KNOWLEDGE MANAGEMENT: STRATEGY TO FACE CONSTRUCTION CHALLENGES. SITUATION IN VENEZUELA

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Abstract
Construction industry plays a vital role on global markets due to the jobs and wealth it creates as well as the services it provides. Among usual project challenges, construction companies, especially on developing countries, Venezuela among them, must face additional difficulties such as union pressures, low productivity, political strife, safety and financial difficulties, changing legal regulations, as well as troubling lack of knowledge management, which make attaining competitiveness and construction sustainability a great challenge. Construction Sustainability, Competitiveness and Knowledge Management are subjects extensively discussed on academic environments but not so widely on productive sectors. Such is the case of Venezuela, since the country, and particularly the oil and petrochemical construction industry, shows a staggering deficiency of formal processes and scientific studies oriented to knowledge management and achieving Construction Sustainability. Due to the importance of construction, private companies, governments, universities and research centers must work together in order to improve industry performance. This research is part of doctoral studies still under development, which is oriented to evaluate the potential benefits of knowledge management on Venezuelan oil and petrochemical construction performance, understanding that such problems could be present in other developing countries. So, while precise strategies are presented, it is suggested to understand the role of knowledge management as a key process that can help to create a new culture oriented to competitiveness and Construction Sustainability. Construction companies must realize that change will start once they are aware of their responsibilities to improve individual and sectoral performance pushing global sustainable development, as well as of the resources and opportunity that all have available to reach that goal.

Keywords: Construction challenges, Knowledge management, Sustainability, Venezuela

1. INTRODUCTION

The organizations that operate on the XXI century must face growing complications on their activities. In addition to the requirements of their business, the search of profitability and competitiveness, answer to global markets and competitor’s requests, must respond to difficulties related to conflicts and wars, climate change and natural disasters, terrorism, political stress, growing social tensions and inflation. In addition to this, now they have to face the critical consequences of the financial crisis of 2008.

Such problems and calamities have a critical effect on individual’s quality of life as well as organizational performance, specially in developing countries, so they request immediate attention and become priorities to public and private entities, often distracting their attention from other relevant topics such as productivity, competitiveness and sustainable development.

Developing countries, Venezuela among them, are least prepared to tackle such crisis because of their structural weaknesses, but even with those elements against, organizations must act proactively in order to achieve higher levels of performance and be able to compete in the challenging global markets. This will demand flexibility and adaptation to change.

While improving performance levels is important for all activities, is particularly relevant to the Venezuelan and other developing countries construction industry, as one of the driving forces of countries growth because of it contributions as a generator of jobs and wealth.
Due to the complexity and dynamism of each construction project, as well as for particular country conditions, Venezuelan construction industry is subject to great challenges and demands coming from technical, financial, labor, tax, market, and political issues, which must be faced by construction companies in order to succeed in the pursuit of their goals.

It is important to recognize that issues regarding construction and sustainable development, competitiveness and knowledge management are widely debated in many countries in academic circles with great intensity; however, these don’t always reach with sufficient strength to all countries and organizations, and aren’t always known by the companies that have the duty to improve their performance.

This is a reality for Venezuelan construction companies that in general lack of information and processes oriented to take the best chance of knowledge and intangible assets, and present competitiveness problems. So it is important to seek ways to support their improvement through integration with the currents that are under development on academic circles.

Leading from that, the aim of this paper is to encourage reflection for Venezuelan and other organizations of developing countries about the need to identify the elements on which support sustainable construction and competitiveness, and encourage them to develop joint strategies with governments and universities to support the improvement of its results. To achieve these objectives, knowledge must be recognized as a source of competitive advantage for construction companies worldwide, as it can support indicators, business competitiveness and construction sustainability improvement.

