

The ideas generation process and the role of the learning curve: simulating the wealth of knowledge in organizations

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Learning is inextricably tied up with knowledge transfer. Having evolved through different phases, it is now set in the context of lifelong learning in order to define specific actions that will lead to ever-greater efficiency and effectiveness within the business world. It is here that a growing interest becomes apparent in the appropriate application of the term "knowledge", the explicit definition of which is not always easy to interpret in practical situations. Depending on the business scenario in question, its different particularities often mean it is unique to a specific environment. Our principal objective in this paper is to search for responses to the question concerning the best way to manage the internal development of knowledge within a company. An implementation model entitled M5LIC (Five-Level Ideas-Creation Model) was designed after having studied the behaviour of more than twenty companies in the services sector. The structure of the model is made up of five levels of ideas generation. Its processes have been carefully investigated to stimulate the generation of cognitive potential within firms so as not to slow down their strategies for sustainable growth and continuous improvement.

The research analyses key factors that maximize the learning curve and the way in which companies can generate exponential growth of knowledge through the generation of ideas.

Palabras clave: Knowledge Management, Learning Curve, Positive Gradient of Knowledge, M5LIC (Model of Five Levels Ideas Creation)

1. Introduction

Knowledge has meant a challenge of immense dimensions for firms. In the name of knowledge, human beings set out on their most extraordinary quests, and set about its acquisition with the purpose of improving on existing structures of thought and making them evolve. The most innovative approach of all is the proposal for its management and listing on the market in organisations.

The scarcity of prime materials, energy restrictions, a lack of technology or shortcomings in technical and practical qualifications on the part of teachers, officials and apprentices were already more than critical reasons for firms to centre on one sole purpose: to conserve their commercial transactions so as not to fall into such deep decline as to endanger their business.

Nadal (2003), in his atlas of industrialisation over the last two centuries, covers the evolution that industry has undergone prior to industrialisation (studying the change from traditional to modern industrial manufacturing), change due to the first and second industrial revolution (the age of coal and mining powers), the aftermath of the postwar years (the dramatic growth of petroleum and the metallurgic industries, the awakening of the automotive giants and the first appearance of the chemical industry) or integration in Europe (restructuring due to

privatisation, commercial openings, the arrival of innovation, electronics, robotics and computing).

The mutation experienced by firms over the last one hundred years may be appreciated, as they moved from an exclusive concern for survival, to valuing another series of factors such as development of new potentials and abilities in operators, sustained growth, the coexistence of professional and personal values, recycling of training and assessment of learning processes and knowledge management. This review carried out by Nadal (2003) that is so precise and meticulous is the most accurate justification behind the explanation as to why it has taken so long for knowledge to be fully considered.

However, one could consider that this blossoming of manufacturing has a principal focus or even affirm that it has a single focus, which consists of grounding business development in knowledge. With great perspicacity, Tissen *et al* (2000) contend that “Knowledge professionals will be converted into the dominant factor of this economy, in the same way as farmers were in the Agricultural age and workers, in the Industrial era. In the Industrial era, workers were sought after simply because of their hands and their strength, but as the application of electronics started to dominate the industry and commerce in general, workers were sought out for their minds, their capability to think and to resolve uncertainties” (pp. 52).

The interest that Knowledge Management has awoken in this era of globalisation has affected the business world in such a way that it has been converted into yet another product. Knowledge is bought, sold, must meet requirements for excellence and expires, which is to say, if it is not renewed, its obsolescence can cause innumerable losses. All of this has transformed the strategic vision of firms, in which knowledge is turned into yet another item to take into account in their value generation processes. Its presence as well as its evolution now forms part of corporate initiatives.

The more colourful part of this research is the sector under study: “the services sector”. Thus knowledge management goes beyond exclusive approaches, given that not only does it find meaning in large firms where the volume of work, staff and turnover are of overwhelming dimensions, but also in smaller settings and, on occasions, those of great family tradition. The following section reveals the influence of learning and what the knowledge-related implications are for the services sector.

