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Impact of Managers and Human Resources on Supply Chain Performance

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Abstract. Current competitive, complex, and uncertain markets push companies toward increasing active collaboration on the part of all human resources (HR) involved in the supply chain (SC), because increasing employee participation and SC collaboration among partners increase SC performance, competitiveness, and, consequently, financial and social success. In this article, we propose a structural equation model to measure the impact of human resources (independent latent variables) on SC efficiency (dependent latent variable). As data gathering instrument, we designed a survey that is responded in a Likert scale and then administered it to 284 participants, including company managers, SC managers, and operators in the Mexican manufacturing sector. For measure the dependence among variables, a structural equation model (SEM) integrates four latent variables: Role of Managers, Learning Environment, Employee Competencies, and Supply Chain Performance. The model is evaluated using Partial Least Squares (PLS) integrated in WarpPLS 6.0 software. Our findings revealed a positive interrelation among the four latent variables, yet in terms of magnitude, the Role of Managers reported the largest effect on the SC Learning Environment.

Keywords: human resources, structural equations model, supply chain, managers, learning focus.

1 Introduction

Supply chain (SC) has become an essential business tool to survive in current competitive markets [1], fueled by rapidly changing customer interests and loyalty. To subsist in these challenging environments, companies must act wisely in their SCs by improving the inventory's management, production and delivery times [2]. In such cases, it is important to coordinate all SC members to work as a unified front and move toward common goals, such as meeting customer demands and improving the efficiency of the procurement, production, and distribution processes, among others.

That collaboration strategies allow companies to take better advantage of human resources (HR), including their abilities, skills, and knowledge, and to understand better both suppliers and customers' concerns in an attempt to integrate, coordinate, and improve the production process and the information flow due to the contribution of all SC members [3]. However, ensuring a collaborative environment to reach common goals is not easy, as it means forging relationships, making adjustments and alignments, communicating effectively, making joint decisions, and sharing information and knowledge, among others [3].

While many studies have emphasized on the role of managers as leaders [4], or the impact of operators, because of their skills and knowledge, on SC performance [5], our research is the first one to quantitatively define the impact of these two human factors on SC performance within a learning environment. In other words, this paper aims at quantitatively defining how the role of managers, employee competencies, an appropriate learning environment, and SC performance are interrelated.

1.1 Role of Managers and a Learning Environment in the SC

The Company directors today, know best the company's strategic objectives, and they are responsible for aligning every SC activity with such objectives [6]. In addition, SC performance have reported that managers' perceptions regarding their environment directly influence their attitudes and commitment to the organization and their subordinates. Furthermore, the abilities and skills of company directors and employees represent a competitive advantage to improve SC performance. For this reason, HR managers must align every employee competency and organizational value with the SC, without neglecting policies, practices, and systems affecting the attitudes, behavior, and performance of SC members [7]. Another important role of managers is to encourage employee skills and creativity by promoting the generation of new ideas applicable to products, services, and work methods for continuous improvement. In fact, the success of organizations and SCs depends on the continuous improvement of employee capabilities and skills, developed when promoting empowerment, participation, and collaboration [8]. Considering our discussion on the role of company managers in the creation of an appropriate learning environment in the SC, we propose the first working hypothesis as follows:

H_1: The Role of Managers has a positive direct effect on the Learning Environment in the supply chain.

1.2 Employee Competencies

Employee capabilities are a competitive advantage in rapidly changing markets. Everything in an organization mirrors the abilities and skills of staff, from the production process to the product itself, including the company's organizational structure, brand(s), marketing strategies, management processes, customer service, and even the supply chain. All this is an open window to what employees can and actually do [7].

To reach high standards and fulfill customer needs, the SC must be collaboratively managed at all levels strategic, tactical, and operational. The appropriate flow of information and inputs is vital from the procurement stage [9] since a product's added value is generated from the beginning. It is also important to train multidisciplinary workers, so their knowledge and skills gained in different domains contribute to their efficacy and to a continuous SC improvement [5]. However, note that managers are responsible for planning such training programs with an appropriate focus that best suits the company needs. Considering thus the role of managers in the development of employee competencies, we propose the second working hypothesis as follows:

H_2: The Role of Managers has a positive direct effect on Employee Competencies in the SC.

It is widely recognized that the information flow and knowledge are key to boosting SC in terms of improving demand forecasts and streamlining the flow of goods and inputs. [2]. Yet, the big advantages of knowledge and information are linked to employee capabilities. Employees must be skilled, must make effective use of data, and ought to share and communicate information that is useful to the organization as a whole, not only to a single department. A lack of such employee competencies may be a major cause of business failure [10], which is why managers must provide an appropriate work environment, focused on learning opportunities for all. These claims allow us to propose the third working hypothesis below:

H_3: A Learning Environment has a positive direct impact on Employee Competencies in the supply chain.

