Knowledge Management: Turning Intangible Assets into Feasibility in the Automotive Sector

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Abstract: Knowledge Management has become the most strategic resource in the new business environment. This research is based on the analysis of the strategic knowledge held within a multinational group; a leader in the design and production of a great variety of components for the automotive industry. It focuses on achieving feasibility and real applications by identifying knowledge gaps that must be overcome to perform certain activities, so as to take the right decision on its acquisition in terms of what to acquire, how to acquire it, and the associated time and costs. We use a recently developed artificial neural architecture called Cooperative Maximum-Likelihood Hebbian Learning, a tool to develop part of an Integral Global Model of Business Management, which has the potential to bring about a global improvement in the firm by adding value, flexibility and competitiveness. From this perspective, the model used in the study generalizes the hypothesis of organizational survival and competitiveness, so that the organization is able to identify, strengthen, and use key knowledge to reach pole position. Our conclusions suggest that it is possible to specify the knowledge that is held but is underused in the departments, taking into account their current levels of knowledge, their relevance and the urgency to acquire new knowledge. Moreover, an analysis of the required evolution rate of the present knowledge may be included which, among other aspects helps detect new knowledge, eliminate obsolete knowledge and validate new needs.

Keywords: Knowledge Management, Intangible Assets, Metaheuristic Algorithms.

1. Introduction

Knowledge has become the most strategic resource in the new business environment (Viedma, 1992; Grant, 1996; Davenport and Prusak, 1998; Zack, 1999; Ordóñez, 2002; David and Foray, 2002; Sáiz and Manzanedo, 2002; Sáiz, Peña and Lara, 2003; Ordóñez and Peteraf, 2004; Viedma, 2005; Bueno, 2005; Carrillo, 2006; Arboníes, 2006). We specifically centre our attention on the study of knowledge management from a pragmatic approach that believes knowledge can be better understood through its classification and organisation (Polanyi, 1958; Myers, 1996; Corchado, Fyfe, Sáiz and Lara, 2004). This approach is based on an understanding of different states of knowledge and their transformation from an initial low starting point - data and information- to other higher points, such as the knowledge itself, its management, and individual, and even organisational responsibilities (Viedma, 2000; Muñoz-Seca and Riverola, 2003; Collison and Parcell, 2003; Lara, Sáiz and Peña, 2003).

In this paper, we use a recently developed artificial neural architecture in order to categorize the needs for the Acquisition, Transfer and Upgrading of Knowledge held by the different departments of an automotive company. It is an extension of a Negative Feedback Network characterised by the use of lateral connections on the output layer and the use of a family of learning rules in the form of lateral connections that are derived from the Rectified Gaussian distribution. The results in this study are drawn from the analysis of a multinational group, leader in the design and production of a great variety of components for the automotive industry. The multinational is undergoing organizational change and faces high levels of growth and expansion, which requires rapid adaptation to the demands of the sector, greater resources, imminent transfers and accurate forecasting of knowledge, coupled with pressing demands to capitalize, share and use them within the group.

The design of the preliminary theoretical model of Knowledge Management is based on three components: the Organization -Strategy and People-, Processes -Acquisition, Transfer and Upgrading of Knowledge- and Technology (Lara, Sáiz and Peña, 2002). The population sample used came from 277 registry entries (individuals) that correspond to the "needs for knowledge" presented by the senior managers of the company departments participating in the study. The knowledge that was gathered involves different stages (knowledge levels) that depicted the actual situation of each department with respect to their assigned tasks or activities that had to be successfully accomplished. It was also possible to obtain valuable data on the degree of importance for the company of the gathered knowledge.

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It is possible then to identify the knowledge gap that needs to be overcome to perform the activity, so as to make the right decision on its acquisition in terms of how it shall be acquired, the time needed and to acquire it. In the same way, it is possible to specify the knowledge that is held but is underused, either because the person who holds it does not use it to the full or because it also has a value and potential use for other departments. Moreover, an analysis of the required evolution of actual knowledge levels may be included to detect new knowledge, eliminate obsolete knowledge and validate new needs.

