

## Determinants of Innovation in Companies at Manaus Free Trade Zone

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**Abstract:** This study's main goal is to comprehend how the main determinants of innovation behave in the companies of the Manaus Free Zone (MFZ). This is a descriptive, quantitative and correlational study, carried out through a survey in electronic format. The descriptive model included three determinants of the external environment dimension and four of the internal environment dimension, which were correlated with four types of innovation and three moderating variables. In total, were collected data from 122 companies (189 respondents), which corresponded to 28% of the universe. The structural equations technique was used to verify the correlation between the variables. Of the internal determinants, the Strategic Orientation stood out, whose influence proved to be positive and significant for three types of Innovation, Product, Process and Organizational. Of the external determinants, the Government Support and the Degree of market orientation had a positive and partially significant relation for Marketing Innovation. In addition, the company's size and the fact that is Local or Subsidiary proved to be relevant for the relations studied. Based on the results, it is suggested that the strategic components receives more attention from the MIP companies, in order to improve innovation performance.

**Key words:** innovation, determinants of innovation, Manaus Free Trade Zone, MFZ

**JEL codes:** C3, O3

### 1. Introduction

This study proposes to analyze the innovation in the Manaus Free Zone (MFZ) and the contribution of several factors, both internal and external to the companies. This is a relevant topic, since mapping innovation at the MIP can highlight the weaknesses and strengths of the companies located in the region, in order to foster their innovative efficiency, and, therefore, ensure the model's sustainability and continuation. The theme's topicality lies in the importance of this model for Brazil and the world, since the Manaus Free Zone [MFZ] conciliates economic and social development with the forest preservation and guarantees national sovereignty over Brazilian borders.

Hence, the study's specific goals are:

- a) To test the relationship between the determinants identified in the literature and the innovation in companies located at MFZ, in order to identify those that show significant relations;
- b) Check if companies' size, origin of the capital, and being local companies or multinationals' subsidiaries influence the above relations, resulting in significant differences when companies are segmented according to these

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criteria.

## 2. Methodology

This is a quantitative, descriptive and correlational study, since it analyzes, observes, records and correlates variables that involves facts or phenomenon, without manipulating them. As for its nature, it can also be classified as applied research, as it aims to create knowledge for solving specific problems, regarding local characteristics and interests.

Based on the literature, we developed a conceptual model that included three determinants of the external environment's dimension, and four of the internal environments, which were correlated with four types of innovation and three moderating variables, this conceptual model can be seen in the Figure 1. The correlation between the determinants and the innovation was then analyzed in the light of the moderating variables to meet the study's objectives. As for the model variables, we defined and used the following constructs:

**Dependent Variable - Innovation:** according to different authors, an innovation is the implementation of a new or significantly improved Product, Process, Organizational Method or Marketing Method by a company. The innovation may be developed by the company itself or together with partner organizations.

**Independent Variable – Determinants of the Internal and External Environment:** they are part of the company's external and internal environments. From an extensive literature review on the subject, we selected 7 (seven) components: Strategic Orientation, Absorptive Capacity, Organizational Structure, Technological Cooperation, Market Orientation and Government Support.

**Moderating Variables:** among several variables, in this study, we chose three: company's size, origin of capital and local or subsidiary, whose data we got from secondary sources.