2. Learning and learning capability as the parameters driving growth in the services sector

2.1. First stage. The conceptual framework of learning and knowledge

It is a fact that societies advance, and if they have managed to do so it has been due to the acquisition of new and better knowledge. For some time, there was a feeling that firms as well as other organisations or institutions had anchored themselves to a working method that was hardly capable of being updated, perhaps because of a fear of new managerial approaches, perhaps because it was thought better not to modify what was producing results. And however, almost suddenly new technologies emerged, better innovations, marked changes of a profound nature and better access to the management of all types of resources. It is these technological advances that have strengthened the competitive position of the different business sectors. But it is not possible to talk about technological progress without mentioning the approach that has brought it all to life: improved management of knowledge.

It is indisputable that the services industry has had to develop capacities such as those that refer to learning in order to be able to reach such evolved levels of management. Wick (1993) considers that learning capability, “is being converted, in companies throughout the country, into a condition for employment, which requires the purposeful attention and commitment of all successful managers. Becoming a learning organisation is not a panacea for all the weaknesses of a firm. It does not mean that a company can avoid all the traps, but it guarantees that it will be able to recover more rapidly”.

Likewise, Yeung *et al* (2000, pp. 50-58) predict that learning capability may be generated by putting the following six principles into practice: a) Create an infrastructure that goes beyond the limits of the organisation. In this way the nuances of each firm's universality are more conducive to the introduction of new values that support continuous improvement; b) Accept that limits exist and that these can be defined and negotiated, such as time limits, given that these ideas persist beyond the lifetime of any one person, and for that very reason must be shared with the passage of time; vertical limits, where the ideas have to flow downwards from above; horizontal limits, where the ideas must be shared between functional units or products; external limits, where the ideas must be shared in the value chain (suppliers-firm-clients); and geographic limits so that ideas are shared beyond the boundaries that define the location of the firm; c) Recognise that ideas are linked to strategy and that their validity shows whether they are in agreement with the demands of the client, if they have financial consequences, if they meet economic criteria and, finally, if parallels may be established between them and the aim of the firm; d) Think of the contingencies, which the authors define as “the parameter that measures anything from strategy or business culture, the point at which a product is laminated, the introduction of a new system of calculation, the arrival of a new executive, the dedication and the influence of the managing director or the challenges faced in the external setting of each business; e) Master capacities that represent more than isolated experiences. Thus, it is proposed to enrich the concept of learning, as the idea lies in mixing together processes that generate ideas with a view to facilitating the creation of knowledge, a concept that covers a stage beyond than the mere presence of a capability, and f) Share influential ideas. Improvisation without any solid reflection of a practical nature is not valid from a personal stance. In this sense, only that which is useful, serves a purpose and is full of content must be included in the learning process. Superfluity only creates disorder. Muñoz-Seca and Riverola (2003) also make their point when they state that contributing to learning capability is to add actions that lead to the end purpose of overall improvement and the generation of competitive value.

The review of these relevant contributions contributes the flesh and blood of this learning capability process, as it shows that pooling influential ideas is to add value to the different interests of the firm, in which the clients as well as the employees and the shareholders themselves all have a role to play.

2.2. Second stage. A conceptual framework of ideas generation

In order to set out the relation between the ideas generation process as a product of operational interaction between knowledge and learning capability – in those sectors which we shall call the trades/services industry – it is necessary to take succinct note of the most decisive contributions.

Finke, Ward and Smith (1992) consider cutting and packing (C&P) processes in which it is necessary at first to reformulate the information and secondly to transform it. Boden (1994) together with Guilford (1979) coincide when affirming that intermediary stages also exist

midway - distortion, preparation and inspiration – between which there is also simultaneity, as all of them definitively group together the beginnings of the ideas creation process as the relevant point in their attainment. There is also some divergence of views on praxis as, on occasions, what some authors consider causal determination, for others are principles; which is to say, for some authors the principles can only be carried out through causal or mobile decisions, whereas for others, those mobile decisions are the fertile ground that is needed without which ideas can not be generated. This is the case of Guilford (1979) who differs from the other authors, as he exclusively considers the principle of “verification” through ideas testing, evaluations, development, implantations and public acceptance. Moreover, Yeung *et al* (2000) uphold as a principle an element that is not taken into account by the rest of the authors and is of great importance in the environment under study: “ideas sharing”. This element makes the ideas generation process more complete, more effective and more profitable, given that it interrelates the transmission agents of the latter process, that is to say, the people. Finally, Finke, Ward and Smith (1992) also consider a further relevant factor in the ideas generation process by including knowledge feedback on creativity and vice-versa as causal determination, an aspect not taken into account by other authors. In this sense, the importance arises from the fact that learning needs to be continually recycled, so that it serves to do away with what is useless as opposed to what is new and innovative.