1.3 Supply Chain Performance

Efficient managers make the company profitable to shareholders. Therefore, they must be the first ones to generate new ideas that can be translated to economic benefits [11], and they are responsible for classifying and sharing all necessary information along the SC. Similarly, managers' performance depends on their qualifications when managing the SC, communicating, promoting changes, and measuring the company's progress, especially in economic terms. For all these reasons, the fourth working hypothesis of this study can read as follows:

H_4: The Role of Managers has a positive direct impact on Supply Chain Performance.

HR training and an appropriate learning environment also contribute to a high-performance SC. That is, efficiently trained employees who refine their skills, become more commitment, and improve productivity are a safe source of competitiveness, since they add value to both products and the SC [12]. Nevertheless, learning in companies must not be focused only on generating added-value, but also on developing effective interaction skills, which promote a pleasant work environment in which employees feel proud to work. As an advantage of teamwork and employee motivation, companies manage to improve designs, processes, and even distribution systems [13]. In conclusion, we believe that if training increases HR commitment, flexibility, and quality, companies obtain significant economic benefits. For this reason, we propose the fifth working hypothesis below:

H_5: A Learning Environment has a positive direct effect on Supply Chain Performance.

SC performance results from the interaction among various elements. HR are perhaps the fundamental ones because employee abilities and skills applied to the SC and the production process bring significant economic benefits thanks to the added-value that is generated. Companies investing in education, training, and opportunities for skills development always have a competitive advantage and are capable of solving any complex problem [14]. That said, to find a relationship between HR competencies and SC performance, we propose the sixth and last working hypothesis of this research as follows:

H_6: Employee Competencies have a positive direct effect on Supply Chain Performance.

Fig. 1 below depicts the six research hypotheses, in which arrows directly connect one latent variable with another.

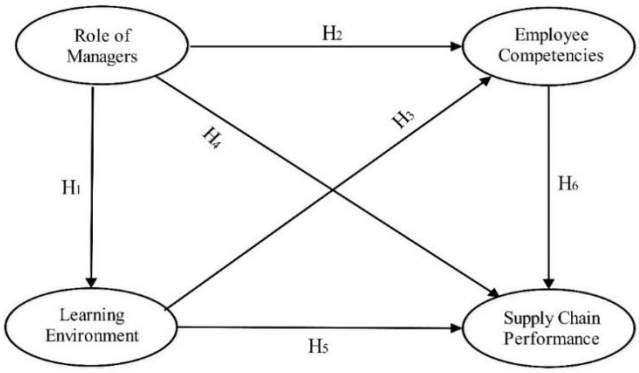

Fig. 1. Research hypotheses.

2 Methodology

This part of the paper describes in detail the methodology followed to conduct our research. The section is divided into six subsections.

2.1 Step 1. Survey Design

To design the survey, we conducted a review of the literature for the four latent variables to be studied: Role of Managers, Learning Environment, Employee Competencies, and Supply Chain Performance. This review of the literature also served to validate the items of latent variables (rational validation). Then, we constructed the first version of the questionnaire, which was composed of two sections. The former aimed at gathering sociodemographic information of participants, whereas the latter assessed latent variables throughout their corresponding items previously identified in the literature review. Finally, we tested the survey accuracy and reliability thanks to a

panel of subject matter experts (SME validation), composed of academics and SC managers. Table 1 shows the final list of items included in the survey.

Table 1. Latent variable.

Role of Managers	**Learning Environment**
Show commitment and support in all SC activities [6, 9]. Identify market fluctuations and rapidly provide the necessary resources for correct SC functioning [7, 9]. Plan and monitor the implementation of SC plans [2, 9]. Their actions are congruent with the company and with SC values [15, 16]. Train workers, promote collaboration, and provide support [6, 16].	Appropriate training and supportive environment [7, 8]. Focus on experimentation, taking the initiative, and responsibility [8, 15]. Secure and psychologically safe work environment [8, 15]. Knowledge sharing [7, 16]. Knowledge transfer among HR in the SC [6, 16].
Employee competencies	**Supply Chain Performance**
Adequate knowledge of corresponding SC activities [17]. Effective communication skills [6, 9]. Trained and skilled in SC operations [10, 15]. Implement new SC projects [2, 9]. Improve SC efficiency and effectiveness amid changes [7, 17]. Invest in talents acquisition for the SC [7, 10].	Increasing profitability [6, 17]. Improved return on investments (ROI) [6, 14]. Increasing sales [6, 9]. Market expansion [7, 17]. Improved product development [7, 17]. Costs reduction [2, 9]. Improved company performance [6, 15].

