湖南大学学报（自然科学版）
Journal of Hunan University (Natural Sciences)

第 50 卷 第 2 期
2023 年 2 月

Available online at http://jonuns.com/index.php/journal/index

Vol. 50 No. 2
February 2023

Open Access Article

https://doi.org/10.55463/issn.1674-2974.50.2.24

Proposal for a Business Management Model for the Manufacturing Industry in the Region of Hidalgo, Mexico

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Received: December 7, 2022 ▪ Review: January 3, 2023 ▪ Accepted: February 8, 2023 ▪ Published: February 27, 2023

Abstract: Companies currently consider human capital a key element for organizational development, derived from the COVID pandemic that was faced in the world. All sectors were affected and the manufacturing industry was no exception, in Mexico such a situation was similar. Only in the state of Hidalgo, Mexico, in July 2020, 16,400 jobs were lost due to the impact of the value chain and mobility restriction; therefore, the objective of this research is to propose a human capital model enabling to explain the factors that contribute to the competitiveness of the manufacturing industry in the Hidalgo highlands. This study is of a quantitative type with a correlational scope, focusing on people who are incorporated into manufacturing companies in the Hidalgo highlands, and the type of sampling used is stratified probabilistic. The findings in this investigation are significant since the hypothesis that affirms the relationship between the marital status of the participants and competitiveness (0.000 in P) is accepted, in the same way the dependency between the factors of seniority and intention. Regarding the relationship of the competitiveness factor with the personal and group factors, they are significant ($p<0.05$) and positive, that is, the higher the value of the personal and group factors, the higher the value of the competitiveness factor, the strength of the relationships is significant because they are greater than 0.70. Based on this, the human capital model is proposed, which recommends generating personal growth opportunities for employees, influencing the competitiveness of the organization. The novelty of the study is that a dependency between the age of the collaborators and personal, group, competitiveness and organizational intention factors can be affirmed with 95% confidence.

Keywords: manufacturing sector, human capital, model, competitiveness.

墨西哥伊达尔戈地区制造业企业管理模式提案

摘要: 公司目前认为人力资本是组织发展的关键要素，源于世界面临的冠状病毒大流行。各行各业都受到影响，制造业也不例外，墨西哥也有类似情况。仅在墨西哥伊达尔戈州，2020 年 7 月，由于价值链和流动性限制的影响，就失去了 16,400 个工作岗位；因此，本研究的目的是提出一个人力资本模型，以解释影响伊达尔戈高地制造业竞争力的因素。本研究

属于具有相关范围的定量类型，重点关注在伊达尔戈高地的制造公司中任职的人员，所使用的抽样类型为分层概率。本次调查的结果意义重大，因为确认参与者的婚姻状况与竞争力（P 中的 0.000）之间关系的假设被接受，资历和意图因素之间的依赖性也是如此。关于竞争力因素与个人和群体因素的关系，均显着（p<0.05）且为正向，即个人和群体因素的值越高，竞争力因素的值越高，实力 的关系很重要，因为它们大于 0.70。在此基础上提出人力资本模型，建议为员工创造个人成长机会，影响组织的竞争力。该研究的新颖之处在于，可以95%的置信度确认合作者的年龄与个人、团队、竞争力和组织意图因素之间的依赖关系。

关键词: 制造业，人力资本，模式，竞争力.

1. Introduction

Currently, companies consider human capital a key piece in organizational development at all levels. Derived from the COVID pandemic that the world went through, all sectors were affected, and without a doubt, the manufacturing industry is one of the most affected; this because not being considered essential as the food sector suffered significant stagnation; only in Mexico, this is one of the fundamental industries in the economy of this country, contributing 18% in its Gross Domestic Product [1].

