Importance of Strategic Knowledge in the Implementation of Industrial Software Development Processes in University Environments: Some Explorations

Elkin Darío AGUIRRE MESA, César Felipe HENAO VILLA, and David Alberto GARCÍA ARANGO
Corporacion Universitaria Americana, Colombia

Keywords: Strategic knowledge, Software industry, Engineering, Learning.

Abstract. This article analyzes the importance of strategic knowledge in the implementation of a software development industry derived from academic processes. For this purpose, an exploratory research of students’ conceptions regarding strategic knowledge is considered as methodology and analyzed the relationship between these conceptions and aspects such as the tendency to share knowledge, knowledge of development methods and knowledge of the dynamics in the industrial sector. These initial conceptions will serve as the basis for the conception of a productive model of software industry enrolled in the systems engineering program of the “Corporación Universitaria Americana”. Challenges and conclusions are proposed in this regard.

Introduction

The continuous evolution of the organizational knowledge and the increasing boom of diverse technological tools in an increasingly globalized environment, has proposed great challenges in the academic formation of Systems Engineers, who must solve problems increasingly complex in real environments.

Given this type of needs, it is proposed that students of Engineering learn in environments that simulate real processes in productive environments under the constraints and difficulties that can occur when embedding these aspects in an academic environment. In the case of Systems Engineering, a way of promoting a conceptualization space that encourages such approaches can be related to the implementation of a Software Industry that obey a productive process that would be carried out during the entire training process.

This article analyzes the importance of strategic knowledge in the implementation of a software development industry derived from academic processes. For this purpose, an exploratory research of students' conceptions regarding strategic knowledge is considered as methodology and analyzed the relationship between these conceptions and aspects such as the tendency to share knowledge, knowledge of development methods and knowledge of the dynamics in the industrial sector. These initial conceptions will serve as the basis for the conception of a productive model of software industry enrolled in the systems engineering program of the “Corporación Universitaria Americana”. Challenges and conclusions are proposed in this regard.

Strategic Knowledge

For the purposes of this paper, Strategic Knowledge Management is defined (SKM) as "... the process of creation, capture, assimilation and dissemination of organizational knowledge linked to the planning, description, impact, prediction, evaluation and generation of strategies” [1]. In this sense, it is worth considering that such processes must be determined by the presence of experts, who interact with the various sectors of the community and through this interaction strengthen the explicit knowledge in the organization. Thus, as from the model of knowledge creation, the forms of their conversion (socializing, externalizing and combining) are presented, as well as the factors that
facilitate their implementation (intention, autonomy, creative chaos, redundancy and variety of requirements). [2]

Also, one can consider that the “…strategic knowledge is knowledge about to act; more precisely, it is knowledge used by an agent to decide what action to perform next, where actions effect both what is believed by the agent and the state of the external world…” [3]

Knowledge Management models, from a conceptual point of view, are born in the needs and / or construction of new methods and methodologies of labor, academic and / or professional development, considering the individual's own tacit competences together with those explicit own competences of the transfer of knowledge acquired through academic and professional development in the development of real organizational challenges. This is demonstrated by Bálbón & Barrios [4], where they analyze knowledge management from an inclusive environment, involving the organization with the environment that surrounds them: The company's own needs (technological, human, financial and information) are analyzed As an opportunity to develop the company from its environment, through a functional and isomorphic model in the theory of production and appropriation of integral knowledge in society.

Software Industry at the “Corporación Universitaria Americana”

The Software Industry Program is an entity attached to the Systems Engineering Faculty of the American University Corporation, whose main purpose is to be a software development company, as well as provide support, advice and knowledge to students who participate in The seedbed oriented to the development of software, and from there can be part of own or third-party developments, training them and generating them concerns for a possible conformation of their own development company.

In the software industry, software products related to students' own development are generated through the project learning methodology in the engineering program, its objective is to be a link of the American University Corporation with the business environment for the development of High quality software and serve as a platform for the generation of company by the students.

Software product is understood as: “a packaged configuration of software components, or a software-based service with auxiliary materials, which is released for and traded in a specific market” [5].

Methodology

The research of the present article is of exploratory type and will be considered as the basis for the establishment of a productive model of software industry in the context of a knowledge management model in the university. We analyze a survey applied to 53 students of the Systems Engineering program of the “Corporacion Universitaria Americana” where we inquire about their appropriation of the strategic knowledge and their knowledge of aspects related to the software industry, the data obtained was applied a test Of chi-square in order to establish relationships and verify the hypothesis related to the importance of strategic knowledge in the development and implementation of processes related to the software industry in the American University Corporation. The results obtained were also compared with information extracted from articles related to knowledge management in the software industry through a hermeneutical analysis of the discursive spheres of the academic environment.