2.2 Step 2. Statistical Validation of Data

Screened data were validated using seven indices. We computed the Cronbach's alpha and the composite reliability index to analyze the internal reliability of latent variables, setting 0.7 as the minimum acceptable value [18]. The Average Variance Extracted was estimated to analyze convergent validity, looking for values above 0.5. Also, we computed R-Squared (R^2) and Adjusted R-Squared as indicators of the parametric predictive validity of latent variables, whereas the Q-Squared (Q^2) was estimated as a measure of nonparametric predictive validity [19]. Finally, the Full collinearity Variance Inflation Factor (Full Collinearity VIF) was computed to measure internal collinearity of latent variables, only accepting values below five.

2.3 Step 3. The Structural Equation Model

To accept or reject the six hypotheses proposed in Fig. 1, we built a model using the Structural Equation Modelling (SEM) technique, with the aid of WarpPLS 6.0®. This piece of software has algorithms based on Partial Least Squares (PLS), widely recommended for small sample sizes and non-normal data [20]. Then, we computed six

indices to assess the resulting model: the Tenenhaus Index, Average R-Squared (ARS), Average Adjusted R-Squared (AARS), Average Path Coefficient (APC), Average Variance Inflation Factor (AVIF), and Average Full collinearity VIF (AFVIF).

The Tenenhaus Index, also known as goodness of fit (GoF) index, indicates the model's explanatory power [19], and acceptable values usually must be higher than 0.36. For APC, ARS, and AARS, we analyzed their corresponding P-values, setting 0.05 as the cutoff and testing the null hypotheses, in which APC, ARS, and AARS = 0, against the alternative hypotheses, in which APC, ARS and AARS $\neq 0$. About AVIF and AFVIF, values must be equal to or lower than 3.3.

Finally, we measured three types of effects in the SEM: direct, indirect, and total. In Fig. 1, direct effects be arrows directly connecting two latent variables, whereas indirect effects are represented by paths with two or more segments. Finally, total effects between two latent variables are the sum of direct and indirect effects. To test the statistical significance we use 95% confidence level, testing the null hypothesis: $\beta_i = 0$, versus the alternative hypothesis: $\beta_i \neq 0$.

3 Results

This section first presents the descriptive analysis of the sample and the latent variables. Then, we discuss results from the model evaluation, including its effects.

Table 2. Latent Variable Coefficients.

Coefficients	Role of Managers	Learning Environment	Employee Competencies	Supply Chain Performance
R-Squared		0.579	0.535	0.553
Adjusted R2		0.577	0.532	0.548
Q-Squared		0.581	0.535	0.553
Composite reliab.	0.942	0.935	0.954	0.947
Cronbach's alpha	0.923	0913	0.942	0.934
Avg. var. ext.	0.766	0.743	0.776	0.717
Full collin. VIF	2.948	2.844	2.233	2.181

3.1 Validation of Latent Variables

Table 2 shows results from the validation performed on latent variables, using indices described in the methodology section.

3.2 Structural Equation Model

Fig. 2 shows results from the model evaluation. Every segment indicates a relationship between two latent variables and it includes a beta (β) parameter, a P-value for the hypothesis testing, and an R2 value to indicate the percentage of explained variance of dependent latent variables. Following the model evaluation, using indices discussed in the methodology section, we obtained these results:

- Average path coefficient (APC) = 0.394, P<0.001
- Average R-squared (ARS) = 0.556, P<0.001
- Average adjusted R-squared (AARS) = 0.552, P<0.001
- Average block VIF (AVIF) =2.504, acceptable if <= 5, ideally <= 3.3
- Average full collinearity VIF (AFVIF) = 2.552, acceptable if <= 5, ideally <= 3.3
- Tenenhaus GoF (GoF) = 0.646, small >= 0.1, medium >= 0.25, large >= 0.36