2. Theoretical model

In this study, knowledge management is understood as a system that integrates its specific functions and processes to create/acquire, transfer/distribute and put into practice/update the ideas and knowledge of a firm's personnel. By doing so, knowledge management, allows people to achieve greater levels of creativity, ensures permanent training and recycling in their specialist areas, and helps them to share and pass on the benefits of their knowledge to other workers who also integrate their colleagues' knowledge into their own work. With this grounding, our new knowledge management model used in this study, shown in figure 1, divides the firm up into three areas, according to the different situations that can arise in the field of strategic knowledge: a knowledge deficit, a partial knowledge deficit and no knowledge deficit. The processes under consideration are creation/acquisition of knowledge, transference/distribution and putting into practice/upgrading knowledge.

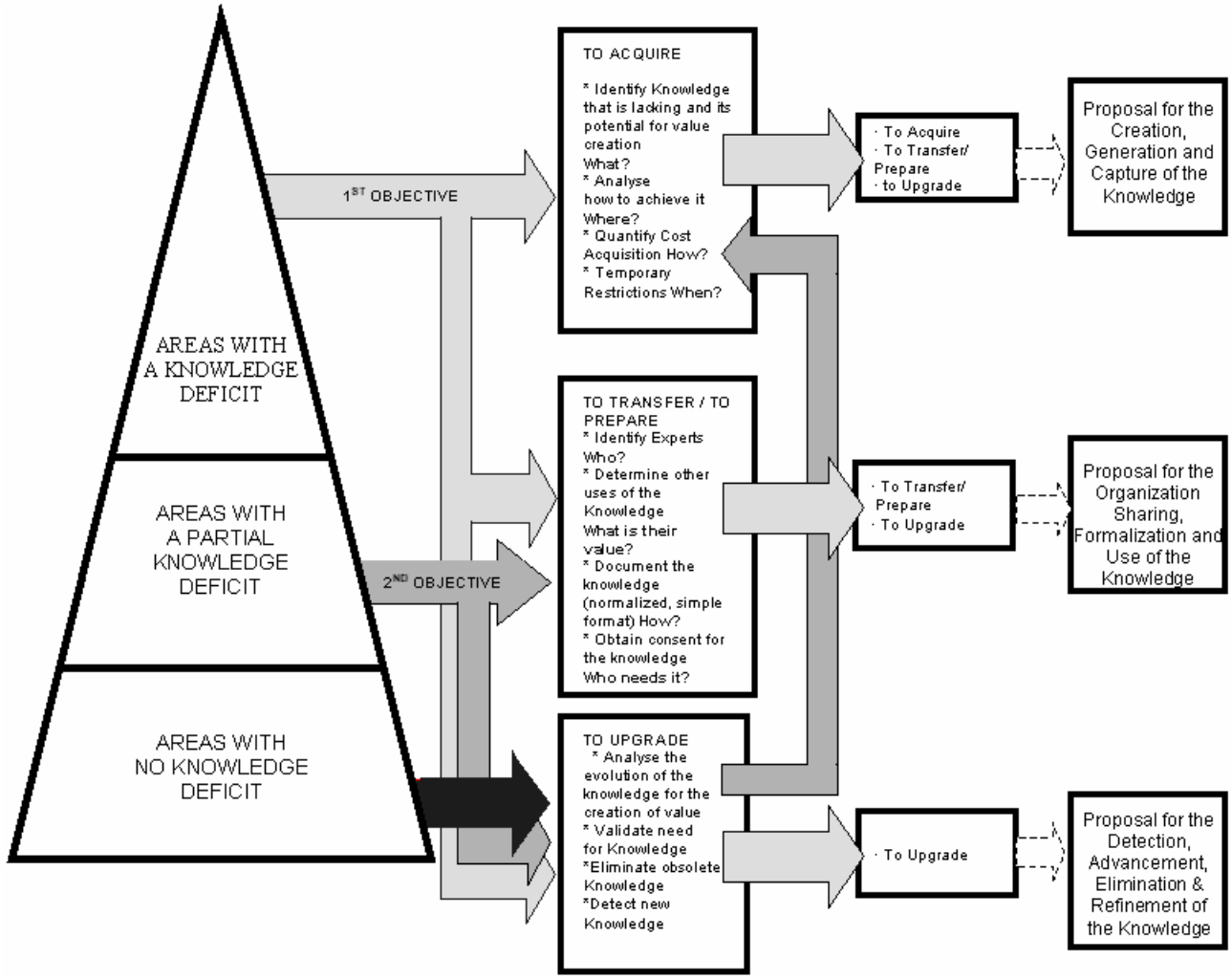

Figure 1: The preliminary theoretical Knowledge Management model proposed in this study (Manzanedo, Sáiz, Peña and Lara, 2002)