During 2022, the manufacturing industry presented a moderate reactivation; hence, in Mexico, the Manufacturing Business Confidence Index (ICEM) stood at 51.2 for September 2021 [1]. In Mexico, there are 244,603 companies in the manufacturing sector, and by January 2022, the total number of people working in this sector was 4,363,913, where 76.2% are operational personnel, which is reflected in Mexico, a growth of 0.1%. This industry is the third with most economic units in Mexico, the second with employed personnel and in the first place in remuneration that are considered salaries, wages, social benefits, utilities, and liquidation amount, reaching 2018 revenues of $ 10,971 09; this industry had a total gross production of 10,800,994,226 placed with this as the first industry in this country [2].

In Hidalgo, 53,126 Economically Active People (EAP) were registered and incorporated into the manufacturing sector, placing the state in the 17th place in the Mexican Republic in the income generated by both the private and parastatal sectors, however during the pandemic in Hidalgo, as reported by the Mexican Institute of Social Security (IMSS), 16,400 jobs were lost as of July 2020 due to the partial or total closure of their sources of employment. This resulted from the affectation of the value chain by the restrictions on the mobility of people and the operation of non-essential economic units, this has been reversed according to the Mexican Institute for Competitiveness (IMCO).

Hidalgo is a state of Mexico and registers 12 industrial parks [3], which according to the Mexican Association of Industrial Parks, are located in the municipalities of Tizayuca 2 (88 companies), Tepeapulco 2 (81 companies), Mineral de la Reforma 2 (45 companies), Tepeji del Río 2 (34 companies), Atitalaquia 2 (27 companies), Villa de Tezontepec 1 (22 companies) and Atotonilco de Tula 1 (7 companies) [4]. According to the Ministry of Economy, in Hidalgo, the municipalities with the highest level of international sales in 2021 were Tepeapulco (US$769M), Tepeji del Río de Campo (US$169M), Tizayuca (US$81.2M), Mineral de la Reforma (US$30.3M), and Tecozautla (US$7.33M). Similarly, the municipalities in this same entity that made the highest level of international purchases in 2021 were Tepeapulco (US$816M), Tepeji del Río de Ocampo (US$237M), Tizayuca (US$73.2M), Mineral de la Reforma (US$42.3M) and Pachuca de Soto (US$17.3M), Tepeapulcois located in the first place of these rankings, being one of the municipalities that make up the Altiplano of Hidalgo along with Almoloya, Tlanalapa, Emiliano Zapata and Apan.

This research proposes a human capital model that explains the factors contributing to competitiveness in the manufacturing industry within the highlands of Hidalgo.

This study considers the five municipalities that make up the Altiplano of Hidalgo: Tepeapulco, Apan, Almoloya, Emiliano Zapata, and Tlanalapa. They enjoy an excellent location close to Mexico City; this last geographical area is characterized by its excellent consumption, communication routes, economy, and logistics for the manufacturing sector. Coupled with this, the Altiplano of Hidalgo has two industrial parks with 81 companies positioning it in second place in the state of Hidalgo, Mexico.

Some authors who have addressed this issue designed an integrated model of human management (HR) and knowledge under a strategic approach or perspective, using a research methodology of action research through intervention in different Cuban companies and had as an actual result because it states

that the essential added value is offered by the generation of technology, for the application of the model in addition to the integrationist consideration of human resource management with knowledge management [5]. On the other hand, a strategy for integrating human capital management into business strategy, applied in the Varadero construction group in Cuba, was designed and implemented [6]. Such a human capital management strategy designed is based on determining the methodological foundations that allow for the utilitarian conception of management and answer the question of how to improve human capital management to integrate it better into the business strategy based on effectiveness.

The relationship between human resource management and the work competencies of these collaborators at a university in Peru was analyzed in [7]; a moderate correlation between the variables of human resources management and labor competencies was demonstrated.

The intention of this research is to develop a model of human capital that contributes to knowing the practices of the collaborators as well as providing an opportunity to understand the needs of the organization that contribute to increasing the competitiveness of this geographical area from the application of a quantitatively validated collection instrument, which considers the variables of individual factors, collective factors, organizational factors, and competitive factors in the latter includes indicators to improve their processes, conservation of natural resources, environmental certifications, tools, technology, automation and the quality of the raw material from the perspective of the collaborators [8].

