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Structural strategies of intellectual capital in the industry of Mechatronics.

(An approach of competitiveness in Mexico)

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Abstract

This article seeks to demonstrate that part of the intellectual capital a successful organization has, results from the application of certain strategies with the aim to become efficient. It also consists of the implementation of best practices according to the values of fidelity, loyalty, and reliability for the education and retention of the people who work in the organization.

The introduction to these strategies will provide the organization leaders in charge of sustaining the competitive performance and efficiency of the firm, with the elementary and strategic infrastructure, processes, practices, and equipment that will help them train and keep the group of people who are responsible for adapting the organization to a current context, and to succeed in the pursuit of a competitive status and development.

The article develops three topics: competitiveness, structural capital, and the Mexican industry of mechatronics. The concept of competitiveness refers to the measurement of the level of improvement of this industry within a global context. The capital structure deals with the habits, processes, and practices applied by successful enterprises. And, the industry of mechatronics considered as one of the state-of-the-art technologies, aims to promote added value to its productive performance for the Mexican government.

Introduction: the industry of mechatronics

During the period of 2000-2007, the federal executive government of Mexico launched an initiative with the name of Center of Productive Articulation (CAP) of mechatronics through the Ministry of Finance (SE). As part of their working agenda, they integrated a group of members in the industry of mechatronics who could provide an assessment of this productive sector in Mexico (AMM, 2006).

Despite the modest efforts exerted by CAP at the diagnostic level during the period of 2000 - 2006, this industry is considered one of the forerunner technologies (PR, 2007) for the development of manufacture of high added value for the federal government during the period of 2006-2012. This has been accomplished through the implementation of guidelines to increase competitiveness as defined by SE. These guidelines attempt to promote cost reduction in the productive processes when performed in Mexico, and upgrade production with the application of more sophisticated technology (SE, 2008).

A concrete definition of mechatronics entails a way to design electro-mechanic products with the aim to assure the optimum performance of systems. A more qualified definition would require of a concept supported by various disciplines in the field of mechatronics and engineering including the following: electrical engineering, mechanic engineering, electronic engineering, control engineering, software engineering, as well as the systems and information technology.