This approach was chosen to develop the functions and processes sequentially according to the overall circumstances of the firm or its individual parts. Thus, the complete circuit begins with the creation/acquisition of knowledge, which leads to its distribution and transference and is concluded with its upgrading or putting into practice. In order to apply the model satisfactorily, the knowledge states need to be considered (Polanyi, 1958) along with their possible conversion processes (Nonaka and Takeuchi, 1995) -

explicit and tacit- and the agents responsible for creating them: individuals, groups, firm, and environment (Nonaka, 1994; Nonaka and Takeuchi, 1995; Ruggles, 1997).

This new model represents three possible knowledge situations: deficit, partial deficit, and no deficit, which might require one or more of the processes: Creation/Acquisition, Transference/Distribution, and Putting into practice/Upgrading -that will give rise to different proposals. In areas with a knowledge deficit, the objective is to acquire or create the necessary knowledge, prior to which the shortcomings need to be detected and identified, as well as the level or specificity of knowledge that is required. Here, it is equally a question of analyzing the way of acquiring the knowledge and estimating the degree of urgency so that it comes on line when necessary.

A partial knowledge deficit in an area indicates that knowledge is only available to experts, and has neither been made explicit nor widely communicated within the organization. The firm holds critical knowledge, but it is not accessible to everybody who needs it. Under this situation and on a case-by-case basis, the knowledge needs to be communicated and shared; a process by which experts and potential usages are identified, involving a search for the means to express it and to make it available. Finally, the areas with no knowledge deficits represent areas where the people and the firm have mastered the required know-how and it is available to those who need it. Through the process of Putting into practice/Upgrading the knowledge, the knowledge is used to the full and is kept updated through the elimination of obsolete knowledge and the detection of other types as new realities are brought to bear. The system provides its own feedback, as this latter process is, necessarily, linked to that of Creation/Acquisition, to obtain this new knowledge, which, in turn, will subsequently lead to Transference/Distribution, before the process is activated once again in due course. Contributions made by authors such as Wiig (1993), Hedlund (1994), Marquardt (1996), Beckman (1997), Ruggles (1997), and Holsapple and Joshi (1998), were given preferential attention in the formulation of the proposed model, to which the upgrading process that was not considered by the latter authors has been added. This process is one of the principal novelties of the model presented in this work which, as well as being very necessary, helps to complement the study and design of Knowledge management models that are of great utility and interest to firms.

3. The artificial neural architecture

We use the standard Maximum-Likelihood Network (Corchado, MacDonald and Fyfe, 2004) with an additional lateral connection (which acts after the feed forward but before the feedback) derived from the Rectified Gaussian Distribution (Seung, Socci and Lee, 1998; Corchado and Fyfe, 2003) and using the cooperative distribution.

This architecture considers an N-dimensional input vector, x, and a M-dimensional output vector, y, with W_{ij} being the weight linking input j to output i and let η be the learning rate. The initial situation is that there is no activation at all in the network. The input data is fed forward via weights from the input neurons (the x-values) to the output neurons (the y-values) where a linear summation is performed to give the activation of the output neuron. The Rectified Gaussian Distribution is a modification of the standard Gaussian distribution in which the variables are constrained to be non-negative, enabling the use of non-convex energy functions:

Feedforward:
$$y_i = \sum_{j=1}^{N} W_{ij} x_j, \forall i \quad (1)$$

Lateral Activation Passing:
$$y_i(t+1) = \left[y_i(t) + \tau(b - Ay) \right]^+ \quad (2)$$

Feedback:
$$e_j = x_j - \sum_{i=1}^{M} W_{ij} y_i, \quad (3)$$

Weight change:
$$\Delta W_{ij} = \eta . y_i . sign(e_j) | e_j |^{p-1} \quad (4)$$

Where the parameter τ represents the strength of the lateral connections.
The cooperative distribution in the case of N variables is defined by:

$$A_{ij} = \delta_{ij} + \frac{1}{N} - \frac{4}{N} \cos\left(\frac{2\pi}{N}(i - j) \right) \quad (5)$$

and

$$b_i = 1 \quad (6)$$

Where δ_{ij} is the Kronecker delta I and j represents the identifiers of output neuron

3.1 Application of the neural network to the proposed model

For each of the Directions considered (A, B and C) different knowledge have been identified (277 in total), independent of their presence or not inside them. They have been evaluated in terms or urgency of acquisition, importance for the company and current status among the employees. For the knowledge presents inside the different areas, it has been reported also their current status inside and in relation with other's.