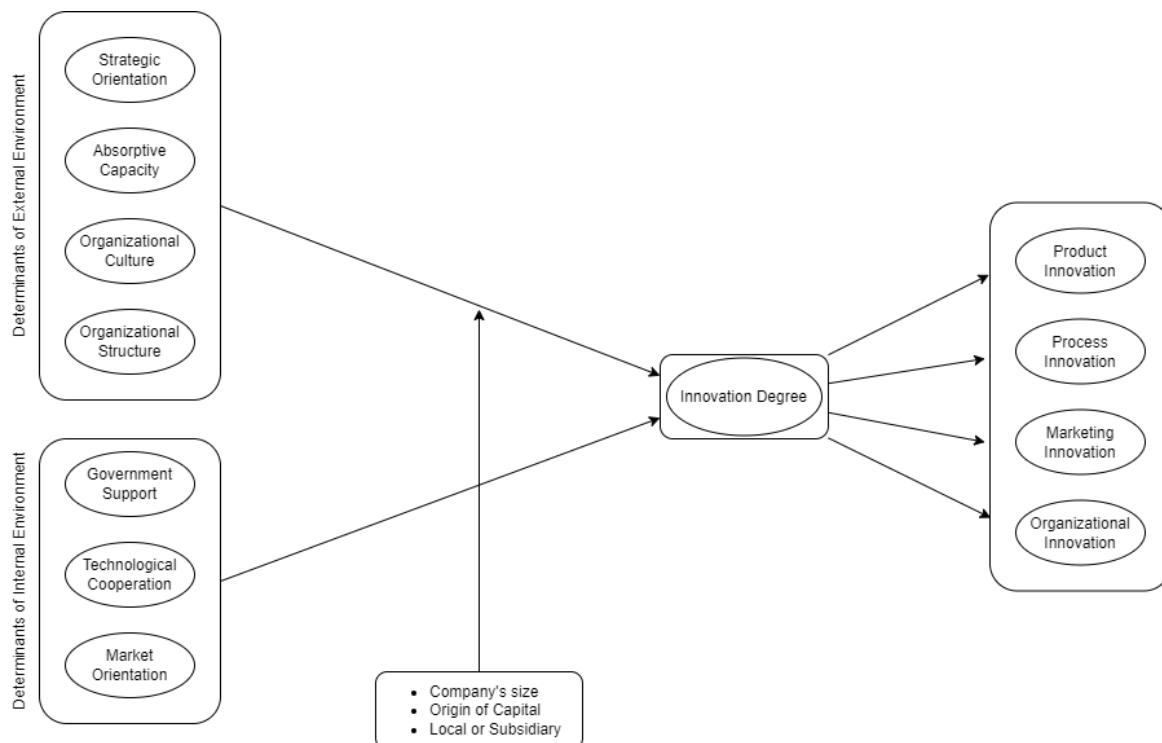


Figure 1 Conceptual Model of the Study

From operational definitions, we developed a questionnaire, which we validated to check its usability, validity and reliability, totalizing 56 questions with answers on a *Likert* scale from 1 to 7, where 1 represents “I totally disagree” and 7 represents “I totally agree”. We applied the questionnaire through an online survey, by choosing the *SoGoSurvey* platform.

The research population comprised directors of the Manaus Industrial Pole, in the estate of Amazonas. The sample, in turn, was non-probabilistic (convenience sample) and the respondent’s contacts were initially obtained by the registered companies in Suframa (438 contacts) and in the Centro da Indústria do Estado do Amazonas [CIEAM] (174 contacts). We sent 1,384 emails, of which 1,078 were received and 199 were answered (113 direct answers via email and 86 with SnowBall technique). For data treatment, we excluded incomplete answers or answers that exhibited a “suspicious behavior” response pattern, outside the intended scope. With this, a final sample of 189 valid observations a final sample of 189 valid observations was reached, which formed the database used in the statistical tests. The sample size proved to be appropriate as the number attained was twice the necessary, both calculated using the known universe sampling formula (81) and obtained using the G\*Power Software (89). We analyzed the database by Structural Equation Modeling, using the Partial Least Squares Method (PLS-SEM) through the SmartPLS v. 3.2.8 software.

### 3. Analysis and Results Discussion

For the analysis, three models were developed to test the possible relations between the independent variables and the dependent ones, all transported to the SmartPls 3 software. They are:

- Model I: Relation of the seven determinants of the internal and external environment dimension with the four types of innovation.
- Model II: Relation of the internal and external environment dimension with the four types of innovation.
- Model III: Relation of the internal and external environment dimension with the innovation construct.

The first analysis, based on Model I, clarifying which determinants had positive and significant relation with each of the types of innovation, after the validation tests, has their results presented in Table 1, indicating that there are positive and significant relations (at the 5% level of significance) between several variables.