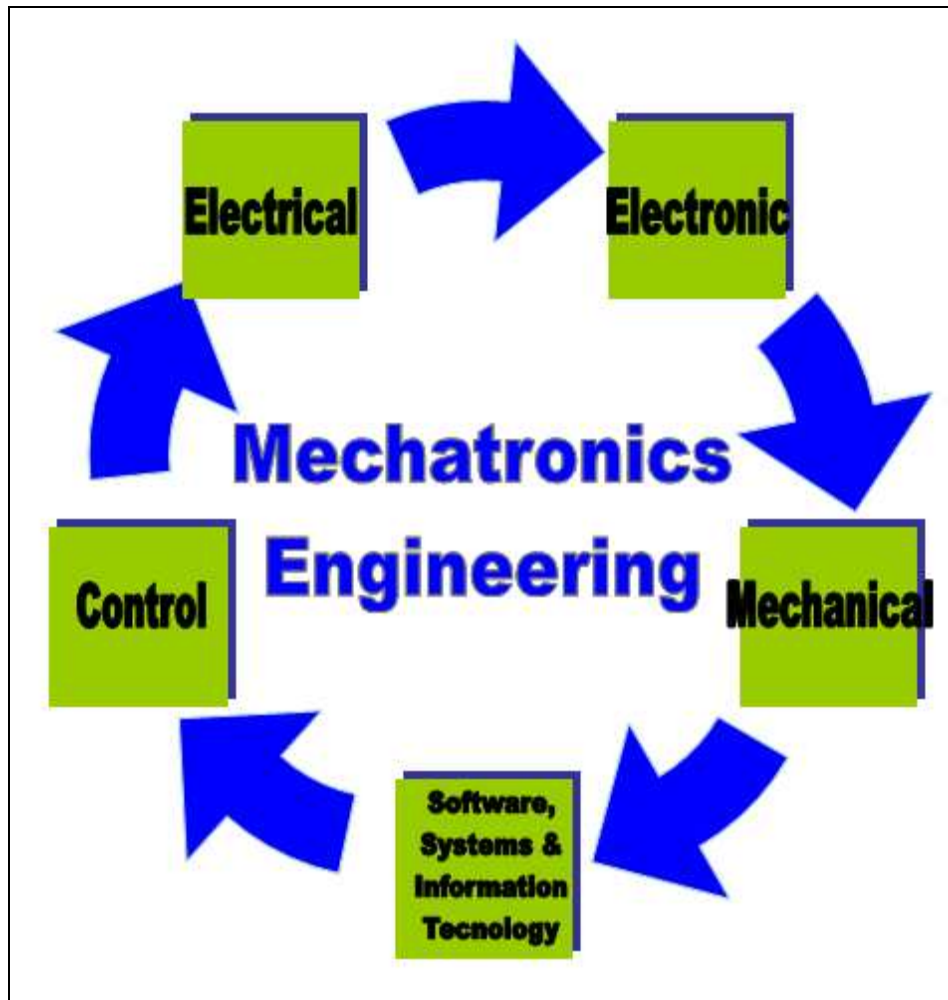


Fig. 1. Mechatronics engineering concept. Designed by: Author.

Mexico as part of NAFTA (North American Free Trade Agreement) has a potential market for the industry of mechatronics given the integration and improvement of its productive chains in the following industries: aerospace, automotive, electro domestic appliances, systems, robotics, automation of production lines and offices, specialized software, etc. This could be achieved through the satisfactory design and production of services and products available for the consumer market or the productive sector in itself.

In order to achieve the integration of the industry of mechatronics in the productive chains of large global corporations, it is necessary to have the human capital that can implement the strategies, organize the institution, lead the organization during the implementation of strategies, and control the development of the master plan.

The companies inserted in the industry of mechatronics must be aware of the competencies required by their human capital, and be able to promote the development of these qualifications. Thus, provide the necessary knowledge for their labor force to become competitive and motivate their personnel to remain affiliated to the organization.

Competitiveness improvement.

The levels of reliability in institutions where there is a high level of competitiveness around the world generally contend that there is a perception of justice and security in them which creates an agreeable environment that promotes the efficiency within the corporation as well as the social peace (WEFORUM, 2008).

The Mexican government has the challenge of improving its competitiveness by exerting actions within the federal agencies, and by resorting to the society as the main agent of change showing respect and observance to the tendencies of globalization.

Today, one of the indicators that allow the comparison and analysis of a country's performance in a globalized context is given by the Global Competitiveness Report (GCR) of the World Economic Forum (WEFORUM, World Economic Forum). This report relies on the Global Competitiveness Index (GCI) to rank the different positions each country has. The index ranks Mexico on 52nd place in world competitiveness below Chile and throughout all Latin America (WEFORUM GCI, 2008).

Country / Economy Analysis: Country performance. Mexico	
Global Competitiveness Index	Rank
	(Out of 131 countries/economies)
Global Competitiveness Index 2007-2008	52
Subindex A: Basic requirements.	56
1st. Pillar: Institutions.	85
2nd. Pillar: Infrastructure.	61
3rd. Pillar: Macroeconomic stability.	35
4rd. Pillar: Health and primary education.	65
Subindex B: Efficiency enhancers.	50
5th. Pillar: Higher education and training.	72
6th. Pillar: Goods market efficiency.	61
7th. Pillar: Labor market efficiency.	92
8th. Pillar: Financial market sophistication.	67
9th. Pillar: Technological readiness.	60
10th. Pillar: Market size.	13
Subindex C: Innovation and sophistication factors.	60
11th. Pillar: Business sophistication.	64
12th. Pillar: Innovation.	71
Business Competitiveness Index 2007-2008.	64
Sophistication of company operations and strategy.	48
Quality of the national business environment.	64

Fig. 2. Country performance for Mexico, (WEFORUM GCI, 2008). Designed by: Author.