The variables have been coded as follow:

- *Urgency of acquisition*, *Level in other areas* and *Importance to acquire* it have been set as 1 for Low, 3 for Medium and 9 for High.
- Current level of the knowledge in the direction studied is 1 when is Null, 3 for Low, 5 for Medium and 7 for Maximum.
- *Situation of the knowledge* in other areas is 3 when Low, 6 if Medium and 9 if High.

As variables have a strict ordinary character, this quantification is not distorted by the read meaning of the values (as the sep the relative situation between themselves) and allows more comfortable set up with the neural network. The outputs of the net are real continuous values.

4. Real data set and results

4.1 Results of descriptive analysis

The data sample comprises 277 registry entries (individuals) that describe the state of "critical knowledge" revealed by the senior management of the company under study.

The critical knowledge, for each entry, is based on information that refers to the actual level of knowledge; the degree of importance attributed to it in order for the activity to be successfully carried out; the most favourable moment for its acquisition, if it is lacking; as well as the level at which such knowledge is needed as well as the level at which it is held in other areas of the company.

Thus, it is possible to identify the knowledge needed to develop the activity that is either unavailable or is not held, and to arrive at the right decision as regards its acquisition. Equally, it is possible to build up a picture of the knowledge that is held, but is not fully exploited, either because it is not fully used by the individual who holds it, or because it is not shared at the required level, or because its potential value and use in other areas of the company is unknown. Furthermore, the study incorporates an analysis of actual knowledge levels and their evolution and upgrading, to detect the need for new knowledge and to eliminate those that serve no purpose.

In the study, knowledge was categorized into eleven classes corresponding to three Corporate Directions. "Direction A" comprises New Business, Purchases and Commercial Relations. "Direction B" covers Project management, Better Industrial Practices, Protection of Design and Technology and Finances. "Direction C" refers to Human Resources, Quality, Organization and Information Systems. All of the areas are grouped together with reference to the flowchart of the company exclusively in terms of critical knowledge. Subsequently, the eleven classes mentioned are sorted out by lines of knowledge, each being assigned the specific knowledge that is inherent to that area.

Table 1 summarizes, in terms of percentages and frequencies, the descriptive profile of the needs for knowledge of each Corporate Direction in relation to the group of the company, as well as their position with respect to the processes of acquisition, sharing and upgrading of the knowledge.

Table 1: Indicative results of the Knowledge Management processes

CORPORATE DIRECTIONS	KNOWLEDGE SHARING	KNOWLEDGE MANAGEMENT PROCESSES		
		ACQUISITION	SHARING	UPGRADING
Direction A	18%	18%	43%	39%
Direction B	51%	8%	48%	44%
Direction C	31%	7%	38%	55%

The results obtained allow us to conclude that "Direction A" has 82% of the necessary knowledge, which is shared out among 43% of the expert workers, but is not shared with other individuals or areas of the

company that require it, and 39% exists at a group or an organizational level, which is therefore potentially upgradable. Such results suggest an excessive centralization of decision making, as the success of this managerial area is dependent on critical knowledge that is concentrated in the hands of a few people. Some of the causes may be explained by the pressing need for this Direction to adapt to numerous different and hitherto unknown markets, which, due in part to their emergent nature, implies that business administration and decisions have to be developed in complex, highly uncertain, and unstable situations. Absent knowledge represents 18%, which is much higher than in other areas of the company.

As regards Direction B, the data shows that only a mere 8% of all necessary knowledge is unknown, and that this Direction participates in the company while holding over half of the key knowledge. It therefore possesses 92% of all critical knowledge, 48% of which is at the exclusive disposal of experts, which requires a sharing process, and 44% is available to the organization. It is worth mentioning that the classes that comprise Direction B refer on the whole to essential competitive abilities that generate most of the company's competitive advantages, which in addition allow it to maintain a position of leadership in the sector. Although the company has shown itself able to master them, an important drawback is also revealed, relating to the great amount of knowledge that is not shared.