Therefore, this study was developed in the manufacturing sector of the Hidalgo highlands that covers the municipalities of Tepeapulco, Apan, Almoloya, Tlanalapa, Emiliano Zapata, and Zempoala, in the state of Hidalgo, Mexico, where the study of this problem is crucial because it impacts on the economic activities of the state of Hidalgo, which requires improving competitiveness to stay in the national and international market considering that according to the consultant Deloitte, the state ranked third for the best business environment for companies and second nationally for greater business confidence to invest this according to the Employers' Confederation of the Mexican Republic. However, the state ranks 25th nationally in terms of foreign investment and position 20 concerning the indicator of economic activity, a situation that puts the manufacturing sector of the Altiplano of Hidalgo in perspective.

2. Methods and Materials

There is a wide variety of social research methods from two main currents: qualitative and quantitative methods, this study is quantitative, so it is part of the positivist or quantitative paradigm due to the data that is collected and how it is collected, processed, which was with the Statistical Software for the Social Sciences (SPSS) in its version 25, which allowed to test the hypotheses from the calculation of Cronbach's Alpha, Chi-Square and the construction of the regression model. According to the type of strategies, it is of a non-experimental nature derived from the fact that the phenomenon to be studied is observed without altering or manipulating the data or any variable. It is of an applied type because the solution and intervention of solutions are considered through scientific theories.

According to the time, this research is synchronous because it is carried out at a particular time, in the time required in which the study is developed; as for the type of research due to the evolution of the phenomenon of the study, this is of a transversal type because the variables will be measured only once [9]. In this study, in terms of its depth, purpose, and scope, the study is characterized as a correlational approach [10] for looking for associating variables in a specific context.

The Economically Active Persons who work in the manufacturing sector located in the Hidalgo highlands are the object of this investigation. According to [11], they were distributed as follows: the municipality of Tepeapulco has 55.5% (18,293) economically active people, Apan with 38.7% (10,821), Emiliano Zapata 56.9% (5,290), Tlanalapa 15.8% (976) and Almoloya 4.8% (341). In this manufacturing sector, from the population of 30,568 people, a representative sample was calculated based on the formula proposed in [12], which yielded the application of 380 surveys to be statistically representative, for the application of these surveys a stratified probabilistic sampling was used whose parameter is the manufacturing sector in the manufacture of metal products, the data collection was through a questionnaire Electronic questionnaire using Google forms where the form was shared with the economically active people of the Hidalgo highlands who collaborate in this industry as an object of study.

3. Results

In this research, sociodemographic variables were analyzed such as: age, gender, marital status, economic dependents, last level of studies, certifications obtained, type of contract, and seniority, as for the items with the Likert response category were 39 evaluated, then the items are reported with their mean and standard deviation, statistics that allow us to describe the behavior of the data set, where it is possible to identify the highest average of the study, which is 3.52 in item 4 that raises "I like to receive training" and the item with the lowest average is item 24 "I often do not know the objective of my work" with 2.33.

From the analysis of the data, it is described that 56.54% male of the participants claimed to have a male gender and 43.46% female. Regarding marital status,

52.36% claimed to be single, 30.37% responded to be married, 10.99% in a free union, 4.71% divorced, and 1.57% to be widowed. Regarding marital status, 52.36% claimed to be single, 30.37% responded to be married, 10.99% in a free union, 4.71% divorced, and 1.57% to be widowed. Regarding the age of the study participants, six intervals were considered where 50% of the respondents claimed to be between 20 and 30 years old, 24.08% between 31 to 40 years old, and 11.26% between 41 and 50 years old, 8.12% were less than 20 years old, 5.24% were aged 51 and 60 years old, and 1.31% of the interviewees claimed to be over 60 years old.