The information obtained from the GCR provides a parameter of competitive performance by country. It also allows to conduct a benchmarking exercise by comparing the country of origin with peers around the globe. By establishing this comparison, the GCI helps to collect information that can be analyzed to identify the best practices applied in other geographic regions.

On the other hand, the outcome derived from the GCI is regarded by investors and specialists in the field, as a useful reference that provides a framework when uttering judgments and opinions with a wide perspective which can trigger direct foreign investment (IED) and the possibility to access other markets.

From the perspective of defining strategies, each one of the GCI pillars permits to establish concrete goals based on indicators and indexes that each country selects in order to improve their ranking. The classification of competitiveness is performed through the revision and analysis of changes experienced in each one of them. For that reason, one must be careful and up to date on the adjustments made, the way these are measured, and the evaluation

of the process, in order to be able to scrutinize the topic of competitiveness specially when performed by experts who often find obstacles and pitfalls that may result in necessary changes. (Montañana, 2004)

Intellectual Capital: best practices in successful organizations

Intellectual capital is a concept derived from the definition of the intangible assets (Axtle, 2006). It includes the information and necessary knowledge to perform any function within the organization for the support and positioning of competitive advantages.

The study of intellectual capital created the need to use different classification categories in order to evaluate its impact within the value of the organization.

Based on the classification performed by Thomas A. Stewart on the topic of intellectual capital, it is divided in the following categories: human capital, structural capital, and customer capital (knowledge of the client) (Axtle, 2006).

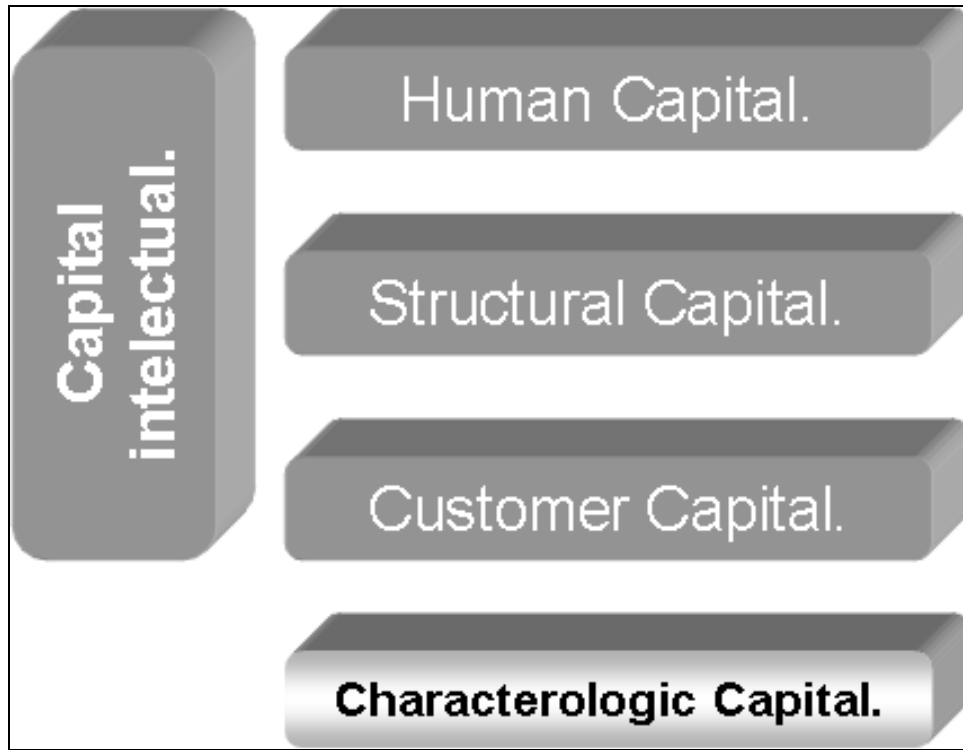


Fig. 3 Intellectual Capital. Designed by Author

- Human capital: is the inventory of knowledge and abilities people possess.
- Structural capital: is the knowledge recorded by different means that remains within the organization even without the presence of the people
- Customer capital: is the knowledge derived from the type of relationship the organization establishes with other institutions, and the way they do business with clients
- Characterologic capital: is a term proposed by Carlos Llanos Cifuentes which states that knowledge can be acquired by observing the behavior of other people (Llanos, 2002)

It is possible to quantify the value of an organization's intellectual capital by comparing the value reflected in the accounting records and its current value within the market.