Results

A dependence analysis of the variables was proposed with a test of $\chi^2$ [3] with a sampling error of 5% with 95% confidence, assuming a heterogeneity of 15%, population selection was done by structural sampling [4], Where the null hypothesis that was studied was the following:
\( h_0 = \) The variables “Strategic knowledge” and “Knowledge of the difference between software lab and software industry” they are independent.

\( h_1 = \) The variables “Strategic knowledge” and “Knowledge of the difference between software lab and software industry” they are dependent.

The variable “Strategic knowledge”, is dichotomous with yes and no values. The variable “Knowledge of the difference between software lab and software industry” assumed a scale of 1 to 5 taking as 1, lower knowledge and 5, greater knowledge.

The expression used to calculate the sample size was

\[
n = \frac{N \cdot Z^2 \cdot p \cdot q}{d^2 \cdot (N - 1) + Z^2 \cdot p \cdot q}
\]

<table>
<thead>
<tr>
<th>Scales</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>YES</td>
<td>0</td>
<td>2</td>
<td>6</td>
<td>8</td>
<td>9</td>
<td>25</td>
</tr>
<tr>
<td>NO</td>
<td>7</td>
<td>4</td>
<td>5</td>
<td>8</td>
<td>4</td>
<td>28</td>
</tr>
<tr>
<td>Total</td>
<td>8</td>
<td>8</td>
<td>14</td>
<td>20</td>
<td>18</td>
<td>53</td>
</tr>
</tbody>
</table>

Table 1. Data obtained from the first question.

The values obtained were:

<table>
<thead>
<tr>
<th></th>
<th>3,30188679</th>
<th>0,24352201</th>
<th>0,12686106</th>
<th>0,02716981</th>
<th>1,34130624</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2,94811321</td>
<td>0,21743037</td>
<td>0,11326881</td>
<td>0,02425876</td>
<td>1,19759486</td>
</tr>
</tbody>
</table>

Then with 4 degrees of freedom, we have a value of \( \chi^2 = 9.54 \). We reject the null hypothesis and approve \( h_1 \). Then, the variables "strategic knowledge" and "knowledge of the difference between software laboratory and software industry" are dependent.

For the next question, the null hypothesis that was studied was the following:

\( h_0 = \) The variables "strategic knowledge" and "knowledge of the dynamics of software development in the industrial sector" are independent.

\( h_1 = \) The variables "strategic knowledge" and "knowledge of the dynamics of software development in the industrial sector" are dependent.

The variable "strategic knowledge" is dichotomous with values if and not. The variable "knowledge of the dynamics of software development in the industrial sector" assumed a scale of 1 to 5 taking as 1, lower knowledge and 5, greater knowledge.

<table>
<thead>
<tr>
<th>Scales</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>SI</td>
<td>2</td>
<td>6</td>
<td>4</td>
<td>8</td>
<td>5</td>
<td>25</td>
</tr>
<tr>
<td>NO</td>
<td>6</td>
<td>12</td>
<td>7</td>
<td>1</td>
<td>2</td>
<td>28</td>
</tr>
<tr>
<td>Total</td>
<td>8</td>
<td>18</td>
<td>11</td>
<td>9</td>
<td>7</td>
<td>53</td>
</tr>
</tbody>
</table>

Table 3. Data obtained from the second question.

Table 4. Values obtained from chi-square.

Then with 4 degrees of freedom \( \chi^2 = 11.41 \). We reject the null hypothesis and approve \( h_1 \). Then, the variables "strategic knowledge" and "knowledge of the dynamics of software development in the industrial sector" are dependent.
Discussion and Analysis of Results

From the obtained results, it can be analyzed that the strategic knowledge is fundamental to initiate a process of software industry in academic environments, since it allows to generate in the student the capacity to make decisions in complex environments attending to principles of externalization of the knowledge of the teacher (in this case the expert). It is vitally important to generate a virtuous circle of project training that allows a continuous relationship between the various fields of knowledge related to the conformation of software development knowledge, taking into account the difficult task of transforming tacit knowledge into Explicit knowledge.

The following chart summarizes the process:

![Relationship between software industry participants in strategic knowledge](image)

Figure 1. Relationship between software industry participants in strategic knowledge.

Conclusion

The relationship between strategic knowledge and the implementation of the software industry in the “Corporacion Universitaria Americana” is functional, insofar as strategic learning of the conception, design, implementation and operation of software and information systems in real environments will allow the development of the competencies needed to make decisions in complex organizational environments.

The relationship between the development expert and the students who are part of the Systems Engineering program of the “Corporacion Universitaria Americana” strongly determines the students’ interaction with the Software Industry and can strengthen the link between tacit knowledge and explicit knowledge in the program.

Acknowledgement

This research was financially supported by Corporación Universitaria Americana—Medellín, Colombia.

References