In the type of contract, the analysis showed that 47.12% of the interviewees answered that they had a temporary type contract, 31.94% permanent, 15.71% trustworthy, 2.09% per project, 1.57% indefinite, and 1.57% the respondents answered that they have an indefinite and informal relationship with 1.57%. Regarding the variable "seniority in the same company", it was obtained that 33.25% of the interviewees have less than one year in the organization where they currently work, 30.89% between 1 and 2 years, 16.75% between 2 and 5 years, while 10.47% argued that they had seniority between 5 and 10 years, and 8.64% of the participants argued that they had worked for more than 10 years in the same company.

Regarding the locality where the participants belonged, 36.65% selected Apan, 34.29% claimed to be from Tepeapulco, 13.09% from Emiliano Zapata, 7.85% from Tlanalapa, 5.50% from Almoloya, and 2.62% claimed to come from another municipality. The data analysis revealed that personal factors present a M=3.42, group factors (M=3.28), competitiveness (M=3.20), intention (M=3.06), and organizational factors (M=2.39), based on the calculation of cross tables, a possible relationship and acceptance is described, as can be mentioned below, highlighting the positive charges.

3.1. Hypothesis

The hypothesis test was carried out to contrast the following:

H1: There is a positive effect between age, gender, marital status, type of contract, seniority, economic dependents and last degree of studies with respect to personal, group, organizational and competitiveness factors.

H2: There is a relationship between personal, group, organizational factors, and competitiveness.

H3: There is a relationship between competitiveness and other factors that allow the definition of a human capital model.

The study also analyzed whether there is a positive effect between age, gender, marital status, type of contract, seniority, economic dependents, and the last degree of studies concerning the personal, group, organizational factors, and competitiveness to verify this was the hypothesis test Pearson's Chi-square correlation, which measures the strength and sense of the relationship between two variables measured in an interval, analyzing whether this is significant when P is different from 0, according to the magnitude of the error in case the hypothesis is accepted.

Table 1 Chi-square test for competitiveness (Own elaboration, data obtained from SPSS v.25)

	Worth	***df***	**Bilateral asymptotic significance**
Pearson chi-square	162.483a	84	0.000
Likelihood ratio	69.284	84	0.876
Linear by linear association	0.075	1	0,785
No of valid cases	328		
87 cases (79.1%) have expected a count less than 5. The minimum expected count is 0.01			

In the hypothesis test with variables such as gender, marital status, age, type of contract, seniority and economic dependents with personal factors, group factors, intention factors, competitiveness factors and organizational factors, in which it can be visualized in the Statistical of the bilateral asymptotic significance (P) that is obtained accepting the hypothesis that affirms the relationship between the marital status of the participants in competitiveness (0.000 in P) since it includes the degree of commitment that the participants present in the organization, of In the same way, the assertion that indicates the dependency between the seniority of the collaborators and the intention factors themselves that measure the intention of the collaborators to leave the organization, either for a better work environment or better salary, is accepted. It can be affirmed with 95% confidence that there is a dependency between the age of the participants and personal, group, intention, competitiveness, and organization factors. Regarding the variable of the last degree of studies, the hypothesis that affirms the relationship between this variable and competitiveness (0.014) likewise with organizational factors (0.016) that include elements of knowledge and belonging to the company.

Table 2 Chi-square test with factors (Own elaboration, data obtained from SPSS v.25)

	Personal factors	**Group factors**	**Intention factors**	**Competitiveness factors**	**Organization factors**
Gender	0.357	0.183	0.272	0.492	0.736
Marital status	0.675	0.654	0.92	0.000	0.266
Age	0.000	0.000	0.000	0.000	0.006
Type of contract	0.846	0.831	0.697	0.096	0.382
Seniority	0.818	0.314	0.002	0.305	0.598
Dependents	0.424	0.567	0.099	0.144	0.605

Continuation of Table 2					
Last degree	0.2	0.848	0.808	0.014	0.016

In the chi-square tests with the personal, group, and organizational factors, the values of bilateral asymptotic significance are less than 0.05, which allows us to accept the hypothesis that states that there is a relationship between the competitiveness analyzed with the personal, group, and organizational factors, this with a deficient error (0.000, 0.000, 0.000 and 0.003, respectively).