Direction C accumulates 31% of the need for knowledge, which in terms of its relevance situates it behind Direction B. It holds 93% of the necessary knowledge, of which 38% requires sharing and 55% is available to the organization. In order not to lose this substantially favorable situation, constant monitoring is necessary to identify new needs for knowledge.

4.2 Results and conclusions of the unsupervised model (empirical analysis)

Figure 2 shows the results obtained from the application of the neural architecture to this date set, while table 2 explains those same results in detail.

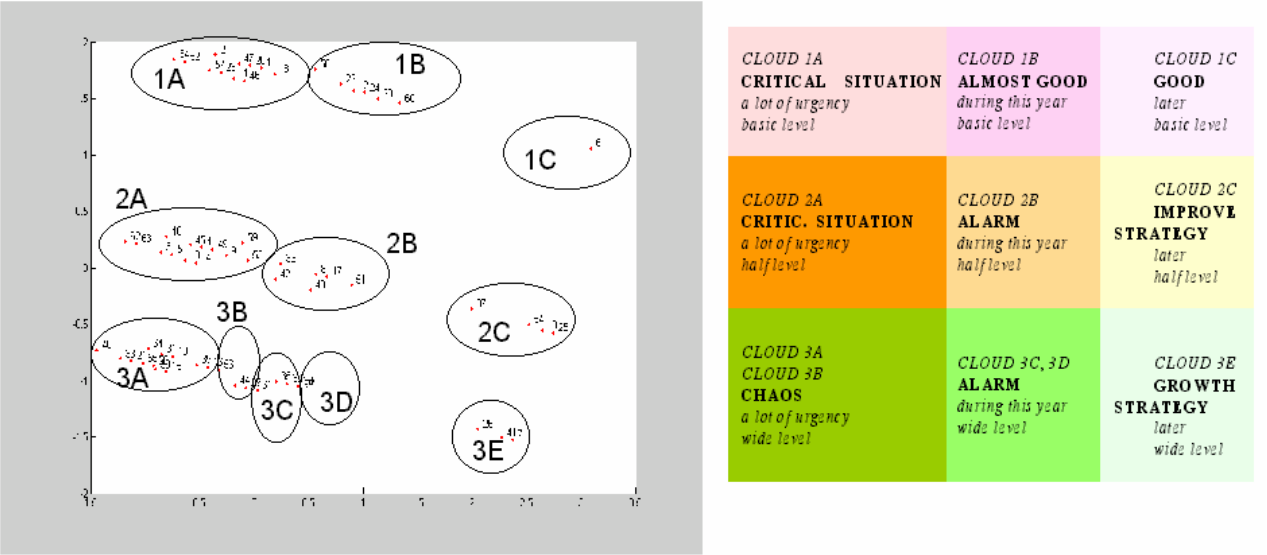

Figure 2: CMLHL on the real data

Table 2: Results

Cloud 1A: CRITICAL		Cloud 2A: CRITICAL		Cloud 3A: CHAOS	
URGENCY	9	URGENCY	9	URGENCY	9
LEVEL IN OTHER AREAS	1	LEVEL IN OTHER AREAS	6	LEVEL IN OTHER AREAS	9
IMPORTANCE	6,9	IMPORTANCE	6,9	IMPORTANCE	6,9
CURRENT LEVEL	1,3,5	CURRENT LEVEL	1,3,5,7	CURRENT LEVEL	1,3,5,7
SITUATION IN OTHER AREAS	3,6,9	SITUATION IN OTHER AREAS	3,6,9	SITUATION IN OTHER AREAS	3,6,9

Cloud 1B: ALMOST OPTIMAL		Cloud 2B: ALARM		Cloud 3B: CHAOS	
URGENCY	6	URGENCY	6	URGENCY	9
LEVEL IN OTHER AREAS	1	LEVEL IN OTHER AREAS	6	LEVEL IN OTHER AREAS	9
IMPORTANCE	6	IMPORTANCE	6,9	IMPORTANCE	6
CURRENT LEVEL	1,3,5	CURRENT LEVEL	1,3,5	CURRENT LEVEL	3,5,7
SITUATION IN OTHER AREAS	3,6,9	SITUATION IN OTHER AREAS	3,6,9	SITUATION IN OTHER AREAS	9