In order to increase this differential and at the same time the value of the organization, the market must acknowledge that every component of its intellectual capital has a purchasing value in itself.

The organizational processes and behavioral patterns when properly documented and followed in a systematic fashion, become part of the structural capital. Some of these habits in successful organizations include (Pfeffer,1998):

1. Workplace security.
2. Selective hiring of personnel.
3. Organizational design based on self-directed equipment, and decentralization of decision-making processes.
4. High retribution based on results.
5. Wide and ambitious personnel training programs.
6. Reduction of obstacles and discrimination based on personal appearance including dress code, language accent, workplace distribution and salary distance among categories.
7. Efficient communication of organizational rules, its financial situation, and the results obtained.

A proposal is the formal design of strategies as part of the organizational culture and its behavior for the betterment of its performance through the implementation of habits that increase the value of the institution in a given market.

The implementation of this set of strategies must remain within the organization despite the migration or mobility of its people, in such a way that it becomes part of its structural capital.

In addition to the implementation of these strategies, the organization must communicate among its members, the outcome of the implementation of those strategies and the impact it has on the value of the organization. This information could be evidenced in the growth of its market participation, and/or its efficiency level in tangible results due to the contribution of its intellectual capital.

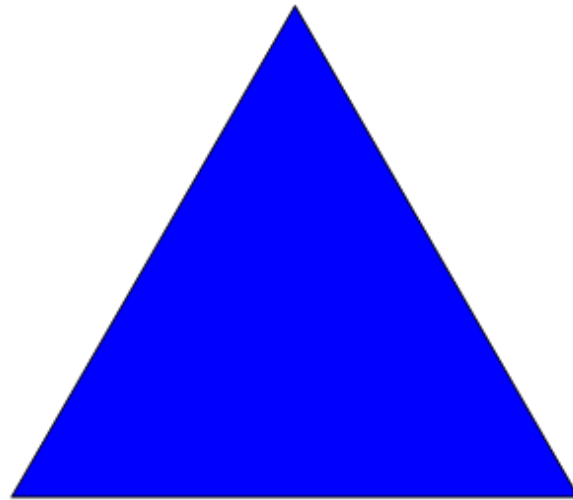
Discussion: Strategic axis

The first step toward the definition of strategies in the structural capital calls for its contextualization within the organizational scheme. It must identify the current and the desirable competitive advantages to be sought in this process.

For example, some of the competitive advantages of different countries are given by their geographic location, their capacity, and the inventory of competencies of their inhabitants (Porter, 2003). Another example is found when identifying the following factors: commitment with the client, innovation, quality, and efficiency (George, 2006). The goal is to choose one of them as the strategic axis and principal target to direct the actions within the organization.

A grouping of the classification of the competitive advantages is illustrated in the following figure:

**1. Responsiveness
to customers.**



**2. Innovation.
3. Quality.**

4. Efficiency.

Fig. 4. Competitive advantages. Designed by: Author.

The selection of a strategic axis begins by taking any corner of the triangle in the figure, and using it as a guiding thread of the general strategy. However, one must consider that any action taken affects every competitive advantage in a different way. It is therefore important to remember that the selection of the strategic axis aims to give greater proportion of attention and direct the strategies in a conscious and well intentioned manner in benefit of the competitive advantage selected. A proposal for the establishment of a well balanced proportion and intention could be the following: 62% for the conductive axis, 24% for the second factor in importance, and 14% for the last factor (De Gregori, 2002).

