciudad Obregon, Sonora, México. The considered variables were: training, legal aspects of training, training budget, training course instructors, training culture and seniority in the company. As a result, the analysis of communalities allows us to observe that of these variables, the one that produces the lowest percentage of the variance is the age of the company, so it could be dispensed as a component of the training.

**Key Words:** *Training, Small and medium-sized Enterprise, Human Resource, Factorial Analysis.*

**JEL:** L20, M10, M13, R11

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