Cloud 1C: GOOD		Cloud 2C: IMPROVEMENT STRATEGY		Cloud 3C: ALARM	
URGENCY	1	URGENCY	1	URGENCY	6
LEVEL IN OTHER AREAS	1	LEVEL IN OTHER AREAS	6	LEVEL IN OTHER AREAS	9
IMPORTANCE	6	IMPORTANCE	6	IMPORTANCE	9
CURRENT LEVEL	5	CURRENT LEVEL	1,5,7	CURRENT LEVEL	1,3,5
SITUATION IN OTHER AREAS	9	SITUATION IN OTHER AREAS	3,6,9	SITUATION IN OTHER AREAS	6

Cloud 3D: ALARM		Cloud 3E: GROWTH STRATEGY	
URGENCY	6	URGENCY	1
LEVEL IN OTHER AREAS	9	LEVEL IN OTHER AREAS	9
IMPORTANCE	6	IMPORTANCE	6
CURRENT LEVEL	1,3,5	CURRENT LEVEL	3,5
SITUATION IN OTHER AREAS	6	SITUATION IN OTHER AREAS	6,9

The fringe of the matrix occupied by clouds 1A, 1B and 1C coincides with the variable "the level needed in other areas", which represents BASIC knowledge, and to the "importance of the knowledge" that is of an essential nature for the company, whereas the variable "current level of knowledge held" does not extend to the expert category.

The area occupied by clouds 2A, 2B and 2C refers to a MEDIUM value in the variable "the level needed in other areas", whereas the "importance of the knowledge" continues to be very important and indispensable for the development of the activity and the "current level of knowledge held" extends across all the categories, including that of the maximum level.

The area occupied by clouds 3A, 3B, 3C, 3D and 3E reflect the maximum parameters of the need for knowledge expressed by other areas, as well as the importance that is attributed to it, which continues to be key, however the greater part is not categorized as expert knowledge .

The fringe of the matrix occupied by clouds 1A, 2A, 3A and 3B reveals areas of immediate ”urgency" in the command of knowledge, which even though it is not held by the company, is of enormous importance to it. It is noted, on the other hand, that the majority of knowledge that is present in the area does not reach the most expert grades.

The data contained in clouds 1B, 2B, 3C and 3D add a degree of "urgency" to the acquisition of medium level knowledge, despite being very important and, indeed even indispensable for the successful development of the activity; it therefore sounds a warning bell as to future needs for new knowledge. As expected the knowledge contained in this fringe of the matrix did not reach the expert category.

Clouds 1C, 2C and 3E represent the calmest situation for the variable "urgency", because they suggest that the knowledge can be acquired later on, without that damaging managerial activity. Both the importance as well as the degree of the knowledge is at medium level. In view of the data presented above, the conclusions drawn from this case study allow us to state that the area occupied by cloud 1C is an OPTIMAL situation, because, amongst other reasons, it means that even though absent knowledge is identified in the area to which it belongs, its acquisition is not urgent and the need for that knowledge expressed by other departments or activities is at a basic level. The knowledge held is considered sufficient, very important and

is shared.

The contrary arises in relation to the points around clouds 3A and 3B, where the immediate acquisition and application of knowledge that is not held is considered urgent, at the same time as the level of the need for knowledge in the other areas of the company reaches its maximum value. We are, therefore, faced with a situation that we refer to as CHAOS that clearly warns of knowledge-related decisions that the company should face up to. Knowledge that is held and applied extends to the expert level and is very important and essential for the development of company strategy.

Similarly, the positions of clouds 1A and 2A warn us that maximum acquisition of knowledge is required in the areas to which the knowledge corresponds, although the needs in other areas are located at a basic and medium level. In these cases, it might be said there is a portfolio of knowledge that can be described as "CRITICAL" for the company, because the concession of new projects might perhaps depend on the correct application of such knowledge, the improvement of certain processes, the incorporation of new clients and, in short, the creation and maintenance of competitive advantages for the company. The knowledge held is at a high level and of extreme importance to the company.

The area occupied by cloud 2C reflects an urgent need for acquisition at a later stage, while the needs expressed by the other areas exist at a medium level. This situation might signify an "IMPROVEMENT STRATEGY", which calls for progressive and gradual improvement and consolidation of knowledge that is already held. The situation of current knowledge in the area itself, it is present at the levels of basic, sufficient and expert and is of reasonable and relative importance.