Assuming that the organization chooses the differentiation as a strategic axis, and efficiency as the secondary factor, it will cause that its initiatives, projects, and actions will be directed in as much as 62% to the attainment of the differentiators of quality and innovation, 24% towards the efficiency factor, and up to 14% towards the business relationship with the client.

Another preliminary decision to be made as proposed in the definition of the strategy, is the selection of the mechanisms that will make it work. A possible way to select such mechanisms is by applying the following model which permits to locate a few relevant concepts, under the framework of the strategy as found in the pillars of the GCR. By performing such an analysis by each of its subsystems or pillars, one can direct the actions towards competitiveness without disregarding the guiding thread frequently identified with the competitive advantages that are present.

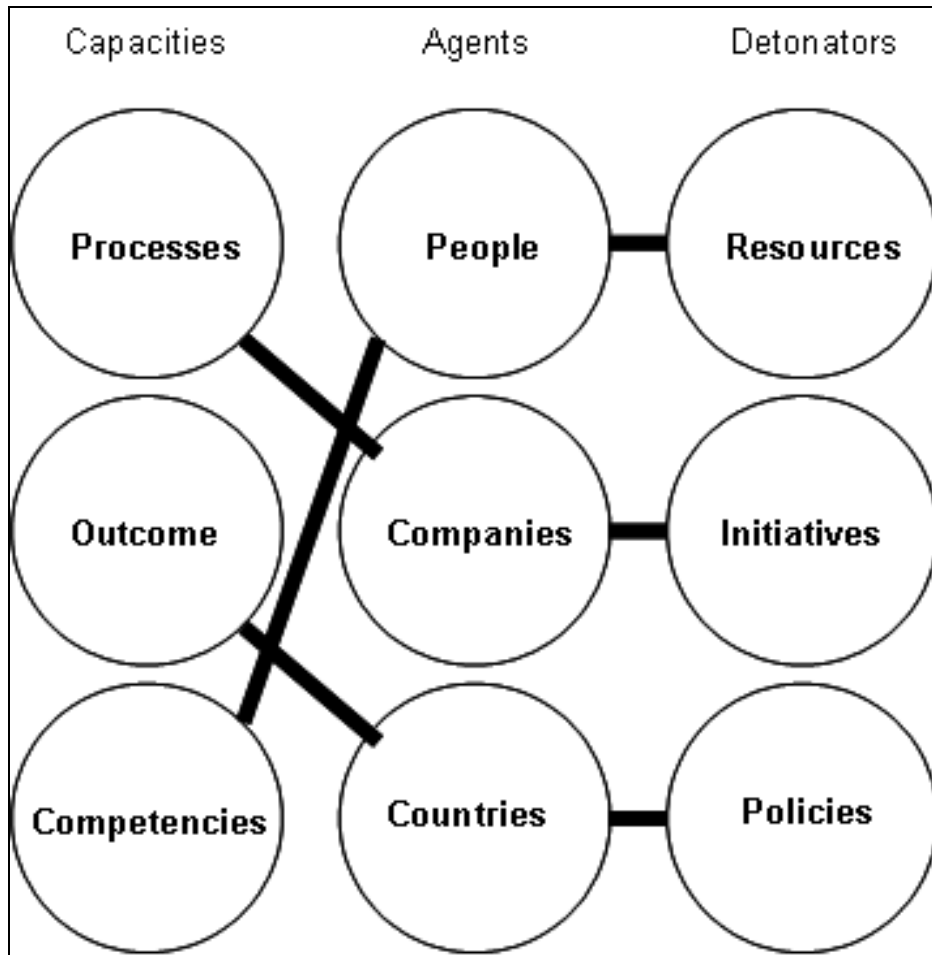


Fig. 5. Strategic drivers. Source: Salvador Cerón Aguilar: Seminario de Competitividad, Universidad La Salle, 2004. Designed by: Author.

The triggers are those concepts that through their actions will create the dynamics necessary to develop a competitive situation performed by the agents.