This same analysis was done for Model II, which examines the relation between the determinants of the internal and external environment dimensions with the four types of innovation. The results can be found in Table 2.

Lastly, Model III is analyzed, which consists of the relation between the determinants of the internal and external environment dimensions and the innovation construct, taking it as a whole. The results are shown in Table 3, demonstrating that there are positive and significant relations (at the level of 5%) between the External environment dimension and the Internal environment dimension with Degree of Innovation.

Finally, a moderation analysis was performed, involving the variables defined for this study, the size of the company, whether the company is local or subsidiary, and the origin of the controlling capital. For the moderation test of the variables Model I was used, in which all determinants were correlated with all types of innovation. For analysis purpose involving company’s size, the Table 4 shows the final results obtained after the validation tests.

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**Table 1 Results of the Structural Model and General adjustment (Model I)**

Structural Model	VIF	Structural Coefficient	Standard deviation	t-value	p-value	R <sup>2</sup>	Q <sup>2</sup>	f <sup>2</sup>
Aborsrptive Capacity -> Marketing Innovation	4.314	-0.089	0.142	0.63	0.529			
Technological Cooperation-> Marketing Innovation	1.836	0.123	0.101	1.21	0.226			
Organizational Culture-> Marketing Innovation	3.077	0.094	0.124	0.76	0.449			
Strategy -> Marketing Innovation	2.989	0.218	0.119	1.83	0.068	0.218	0.513	0.22
Organizational Structure -> Marketing Innovation	1.37	0.084	0.077	1.09	0.277			
Government Support -> Marketing Innovation	1.65	-0.181	0.092	1.97	0.049			
Market Orientation -> Marketing Innovation	1.767	0.286	0.084	3.41	0.001			
Aborsrptive Capacity -> Organizational Innovation	4.314	0.138	0.108	1.28	0.2			
Technological Cooperation -> Organizational Innovation	1.836	0.084	0.073	1.15	0.251			
Organizational Culture -> Organizational Innovation	3.077	0.218	0.1	2.17	0.03			
Strategy -> Organizational Innovation	2.989	0.2	0.091	2.20	0.028	0.483	0.406	0.62
Organizational Structure -> Organizational Innovation	1.37	0.164	0.068	2.43	0.015			
Government Support -> Organizational Innovation	1.65	-0.057	0.07	0.81	0.416			
Market Orientation -> Organizational Innovation	1.767	0.125	0.07	1.79	0.074			
Aborsrptive Capacity -> Process Innovation	4.314	0.141	0.139	1.01	0.311			
Technological Cooperation -> Process Innovation	1.836	0.051	0.082	0.62	0.535			
Organizational Culture -> Process Innovation	3.077	-0.038	0.104	0.37	0.715			
Strategy -> Process Innovation	2.989	0.428	0.106	4.04	0	0.391	0.336	0.461
Organizational Structure -> Process Innovation	1.37	-0.016	0.072	0.22	0.826			
Government Support -> Process Innovation	1.65	0.039	0.082	0.47	0.636			
Market Orientation -> Process Innovation	1.767	0.125	0.078	1.60	0.109			
Aborsrptive Capacity -> Product Innovation	4.314	0.012	0.125	0.10	0.922			
Technological Cooperation -> Product Innovation	1.836	0.075	0.089	0.84	0.403			
Organizational Culture -> Product Innovation	3.077	-0.039	0.107	0.37	0.713			
Strategy -> Product Innovation	2.989	0.249	0.104	2.40	0.017	0.313	0.233	0.35
Organizational Structure -> Product Innovation	1.37	-0.022	0.081	0.27	0.79			
Government Support -> Product Innovation	1.65	0.096	0.069	1.40	0.16			
Market Orientation -> Product Innovation	1.767	0.326	0.087	3.77	0			