2. NATURE AND IMPORTANCE OF CONSTRUCTION INDUSTRY

The construction industry plays a vital role for humankind as has the responsibility of building the facilities and infrastructure that enable the development of human activities. [1] Due to the importance of housing facilities, infrastructure for communications and transportation, sanitation and water, the importance of the industrial and commercial services it offers, the number of jobs generated, as well as its contributions to the growth of nations, the construction industry has great influence in the socio-economic development of all countries. As such it is a key element for achieving sustainable development. [1] - [2]

The particular nature of the construction is evidently seen at the complexity of the activities, the size of the organizations, the temporary nature of the projects, the fragmentation of activities and the combination of work practices and cultures found in every project. [3] That complexity is increased as each project requires the participation of various organizations such as consultants, practitioners and communities that provide a wide range of services necessary for the completion of each project. [1] - [4]

Despite its socio-economic importance, it is common that the public image of construction is quite poor, with a widespread perception that companies in the sector are extremely traditionalist and therefore do not take advantage of the benefits of innovations technology. [4]. This perception is unfounded, based on progress with the use of new materials, prefabrication elements, modular buildings, industrialization and mechanization of processes, and overall improvement in the services of the buildings that evidence the evolution of the construction industry. [4] - [5]

In light of these realities, the construction industry should be seen as a knowledge-based industry, requiring higher levels of knowledge, in order to adapt to the markets changes. [4]
3. CHALLENGES FOR THE CONSTRUCTION IN THE XXI CENTURY

Because many construction projects have complex scopes with cross functional requirements that involve the attention of various interest groups, construction companies must attend demands from several fronts. This imposes on project leaders the need of a dynamic and innovative vision, and the creation of multi-disciplinary and virtual work teams, in order to meet the complex requirements of each project. [6]

The complexity of construction becomes evident if we take into account the challenges associated with design processes, reengineering, new construction techniques and processes, environmental, safety, quality, human resources, management, the demands of the owners and customers, educational processes and decision-making, and the strict standards and regulations that mark the performance of each project. [1] - [7]

To further complicate the situation, construction industries face additional difficulties such as union and competitors pressures, low productivity, specification and technical problems, troubles with the supply or quality of materials and equipments, administrative and financial difficulties, changing tax and legal regulations, safety problems, operational risks and lack of knowledge management. [8]

The issues described are related to diverse areas of interest that go from the contractual relationships with customers up to the contract completion, and involve clients, consultants, insurance companies, financial organizations, labor unions, suppliers and service providers, contractors and members of the organization itself. [8]

It is considered that a project has been successful when it has been completed on time, according to specifications, budget and client satisfaction, but due to the challenges and complications of this business, It’s fairly common to find high levels of error and to need to rework some aspects of most projects. [8]. Especially in developing countries, the successful performance of large-scale projects is not very common due to various reasons, linked with consulting firms, contractors and coordinators of the project, as well as for labor productivity, resources supply, problems linked with water or energy supply, water or waste treatment services among other. [7] - [8] - [9]

The major performance problems faced by construction contractors working on developing countries can be divided into problems associates with: 1. Poor infrastructure of the industry, 2. Inadequate information management, frequent changes of directions and breach of obligations by clients and consultants and 3. Deficiencies of the contracting companies. [9]

All these problems become challenges to be overcome by the industry, and make necessary to understand the factors that enhance and limit innovation in the construction industry. [5]

The main challenges faced by the construction industry - according to the perspective of oil and petrochemical sector in western Venezuela - are evident in the following table N. I. Main challenges faced by construction.
TABLE I
MAIN CHALLENGES FACED BY CONSTRUCTION

<table>
<thead>
<tr>
<th>Main challenges faced by construction</th>
<th>Casos</th>
<th>% resp. col.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labor issues</td>
<td>31</td>
<td>32,0%</td>
</tr>
<tr>
<td>Market issues</td>
<td>18</td>
<td>18,6%</td>
</tr>
<tr>
<td>Political issues</td>
<td>12</td>
<td>12,4%</td>
</tr>
<tr>
<td>Financial issues</td>
<td>12</td>
<td>12,4%</td>
</tr>
<tr>
<td>Technical issues</td>
<td>11</td>
<td>11,3%</td>
</tr>
<tr>
<td>Taxes issues</td>
<td>9</td>
<td>9,3%</td>
</tr>
<tr>
<td>Other (organizational culture, currency control, public disorders)</td>
<td>4</td>
<td>4,1%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>24</strong></td>
<td><strong>100,0%</strong></td>
</tr>
</tbody>
</table>