As an example of the use of this model, there are three elements proposed for Mexico to improve its competitiveness (selecting 3 concepts, one from each column, and with two or three on the same line):

- a) Initiatives (innovation and quality). Based on internal and external knowledge. With the purpose of creating processes of greater added value (best paid) that must be included in the chain of Mexican value.
- b) Individuals (as agents). Each individual (human being) promotes the adaptation process needed for the fulfillment of goals. S/he receives the benefits and takes risks from the existing triggers. The human factor besides the natural resources of a country represents one third of the total population of the United States of America. Given the importance of the human factor, ¿why not improve their quality of performance?
- c) Competencies (capacities). Development of functional, technical, and human abilities of individuals.

The selected concepts are: initiatives – individuals – and competencies, therefore, the facilities that the government can give to support the project of positioning the competitive advantages must be considered. The strategic axis is the differentiator due to the fact that the trigger is closely related with the concepts of **innovation and quality**.

A few proposed initiatives (trigger) for the government to facilitate the necessary environment to improve the Mexican competitiveness are:

- a) Foster innovation in agreement with the Mexican reality.
- b) Facilitate the development of individuals through education and its connection with the corporate sector.
- c) Encourage enterprises to use and benefit from governmental programs that support innovation and supply the necessary factors to create a strong bond between education and the corporate world.
- d) Create a sense of truthful justice and security so that the corporate and personal competencies remain within the country.

In order to continue with the same example and based on the selected concepts of: initiatives, individuals, and competencies, their development will be made possible, locating initiatives in the selected competitive advantage as the strategic axis. Each project as part of every initiative will regard the individual as the agent of change to increase the competencies.

Strategy control

It is necessary to measure and evaluate the development of the strategy and the impact it has over the relevant indicators. For that end, the framework provided by the GCI permits to analyze the way in which the indicators, that want to be promoted through a strategy, are structured and can be identified. Once these indicators are identified, it will be possible to obtain its current value based on the current models of measurement, or through the ones that the organization selects based on their own criteria.

The intention to identify the indicators is to set measurable goals that can be evaluated based on the definition of strategies. However, it is important to remember that in dealing with indicators and their initial measurement, it is possible to make necessary changes in order to improve them, keeping in mind the magnitude they represent and giving equal weight to their composition and changes, as well as the eventual changes in time throughout the different periods of the study. In order to maintain a continuous improvement and sustainability for each organization selection of indicators as its strategic metrics is relevant with the aim to achieve the positioning of its competitive advantages.

In other words, in the same way that other economic indicators, the best use comes from the analysis of the changes suffered when they are measured in a periodic manner, granted that the assessment method is always the same. It is important to mention that the definition and the mechanisms of measurement and evaluation suffer changes according to the depth of knowledge of the phenomenon and to correctly revise the changes of the indicators, it will be necessary to adjust or recalculate them under the new conditions.

Although this practice reveals that human beings confirm the fact that things do change, the possibility for new learning outcomes is always present (Montañana, 2004) under different scenarios.

For example, if we regard a few historic moments as points of inflexion of a saga, regarded as milestones of a linear image in the definition of a variable that facilitates the understanding of a dimension of the competitive capacity that a country has experienced, one can find the following recent changes:

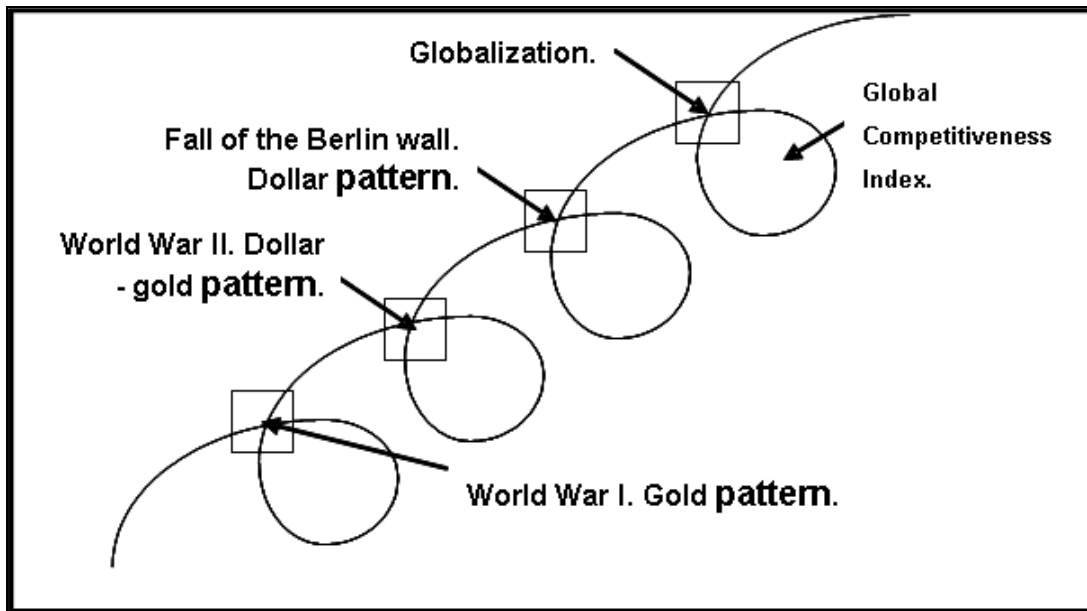


Fig. 6. Saga. Designed by: Author.

The purpose of the image is to represent that in the saga that is being formed, the historic moments represent the milestones and the changes that serve as landmark to the moment of change in the mechanisms of measurement and evaluation in order to be easily found.

Consequently, if we locate the GCI index as a variable that represents the dimension of the economic performance of a country in a well defined and acceptable way through the consensus of the WEFORUM members, and also by being aware that the indicator will change to adapt to the context based on the implementation of the necessary changes of its definition, it must be considered that the intervention of the government to create the ideal environment to improve competitiveness has its major influence in the actions applied for the betterment of the different indicators. Therefore, it is possible to imagine that the relevance of the work in planning the strategy is critical to outline the tasks that make an impact on the indicators with greater relevance for each country as an important part in the betterment of the positioning of a country in regard to the competitiveness of the member countries of WEFORUM based on the GCI parameter.

It is also essential not to lose sight of the efforts performed by GCR and their index originated by people whose professional performance and development was realized in countries classified as innovation driven, in spite of being presented, revised, and supported countries who seek to be a World Economic Forum member. This represents an additional degree of complexity in the explanation of the impact that the fore mentioned initiatives will have towards the parameters outlined by the GCR.

Conclusions

The structural strategies of the intellectual capital oriented towards values such as fidelity, reliability and loyalty of their personnel are desirable to cultivate the habits and traditions that will allow the organization to become a successful entity.

The study of these strategies and the way in which they have to be integrated to the global strategy of the organization in search to achieve competitiveness, are part of the necessary elements to study and develop the methods that promote the alignment of the general organizational goals with the structural strategies of the intellectual capital.

One of the goals of integrating the structural strategies of the intellectual capital is their contribution to the competitiveness betterment of the organization and consequently to the improvement of the indexes of competitiveness of the countries that find in the sharing of this knowledge a benefit for the productive sector. By distinguishing the value of this contribution to the organization and in order for them to have a distinctive mark that differentiate them from the rest and allow them a better positioning having a significant advantage in the global context, they will make it possible to attract the interest of potential investors and in general of stakeholders.

The study of the development of the intellectual capital through the learning of habits and processes of successful organizations, is a topic that must be carefully analyzed in search of strategies that allow the competitive betterment of organizations in the long run.

A great deal of these topics is of interest to the different governments knowing that the generation of programs and policies that promote the development of structural strategies for the betterment of the intellectual capital with a special focus on the values of fidelity, reliability, and royalty, is of utmost importance because of its contribution to the value of organizations from the perspective of competitiveness.

The connection among these topics in the industry of mechatronics is of particular interest to the current administration of the Mexican government, due to the fact that the state-of-the-art technology as outlined in the national development plan has the necessary elements to improve its level of competitiveness.

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