**Table 2 Result of the Structural Model and General Adjustment (Model II)**

Modelo Estrutural	VIF	Structural Coefficient	Standard deviation	t-value	p-value	R <sup>2</sup>	Q <sup>2</sup>	f <sup>2</sup>
External Environment Dim. -> Marketing Innov.	2.027	0.188	0.096	1.964	0.05	0.170	0.511	0.17
Internal Environment Dim. -> Marketing Innov.	2.027	0.268	0.096	2.794	0.005			
External Environment Dim. -> Organiz. Innov.	2.027	0.126	0.073	1.725	0.085	0.487	0.406	0.64
Internal Environment Dim. -> Organiz. Innov.	2.027	0.606	0.063	9.645	0			
External Environment Dim. -> Process Innov.	2.027	0.173	0.092	1.884	0.06	0.364	0.335	0.41
Internal Environment Dim. -> Process Innov.	2.027	0.473	0.081	5.806	0			
External Environment Dim. -> Product Innov.	2.027	0.399	0.09	4.434	0	0.302	0.233	0.33
Internal Environment Dim. -> Product Innov.	2.027	0.196	0.1	1.97	0.049			

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**Table 3 Result of the Structural Model and General Adjustment (Model III)**

Modelo Estrutural	VIF	Structural Coefficient	Standard deviation	t-value	p-value	R <sup>2</sup>	Q <sup>2</sup>	f <sup>2</sup>
External Environment Dim. -> Innovation	2.027	0.271	0.072	3.768	0	0.536	0.32	0.75
Internal Environment Dim. -> Innovation	2.027	0.518	0.067	7.761	0			

**Table 4 Result of the Structural Model and General Adjustment Considering Company's Size**

Moderation Company size		Structural coefficient	Standard deviation	t-value	p-value	Adjusted R <sup>2</sup>
Organizational Structure -> Organizational Innovation	Original	0.164	0.068	2,43	<b>0.015</b>	0.483
	Larger (Group 1)	0.03	0.083	0,367	<b>0.713</b>	0.569
	Smaller (Grupo 2)	0.344	0.099	3,456	<b>0.001</b>	0.441

Thus, it is observed that the relation between the Structure Suitability and the Organizational Innovation, which existed in the original group, was maintained in the companies of Group 2 (smaller companies), but was lost in companies of Group 1 (larger companies). We can assume, with this result, that medium and small companies are more influenced by the adequacy of the organizational structure with the degree of organizational innovation among the companies studied.

For the moderating variable Origin of Capital, it was observed that, of the 28 relations between the determinants and the degrees of innovation, all relations were rejected, that is, there was no statistical difference between the results of the groups, and it can be concluded that the Origin of Capital effect does not moderate the relations.

For the moderating variable Local or Subsidiary, it should be considered initially that in the total group there was a positive and significant relation between Absorptive Capacity with Product Innovation, Organizational Culture with Organizational Innovation and Organizational Culture and Process Innovation. Table 5 shows the result of this analysis including the Company's Origin variable.

**Table 5 Result of the Structural Model and General Adjustment Considering Company's Origin (Local/Subsidiary)**

Moderation Local/Subsidiary		Structural coefficient	Standard deviation	t-value	p-value	Adjusted R <sup>2</sup>
Absorptive Capacity -> Product Innovation	Original	0.012	0.125	0.10	<b>0.922</b>	0.313
	Local	0.314	0.238	1.315	<b>0.189</b>	0.3
	Subsidiary	-0.198	0.141	1.404	<b>0.16</b>	0.379
Organizational Culture -> Organizational Innovation	Original	0.084	0.073	1.15	<b>0.251</b>	0.483
	Local	-0.149	0.133	1.126	<b>0.26</b>	0.559
	Subsidiary	0.501	0.139	3.612	<b>0</b>	0.493
Organizational Culture -> Process Innovation	Original	-0.038	0.104	0.37	<b>0.715</b>	0.391
	Local	-0.362	0.177	2.049	<b>0.04</b>	0.405
	Subsidiary	0.211	0.13	1.624	<b>0.104</b>	0.442

As a consequence of the analysis, we can say that the fact that the company is subsidiary contributes in a greater degree for the organizational culture to have a possible influence on organizational innovation and in local companies, on the other hand, it has greater influence on process innovation. Such results seem interesting, since the first one suggests that, due to the fact that in the MIP many Asian companies have their own (specific) organizational culture, such culture can influence organizational innovation. The second result suggests that local companies tend to have more freedom to implement process innovations without the need for approval.