The points that define cloud 3E attract attention, because they refer to knowledge needed by others at a wider level, nevertheless its acquisition is not urgent. This might be a case of knowledge needed for the future in order to expand and to grow, either in new processes, markets or products, which is given the name of "GROWTH STRATEGY. The purpose of the company will determine the most appropriate moment to take on these decisions. The knowledge held is important and above average.

Cloud 1B represents a medium level urgency of acquisition, at a basic level; it can therefore be described as an ALMOST OPTIMAL situation; knowledge is held at an acceptable level and its importance reaches an intermediate value. Clouds 2B, 3C and 3D identify a situation of ALARM, because, although the urgency is not at maximum but at medium level, the need for this knowledge in other areas is indispensable. This leads us to conclude that the key knowledge is held and applied only in the area to which it corresponds, but it is not fully exploited, as it is neither transferred nor shared with other areas and activities that need it.

5. Discussion

The results obtained allow us to propose three approaches to the matter. The unfavourable situation that appears in the areas where there is a lack of knowledge may be due to the critical knowledge that depends, in great measure, on non-controllable factors for the company. At the same time, these are crucial to its success and progress. It therefore becomes necessary to take immediate steps towards the acquisition and control of such knowledge. It has been demonstrated that areas of the firm exist where the knowledge is mastered but is not shared among workers. Some of the reasons are due to the unrestricted growth experienced over recent years that has up until the present prevented consolidation; the responsibility and difficulty involved in new forms of working, moving from simple pieces to complete processes; recent expansion at an international level of the company that imply various economic-financial, and fiscal regulations in other business environments; and the traditional confidentiality and security required by patents. As a consequence, in order not to lose this essential knowledge and to continue maintaining its leadership, it is necessary to act on the transfer and sharing of knowledge that is, at present, only held by a limited number of professionals.

In the process of updating and refining knowledge, actions are proposed which tend to anticipate new knowledge and renew existing knowledge. This leads us to suggest actions that are intended to advance and to update/upgrade present levels of knowledge, through the elimination of obsolete knowledge and the acquisition, generation or creation, before its business competitors, of knowledge that will direct future managerial activity. However, to do the set up of the model and evaluate the knowledge presents and absents in each Direction, is required to establish as first step an strategic analysis of the situation of the company: to know where the company is and where would like to be in the future. If, as result of this

exercise, it comes to be that the activities of the firm would go inside different sectors, the help of experts in these sectors should be required (as consultants or as new employees).

This set up of the model has some limitations. First one in the transfer of the knowledge requirements to the economic factor, as the results of this audit tool would have to be presented the administration organism inside the company. Therefore an intense work of costing and analysis has to be taken, always considering some hypothesis that will determine the success of the decisions. So depending of the person taking that responsibility the outcome can be one or other. The second limitation is related to the way of transferring the knowledge between persons and departments. This process has to be quietly arranged, because knowledge uses to be quite spread all around and to perform a general process to transfer it at the same timeframe can result in a total revolution that can drive the company to the chaos and stop all normal activities.

Despite all difficulties, the model breaks the barriers between the departments of the company and forces them to work together and set common action plans to identify, share and acquire everything that they need to improve their development, in benefit of the whole company and employees. It forces also the company to arrange training plans for the employees and acts as a firewall against the brainscape.

References

Arboníes, A. (2006) *Conocimiento para innovar*. Díaz de Santos. Madrid.

Beckman, T. (1997) "A Methodology for knowledge management", International *Association of Science and Technology for Development, AI and Soft Computing Conference*, Banff.

Bueno, E. (2005) "Una reflexión crítica sobre la comprensión de la Sociedad y Economía del Conocimiento: la era de los intangibles". *Capital Intelectual*. No. 0, 1º trimestre, pp. 6-17.

Carrillo, F. (2006) *Knowledge cities, approaches, experiences, and perspectives*. Butterworth-Heinemann. USA

Collison, Ch. and Parcell, G. (2003) *La Gestión del Conocimiento*. Paidós. Barcelona.

Corchado, E. and Fyfe, C. (2003) "Connectionist Techniques for the Identification and Suppression of Interfering Underlying Factors", *International Journal of Pattern Recognition and Artificial Intelligence*, Vol 17, No 8, pp 1447-1466.