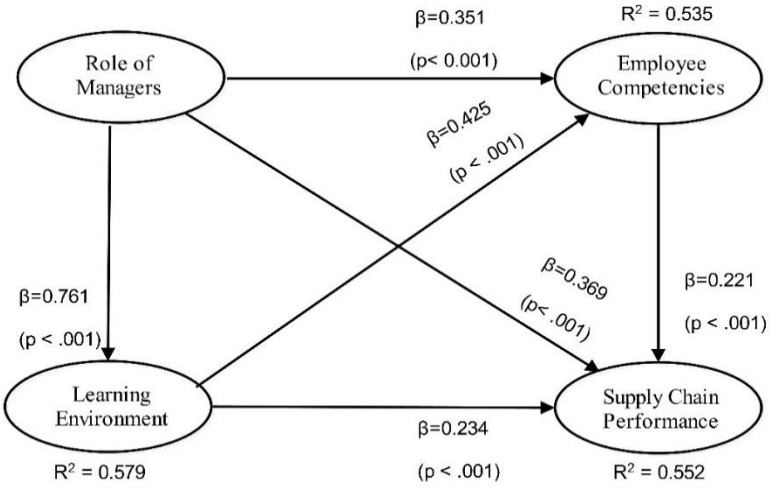

Fig. 2. Evaluated model.

3.3 Effects Analysis

Direct effects

Direct effects allowed us to validate hypotheses presented in Fig. 1 and analyzed in Fig. 2. From the model's evaluation, Table 3 shows results regarding our six research hypotheses.

Sum of indirect effects

Table 4 below shows the sum of indirect effects found in our model (see Figure 2).

Table 3. Hypotheses validation.

Hypothesis	Independent Variable	Dependent Variable	β	Effect Size	P-Value	Decision
H1	Role of Managers	Learning Environment	0.761	0.579	P< 0.001	Accepted
H2	Role of Managers	Employee Competencies	0.351	0.239	P= 0.014	Accepted
H3	Learning Environment	Employee Competencies	0.425	0.296	P< 0.001	Accepted
H4	Role of Managers	Supply Chain Performance	0.369.	0.257	P< 0.001	Accepted
H5	Learning Environment	Supply Chain Performance	0.234	0.156	P< 0.001	Accepted
H6	Employee Competencies	Supply Chain Performance	0.221	0.139	P< 0.001	Accepted

Table 4. Sum of indirect effects.

To	From	
	Role of Managers	**Learning Environment**
Employee Competencies	0.323 (P<0.001) ES = 0.220	
Supply Chain Performance	0.328 (P<0.001) ES = 0.228	0.094 (P<0.012) ES = 0.063

Table 5. Total effects.

To	From		
	Role of Managers	**Learning Environment**	**Employee Competencies**
Learning Environment	0.761 (P<0.001) ES = 0.579		
Employee Competencies	0.674 (P<0.001) ES = 0.459	0.425 (P<0.001) ES = 0.296	
Supply Chain Performance	0.697 (P<0.001) ES = 0.486	0.328 (P<0.001) ES = 0.219	0.221 (P<0.001) ES = 0.139

Total effects

Table 5 summarizes the total effects for every relationship in the model. Note that in three relationships, total effects equaled direct effects, meaning that no indirect effects

were found in those cases. For each one of the three remaining relationships, the table provides the sum of indirect effects.

4 Conclusions and Industrial Implications

We conducted this research in the manufacturing industry of Chihuahua, Mexico, but our conclusions, especially about the role of managers in supply chain performance, can extend beyond this territory and touch the whole Mexican manufacturing sector.

First, as [4] argues, SC performance is built upon trained managers that guarantee the well-being of the system. Our findings support this claim as we proved that the Role of Managers has a significant positive direct effect on *Supply Chain Performance*. Additionally, as [5] affirms, it is important to ensure an appropriate *Learning Environment* to support the development of Employee Competencies, which, in turn, have a positive effect on SC efficiency.

Our findings also revealed the strong impact of the *Role of Managers* on an appropriate *Learning Environment* and *Employee Competencies*. Managers must have outstanding qualifications to recognize the current and future needs of the companies and, then, train their employees based on such needs [11]. In fact, in this research, the direct effect of the *Role of Managers* on *Employee Competencies* is like the indirect effect, occurring thanks to the Learning Environment. In other words, appropriate opportunities for learning, granted by managers through effective training programs, have the potential to increase and sharpen employee abilities and skills.

Finally, although we may have expected a higher effect from *Employee Competencies* on *Supply Chain Performance*, this research still proves the importance of having skilled employees for the correct functioning of the SC. In fact, even though the effect of the first latent variable on the second one was relatively low (0.221), we found that Employee Competencies are of vital importance, since they serve as a mediating variable between *Supply Chain Performance* and other variables.

In conclusion, our findings stand out for the value of this research, which quantitatively validated the importance of Managers, Employee Competencies, and a Learning Environment for Supply Chain Performance. Likewise, we demonstrated that collaboration between HR and managers reflects on the success of companies and the correct functioning of SCs.

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