#### 4. Conclusion

This study aimed to identify the main determinants of innovation in MFZ companies in the light of some local conditions. For the purposes of conclusions, we can conclude that:

Of the determinants chosen based on the literature, for the purpose of the study, the degree to which the company's strategy is focused on innovation was the most relevant determinant, reaching a positive and significant relationship with three of the four degrees of innovation - product innovation, process innovation and organizational innovation. If we consider only local companies, the relationship expands to all types of innovation, that is, a business strategy aligned with innovation can facilitate the achievement of good innovative results. Other conclusions of this analysis are that the adequacy of culture and organizational structure had a significant relation with organizational innovation. This result, although relatively obvious, is consistent with the literature.

In turn, the determinant "Market Orientation degree" had a positive and significant relation with the product innovation degree and Market innovation degree. This result is consistent, as the influence that the market can have, both on the product and on the marketing of an innovation, is notorious.

It is worth noting, however, that the determinant "technological cooperation" did not obtain statistical results in relation to any type of innovation. Evidence thus suggests that innovation in MFZ is going in a direction contrary to the global trend of *Open Innovation*, in which innovation is strongly related to cooperation and external technological partnerships.

This can also reflect on the determinant "absorptive capacity". This determinant was not correlated with any type of innovation. Possibly, MFZ companies have difficulties in absorbing and transforming external knowledge into innovations, but for a decisive conclusion there is a need for more studies on the subject.

Finally, the determinant "governmental support for innovation" had little results on the degree of innovation, possibly due to the fact that almost half of the companies surveyed do not use any type of incentive in the region.

In addition, considering that, for each variable, the answers were divided into two subgroups for the purpose of analysis, the main results achieved were:

The origin of capital effect did not moderate the relationships, that is, regardless of whether the capital is national or foreign, the results obtained in the original analysis are maintained.

Regarding company's size, we can conclude that medium and small companies are more influenced by the adequacy of the organizational structure in the degree of organizational innovation, that is, in larger companies the organizational structure does not influence organizational innovation. This result apparently makes sense, as medium and small companies are more agile, less bureaucratic, making organizational innovations easier to implement.

Finally, regarding the Local/Subsidiary moderating variable, two conclusions emerge from the study. Initially, the first was that, in subsidiary companies, organizational culture has a greater influence on the outcome of organizational innovation than in local companies. The second conclusion was that organizational culture has a significant relation with process innovation much more in local companies than in subsidiaries.

From an academic point of view, the study contributes to the current literature, expanding the discussion on innovation, especially when investigating the understanding of its determinants in specific contexts. From a broad theoretical model, it was possible to select the main determinants that influence the different types of innovation in the MFZ, both external and internal, which can be replicated, with modifications, in other similar environments, both nationally and internationally. Here, therefore, is a contribution in that direction.

From a practical point of view, the study also brings important contributions to enable innovation, given its importance and challenge for business managers, making them more assertive in the allocation of limited resources, in order to stimulate relevant innovations for MFZ companies. The study showed evidence that managers should emphasize the strategy focused on innovation, as this was the most expressive determinant obtained as a result of the analyses. The study also allows us to recognize that managers of MFZ companies should improve technological cooperation with universities, research institutes and other companies in the region, as it was the determinant that was less emphasized and, therefore, with greater opportunity for improvement.

Finally, from the perspective of public policies, the study showed that tax incentives aimed at innovation should have their reach expanded, as many MIP companies still do not use any incentives or perhaps do not even know about them.

### Acknowledgements

This article was supported by University of Amazon State and University of São Paulo.

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