Corchado, E., MacDonald, D. and Fyfe, C. (2004) *Maximum and Minimum Likelihood Hebbian Learning for Exploratory Projection Pursuit, Data mining and Knowledge Discovery*, Kluwer Academic Publishing.

Corchado, E. Fyfe, C., Sáiz L. and Lara, A. (2004) "Development of a global and integral model of business management using an unsupervised model", *Conference on Intelligent Data Engineering and Automated Learning (IDEAL'04)*, UK.

Davenport, T. and Prusak, L. (1998) Working *knowledge: How organizations manage what they know*. Harvard Bussines School Press. Boston.

David, P. and Foray, D. (2002) "Una introducción a la economía y a la sociedad del saber". *Revista Internacional de Ciencias Sociales*, marzo, No. 171. www.campus-oei.org/salactsi/rics171.htm.

Grant, R. (1996) "Toward a knowledge-Based Theory of the Firm". *Strategic Management Journal*, Vol 17 (winter special issue).

Hedlund, G. (1994) "A model of Knowledge Managementand the N-Form corporation". *Strategic Management Journal*, Vol 15 (summer special issue), pp 73-90.

Holsapple, C. and Joshi, K.D. (1998) "Knowledge Management: A Three fold framework", *Kenucky Initiative for Knowledge Management*, Research paper No 118, College of Business and Economics, University of Kentucky.

Lara, A., Sáiz, L. and Peña., T. (2003) "La gestión de la producción y del conocimiento: Sinergias para una estrategia empresarial", *V Congreso de Ingeniería de Organización*, Valladolid.

Manzanedo, M.A., Sáiz, L., Peña, T. and Lara, A. (2002) "Desarrollo de un modelo integral de Gestión del Conocimiento desde un enfoque de procesos", *XI Congreso Español sobre Tecnologías y Lógica Fuzzy (ESTYLF)*, León.

Marquardt, M. J. (1996) *Building the learning organization, a systems approach to quantum improvement and global success*, McGraw Hill, USA.

Muñoz-Seca, B. and Riverola, J. (2003) *Del buen pensar y mejor hacer*, McGraw Hill, Madrid.

Myers, P. (1996) *Knowledge Managementand organizacional design*. Butterworth-Heinemann. USA.

Nonaka, I. (1994) "A dynamic theory of organizational knowledge creation". *Organization Science*, Vol 5, No. 1, pp 14-37.

Nonaka, I. and Takeuchi, H. (1995) *The knowledge-creating company: How Japanese companies create the dynamics of innovation*, Oxford University Press, New York.

Ordóñez, P. (2002) "Knowledge Managementand organizational learning: typologies of generis knowledge strategies in the Spanish manufacturing industry from 1995 to 1999". *Journal of Knowledge Management*. Vol 6, No. 1, pp. 52-62.

Ordóñez, P. and Peteraf, M. (2004): "Managing and measuring Knowledge-based resources: a forevord", I*nternational Journal of Learning and Intellectual Capital,* Vol 1, No. 4, pp. 377-379.

Polanyi, M. (1958) *Personal knowledge*. Routledge and Kegan Paul. London.

Ruggles, R. (1997) *Knowledge Managementtools*, Butterworth Heinemann, Washington.

Sáiz, L., Peña, T. and Lara, A. (2003) "The circular relation between Knowledge Managementand Value Creation", *II Congreso CISIC*, Madrid.

Seung, H.S., Socci, N.D. and Lee, D. (1998) "The Rectified Gaussian Distribution, Advances in Neural Information Processing Systems", Vol 10, pp 350-356.

Viedma, J.M. (2000) "Gestión del Conocimiento y del capital intelectual". *Nueva Empresa.com,* No. 454. Suplemento: Cuadernos de Management para una dirección eficaz. pp. 99-105

Viedma, J.M. (2005) "Intangibles y Excelencia Empresarial en el Contexto de la Economía del Conocimiento. *1er. Congrés Catalá Comptabilitat i Direcció. Associació Catalana de Comptabilitat i Direcció*. Barcelona.

Wiig, K.M. (1993) *Knowledge Managementfoundations: thinking about thinking-how people and organizations create, represent and use of knowledge*, Schema Press, Arlington, Texas.

Zack, M. (1999) Knowledge and strategic. Butterworth-Heinenmann. USA.