These results represent a particular vision of a productive sector and cannot generalize a reality far more complicated, but it is indisputable that the nature and complexity of these challenges in general affect the construction organizations. [8]

All the issues involved in each project confluence in the main challenge faced by construction companies, that is successfully complete each work with the quality required by the client, within the agreed timetable and budgets. To achieve it the construction companies are obliged to assume a proactive and innovative role that enables them to optimize their performance, sustaining and aiding in the growth and strengthening of national industries. [7] - [8]

4. SUSTAINABLE CONSTRUCTION

To maximize the contributions from construction to the overall needs of society, for several decades some countries have been studying Sustainable Construction. Among several definitions, it is described as the creation and management of a healthy environment built on the basis of efficient resources and ecological principles, or the use of local solutions for local problems, while respecting people and planet’s eco-capacity. [1] - [7]

This is a complex concept, which combines human and technical elements, with various implications and priorities that acquires different approaches if it is analyzed in terms of economies of developed markets, economies in transition or developing countries. Therefore, depending on the priorities of each country, Sustainable Construction analysis is linked with physical problems related to resources, biological problems associated with people and sociological problems associated with socio-political, socio-economic and socio-cultural elements [1] - [7]

Figure 1 shows the evolution of construction vision up to actual conception on global context.
Here is highlighted the interdependence between social, cultural, economic, environmental, social and equity issues, that’s obligatory to study the construction in the overall global context towards sustainable construction. [10]

Based on such evidences, to achieve Sustainable Construction in Latin America, it is needed to clearly address the specific circumstances that affect its countries in the economic, social and natural fields. That is because of its requirements for reducing poverty, sustaining economic growth, achieve better income distribution and face the urban sprawl. [7]

These goals of sustainability can be achieved if the actors take into account the need to develop networks and regional capacities, to strengthen education and training, develop public policies that foster sustainable construction, strengthen the use of technology and assessment techniques to identify local and regional needs. [7]

Several elements can obstruct the development of sustainable construction. Among them: lack of capacity in the construction sector, uncertain economic environment, political insecurity, poverty, low levels of investment in urban, technological inertia, flaws of integrated research, lack of knowledge and reliable data, disinterest in issues related to sustainability and ignorance and lack of understanding of the problem by professionals in construction, public, private and public in general. [7] - [10]

This is one of realities related to Venezuelan context, as the country shows very little progress on the path to reach for construction sustainability. [8] That is why it is suggested that the principles of sustainable construction should be incorporated as subjects of formal education and training of all those involved directly or indirectly with the construction works. [1] - [7]

Recognizing the importance of tearing down these barriers and support the achievement of sustainability in construction, justifies further research and dissemination of knowledge on this subject. [7] - [10]. This is particularly important for Venezuela and other developing countries as Sustainable Construction can become a key element in the achievement of sustainable development as a global goal. This justifies further research on this field.
5. KNOWLEDGE MANAGEMENT AS A STRATEGY FOR COMPETITIVENESS AND SUSTAINABILITY OF CONSTRUCTION

Knowledge management is described as the continuing process of creation and dissemination of new knowledge throughout the organization, which allows the introduction of new products and services, technologies and systems that promotes organizational change and adaptation to new environment challenges. [11]

Knowledge management makes available to individuals and organization, in an orderly and practical way, a number of tacit and explicit knowledge that consent operation and organizational growth. This is accomplished through the use of tools and technologies that allow individuals to capture share and use knowledge to make better decisions timely. [12]

Because of those contributions, in today's global world, economies that have a higher viability to achieve their development are those based on knowledge. [12]. Such is the value recognized to knowledge as resources that the European Commission aims to make Europe the largest global knowledge economy by 2010, to increase productivity and competitiveness to find greater progress in achieving a welfare state, cohesion and sustainability. [13]

This advanced view is also involving actors from the construction industry, which recognize that this sector also relies heavily on knowledge. So, the need to manage knowledge is emerging in the order of innovation, improvement of performance of processes and customer satisfaction, which are necessary to maintain competitiveness. [14].