For H3 (There is a relationship between competitiveness and the other factors that allow the definition of a human capital model), the existence of the relationship between the competitiveness factor with personal and group factors is significant ($p < 0.05$) and based on In the result, it is argued that said the relationship is positive, that is to say, the higher the value of the personal and group factors, the higher the value of the competitiveness factor in the organization, the strength of the relationships is considered good because these are greater than 0.70.

To know the influence of the independent variable, linear regression analysis was carried out, as shown in Table 3. The linear regression model indicates that person, group, intention, and organizational factors explain 79.1% (R squared) of the competitiveness variable, and 19.9% are other factors.

Table 3 Linear regression model (Own elaboration, data obtained from SPSS v.25)

Model	**R**	**R square**	**Adjusted R square**	**Std error of the estimate**	**Change statistics**				**Sig. Change in F**
					Change in R square	**Change in F**	**gI1**	**gI2**	
1	0.769	0.791	0.586	0.41301	0.591	106.7361	4	295	0.000
a.	Predictors: (Constant), Fac_organization, Fact_personal, Fac_intention, Fac_group								
b.	Dependent variables: Fac_competitiveness								

The resulting analysis of variance explains the existence of the relationship between the variables, showing that the model is significant by showing that the significance statistic is less than the test parameter ($p < 0.05$). The results shown are extremely important and contribute to the study area because the coefficients and significance for each factor analyzed were significant ($p < 0.05$), that is, the factors proposed in this research to establish the model provide sufficient evidence for constructing the linear regression model, as shown below:

Competitiveness = 0.148 + 0.435 (personal factors) + 0.330 (group factors) + 0.124 (intention factors) + 0.040 (organization factors).

$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4$

where:

Y = competitiveness;
a = 0.148;
b1 = 0.435;
X1 = personal factors;
b2 = 0.330;
X2 = group factors;
b3 = 0.124;
X3 = intention factors;
b4 = 0.040;
X4 = organizational factors.

This means that if the organization supervises the implementation of the factors resulting from this investigation, it will contribute to the company's competitiveness in personal factors with a 43.5% of the variability of competitiveness, group factors 33%, intention factors 12.4%, and organizational factors 4%.

3.2. Intention to Use Human Capital Model

This research aims to propose a Human Capital Model (HCM) with the intention of use. The model provides a more fantastic opportunity to human capital regardless of the hierarchical level in which it is, considering that the synergy that is promoted in group activities allows for improve the benefits in the company; that is why it is recommended to generate opportunities for the personal growth of the collaborators in such a way that it allows influencing the competitiveness of the organization [13].

In the proposal presented, human capital is considered the most valuable resource of the organization, in which I recommend, based on the results, invest constantly, with training, training, or on your own bet to improve your educational level. For this reason, it is important to recommend seeking to obtain greater benefits for the staff, that they contribute ideas, that they be creative in their work areas at all times, but the most important thing is that the employer must be convinced that he must rely on the staff that work with him he and that he has excellent potential to achieve organizational objectives. It should be noted that within the model, personal, group, intention, and organizational variables are considered so that they are used in subsequent research, although it can be understood that human capital is a fundamental pillar in their development.

Next, the Human Capital Model is proposed to be analyzed and, where appropriate, used in the process and development of activities of the manufacturing companies of the Hidalgo highlands.