In both developed and developing countries, construction companies report problems with the management of knowledge such as: Lack of effectiveness on lessons learned from previous projects, loss of knowledge because of personnel transfers, difficulties in capturing, organizing and retrieving knowledge achieved in the projects, breakdowns in communication between projects, lack of records of decisions taken and large amounts of knowledge poorly organized and difficult to access, locate and use. [3] - [15]

In addition to the barriers mentioned earlier, researchers who study sustainable construction reported problems of shortage of skilled professionals, technicians and craftsmen, limitations in understanding the need to better use the knowledge in construction as well as the absence of information and accurate data to make the best decisions. This leads to the need to establish mechanisms to eliminate these barriers through the creation of conditions which aid the distribution and usage of knowledge. [7] - [10]

In front of such problems the cultural change related to knowledge management in construction will lead to decrease projects execution time, improve quality and customer satisfaction and reduce the need to re-discover knowledge already achieved. [6]

The importance of knowledge for the sustainability of construction is such that several global processes aimed at maximizing the use of these resources have emerged, such as Agenda 21 and the Habitat II Agenda for Sustainable Development, which foster the global partnership to achieve implement principles of sustainability in the construction through R & D, as well as “The Knowledge Management Project” that supports research and practice of knowledge management with a focus on the construction industry [1] - [16]

The main benefits of proper knowledge management in construction are evident in areas such as: Innovation thrives more easily; workers achieve greater effectiveness and efficiency with
overall performance improvements; project delivery indicators improve; lessons learned from a project can benefit next one; the transfer of knowledge between the various stages of each project is facilitated; intellectual capital is maximized, ability to respond to the demands of customers improve, products with higher added value are supplied and organizational risk is reduced because of lower levels of uncertainty. So knowledge becomes the driving force behind the construction, allowing the optimization of the main competitive advantages. [17]

In order to obtain such benefits, the production, dissemination and use of these intangible resources results of vital importance to both organizations as for the teams responsible for each project, as they support the solution of problems as well as the management of change and innovation. [4] - [17]

To disseminate knowledge relevant to sustainable construction, developing countries require that research be carried out to feed the databases, knowledge on the various technologies and tools available to achieve sustainable construction, use the best practices that support these processes and primarily to develop specific strategies for the sharing of knowledge. [10]

Related to that goal, in the context of global trends, in Latin America there has been some progress in studying the problems of productivity and competitiveness for the construction. From such guidance have emerged some few strategies related to constructability and lean construction and in general, even if yet not as wide as needed, a growing interest to support the achievement of sustainable construction. [7] - [15] - [18] - [19]

Among other advances in the field of knowledge management in Latin America, we find the model of the social value of knowledge and territoriality, which offers an approach that demonstrates the social value of knowledge about human resources, recurrent education, culture innovation and networking technology cooperation in the framework of territoriality, and endogenous development [20], as well as the prototype of knowledge management for construction companies, which propose the classification of knowledge of the company different business functional areas and levels in order to facilitate knowledge exploitation and the preservation of the lessons learned. [15]

6. SITUATION IN VENEZUELA

Despite being so relevant, few advances exist in Venezuela regarding knowledge management for the construction sector, since except for current investigation, have not been identified yet other studies aimed specifically at improving the performance levels neither of general construction nor for oil and petrochemical sector, based on the use of knowledge as strategic assets. In fact, it was only in 2008 when formal research in this field was initiated. [21].

The first investigation in this field assessed the group of 38 organizations providing services of construction and maintenance for the oil and petrochemical industry in western Venezuela. The organizations that participated in the research include small, medium and large industries, with activities at local, national or international level. [21]

The Tables II, III and IV collect some of the results of research in critical areas such as structures, resources and techniques used to manage knowledge. [21]
TABLE II
**FORMAL STRUCTURE FOR KNOWLEDGE MANAGEMENT**

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>%</th>
<th>Accumulated %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agree</td>
<td>8</td>
<td>33,3</td>
<td>33,3</td>
</tr>
<tr>
<td>Disagree</td>
<td>16</td>
<td>66,7</td>
<td>100,0</td>
</tr>
<tr>
<td>Total</td>
<td>24</td>
<td>100,0</td>
<td></td>
</tr>
</tbody>
</table>