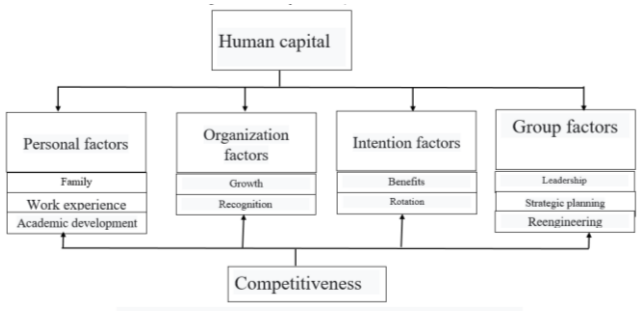

Fig. 1 Human capital model (Own elaboration, data obtained from SPSS v.25)

As a result of the quantitative analysis carried out, the presented model shows five variables to consider, obtaining competitiveness as the most important. The MCH shows that organizations, both within the market and within its scope, must consider the personal factors of human capital to be the main independent variable, which with its family dimensions, work experience, and academic development allows the empowerment of employees in the organization, thus impacting both resources and the efficient development of the organization to be competitive, leaving the proposal open for future research in this regard.

4. Discussion

According to the results achieved in the study, the five components obtained from the analysis executed are sampled, explaining the factors of intention, competitiveness, organization, personal, and group, considering that there is a correlation between the variables at a level of significance of 95% aspect that coincides with what was addressed by [14], where they establish significant relationships between four individual, group, organizational, and results factor components, allowing to exhibit the relationship between the resulting variables with competitiveness.

This study reflects the significant relationship that exists between the factors cited as studied by [7] where they show a moderate correlation between the variables of human resources management and labor competencies; from the analysis, it can be affirmed that the staff is the critical factor in the ability of adaptation of the organization and in the constitution of a competitive advantage. Hence, the future of the former depends on achieving a commensurate and committed human capital.

The MCH highlights the intention factors that consider the initiative and creativity presented by employees in the manufacturing industry, which is why it coincides with [15], which shows evidence of the influence of service leadership on employees, contributing to performance and in the performance of the employees of the analyzed companies. To conduct this research, different authors were studied, which highlight the importance of human capital in the development of companies, obtaining that the management of human talent and the management of human resources are closely related to strengthen the processes of selection, performance, evaluation, and training of personnel, as exposed by [16] in most of the studies analyzed where the significant impact that human resources management has on job performance coincides with what is proposed in this research where the influence of human capital on the competitiveness of companies is highlighted.

Based on the results, it can be concluded that the Human Capital Model (MCH) is convenient for the manufacturing sector derived from the quantitatively processed results both to the instrument where the parameters for its validation are met and that allows to highlight the importance of considering personal, group, organizational, intentional, and competitiveness factors in organizations, because as also stated in [12], there is a significant relationship between these factors and productivity.

5. Conclusion

This article shows that human resources are the main asset of a company, so it will depend on the management that is carried out with the collaborators to achieve competitive advantage in the companies.

It is also concluded that these types of studies can have significant benefits for both the worker and companies in terms of competitiveness since, from the proposed model, the five resulting dimensions are considered, which allows for identifying and strengthening human capital in the manufacturing industry and consequently will impact the economic development of the area of the Hidalgo highlands in Mexico.

With this study, we have given an answer based on the exposed evidence and to be able to carry it out in organizations, where the novelty of this research is the construction of a human capital model that knows and potentiates the specific needs of the manufacturing sector. to provide competitive advantage in your industry.

It is concluded that this MCH provides a broad understanding of the importance of employees in organizations, considering all of its dimensions contributing with a specific option to increase competitiveness in companies in the manufacturing sector, this research can be taken as a reference to future lines of research.

Acknowledgment

The authors appreciate the facilities granted by Consejo Nacional de Ciencia y Tecnología (CONACYT), the Instituto Politecnico Nacional (IPN), and the Secretariat for Research and Postgraduate Studies (SIP). To the Interdisciplinary Unit of Engineering and Social and Administrative Sciences and to the Center for Research and Development of

Digital Technology. Likewise, the Researchers Performance Incentive Program (EDI) and the Commission for the Operation and Promotion of academic activities of the National Polytechnic Institute (COFAA) in the same way we thank the Tecnologico Nacional de Mexico/Instituto Tecnológico Superior del Oriente del Estado de Hidalgo (ITESA).

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