TABLE III
**RESOURCES AVAILABLE FOR KNOWLEDGE MANAGEMENT**

<table>
<thead>
<tr>
<th>Resources available for Knowledge Management</th>
<th>Cases</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personnel for KM functions</td>
<td>5</td>
<td>27,8%</td>
</tr>
<tr>
<td>Systems and programs for KM</td>
<td>5</td>
<td>27,8%</td>
</tr>
<tr>
<td>KM Department</td>
<td>3</td>
<td>16,7%</td>
</tr>
<tr>
<td>Standards for managing and sharing knowledge</td>
<td>3</td>
<td>16,7%</td>
</tr>
<tr>
<td>Other</td>
<td>2</td>
<td>11,1%</td>
</tr>
<tr>
<td>Total</td>
<td>9</td>
<td>100,0%</td>
</tr>
</tbody>
</table>

TABLE IV
**TECHNIQUES, TOOLS OR METHODS FOR KNOWLEDGE MANAGEMENT**

<table>
<thead>
<tr>
<th>Techniques, tools or methods for Knowledge Management</th>
<th>Frequency</th>
<th>%</th>
<th>Accumulated %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Procedures established on quality system</td>
<td>4</td>
<td>30,8</td>
<td>30,8</td>
</tr>
<tr>
<td>Work meetings</td>
<td>5</td>
<td>38,5</td>
<td>69,2</td>
</tr>
<tr>
<td>Brainstorm</td>
<td>1</td>
<td>7,7</td>
<td>76,9</td>
</tr>
<tr>
<td>Combination of above</td>
<td>3</td>
<td>23,1</td>
<td>100,0</td>
</tr>
<tr>
<td>Total</td>
<td>13</td>
<td>100,0</td>
<td></td>
</tr>
</tbody>
</table>

While still with preliminary results, the investigation has begun showing the low proportion of companies belonging to this group, with resources, formal processes and practices for managing knowledge. The conclusions showed that the most part have no formal knowledge, resources, structures, techniques and specific technologies to manage their knowledge, with evidences of weaknesses on the cultural, organizational and technological issues needed to support appropriate knowledge management. [21]

In addition to the shortcomings of the companies themselves, neither the government nor the guilds that cluster the construction companies, such as the Industry, Oil or Construction Chambers and the Venezuelan Association of Construction Exporters have developed processes aimed at fostering the use of these resources among members. [21]
7. CONCLUSIONS

No construction organization can escape the responsibilities that have to achieve better performance levels, maximizing their chances of success in the competed world markets, supporting the improvement of sectoral indicators. The task of achieving competitiveness and sustainability depends on the coordinated work of governments, universities, research institutions, unions, guilds and private companies worldwide.

This is needed in developing countries, especially Venezuela, due to the great challenges faced by construction companies, as the daily complications and the demands and requirements of each project leave little time for the continuous improvement.

To break this vicious cycle and support the achievement of competitiveness and sustainability of the construction industry, there is a need to facilitate understanding of the magnitude of the problem and disseminate knowledge relating to it.

For the Venezuelan and other developing countries cases, given the low level of advancement in the formal and planned use of knowledge, is urgent to implement tangible measures to allow the use of these resources through the implementation of models of knowledge management in construction, the development of research lines, as well as the support of government and guilds acting together in raising the levels of national performance.

In this preliminary stage of research, there are no final conclusions or precise strategies to be proposed, even if it is conclusive that stakeholders must realize that progress begins with the recognition of the existence of problems as well as the improvement opportunities faced by industry. Next step will be the change of orientation of construction institutions in front of knowledge. So, while precise strategies are proposed, it is suggested to understand role of knowledge management as a key process that can help to create a new culture oriented to competitiveness and construction sustainability.

Discussion of those topics should transcend the academic environment and arrive to the construction companies themselves so they can see their individual responsibilities for the achievement of sustainable construction and the benefits of knowledge as strategic resource, and may set gradual changes in their internal processes in order to enrich them.

In this way it will be possible to create a cultural change which will allow to valuate knowledge as a resource to help countries become increasingly independent and competitive, through an appropriate balance between the social benefits expected by society and competitiveness, helping to reach a truly global sustainable development.

REFERENCES