Following this review and taking the conclusions into account, an integrated model for the generation of ideas is proposed. It is based on five cyclical levels and, at the same time, on temporal correlations, and is subject to what in the opinion of most experts should be contained in any useful plan for the generation of ideas, and in consequence, for knowledge creation.

3. Model M5LIC (model of the five levels of ideas creation)

The model that is presented below is aimed at facilitating the generation of a positive knowledge gradient among workers in the services sectors. Its starting point is the ideas generation process. Thus, the scientific contribution lies in securing two objectives; a) To transmit how levels of ideas generation should interrelate to secure favourable results both at a personal level for each worker and at a global organisational level and b) To know how to interpret the quantification of these results through a novel concept called the positive knowledge gradient – which is represented as a learning curve -. The existence of this gradient reflects the optimization of the model (M5LIC).

Carefully examining the definitions that complete the outputs (knowledge generation) and the inputs (ideas development), five levels are identified with their respective components which are set out as follows; a) Behaviour-Readiness; b) Preparation; c) Search for the known; d) Production-Applicability and e) Final-Stage Guarantee (see figure 1).

Level 1. Behaviour-Readiness. This level refers to the stages of incubation, ideas-strategy and recognition of the existence of limits as proposed by Guilford (1979), Yeung *et al* (2000).

The objective of this first level has the purpose of setting in motion a stage that is conducive to creativity in the agent generating the ideas. More specifically, it is a stage dedicated to the study of work behaviour from a psychological perspective, such as willingness, interest, conduct or procedures. In practice, it is usually called to want or not to want. Simultaneously, the path leading to the third stage arises from this first level that is termed readiness (the term readiness, is considered the most appropriate for this path in its basic meaning, given the effect that must be brought about to generate action between levels 1 and 3). This path

symbolizes the trajectory or itinerary that the agent generating the ideas must follow to achieve the objective, the consequences of which will undoubtedly be to amass sufficient knowledge to produce innovative ideas.

Level 2. Preparation. As the sequence of the ideas generation process is temporal, any one level can not be commenced without having arrived at and moved beyond the preceding level, such that if an analysis is made of all the concepts presented by the authors, it is found that the preparation process as so named by Guilford (1979) is the most suitable in this section of the cycle, which in chronological terms is constituted by the acquisition of skills, information, resources or experiences.

The objective at this stage is, purely and simply, to acquire everything that the mind considers useful, necessary and essential to operate in the setting in which the individual is active, whether for personal or for business reasons. Although *a priori* it might appear similar to the previous level, the difference stems from the worker requiring a very large psychological component to show readiness towards the generation of ideas at level one, whereas at this level, all that is needed is purely technical and conceptual knowledge. Having emerged from this phase or stage, once again the state of readiness will lead the agent towards level three, the objective of which is to evaluate existing mental models and their connection with the technical formats.

Level 3: Search for the known. The parameters for coordination, auscultation and mastery of the most representative capabilities expressed by Boden (1994), Yeung *et al* (2000) converge at this point, which is to say, grouping known and used ideas without any obvious relation, uniting two or more different concepts or systematically applying known transformations used in an unusual way. It has been referred to as the search for the known, due to the objective at this stage which is for the worker to identify what the worker already knows in order to discern what is, on the contrary, unknown. In short, the worker resorts to the personal database in which the same or, where applicable, something very similar to what is needed will be found to meet the objective at hand. Once that has been done, the objective continues, given that the worker must acquire everything that is lacking, either by referring to different states, ordered hierarchical structures, inter-related links, segments of maps, meaningful and memoristic learning.

However, at this point, as may be seen from the model, capability appears as a path that marks a high point between this level and the following that is referred to as production and applicability. This means that the fourth level can not be reached if the agent has not hitherto developed a capability for learning about its obsolete structures or simply those that are lacking; however much readiness there may be on the part of the operator, if there is no capability, the result can never be axiomatic. As may be observed up until now, the generation of ideas is produced if and only if there is, in the first instance, a readiness on the part of the agent and in second place, if the latter has a learning capability. These two premises being satisfied, the fourth level will allow us to explain all the contents that correspond to the agent.

M5LIC
FIVE LEVELS IDEAS CREATION MODEL

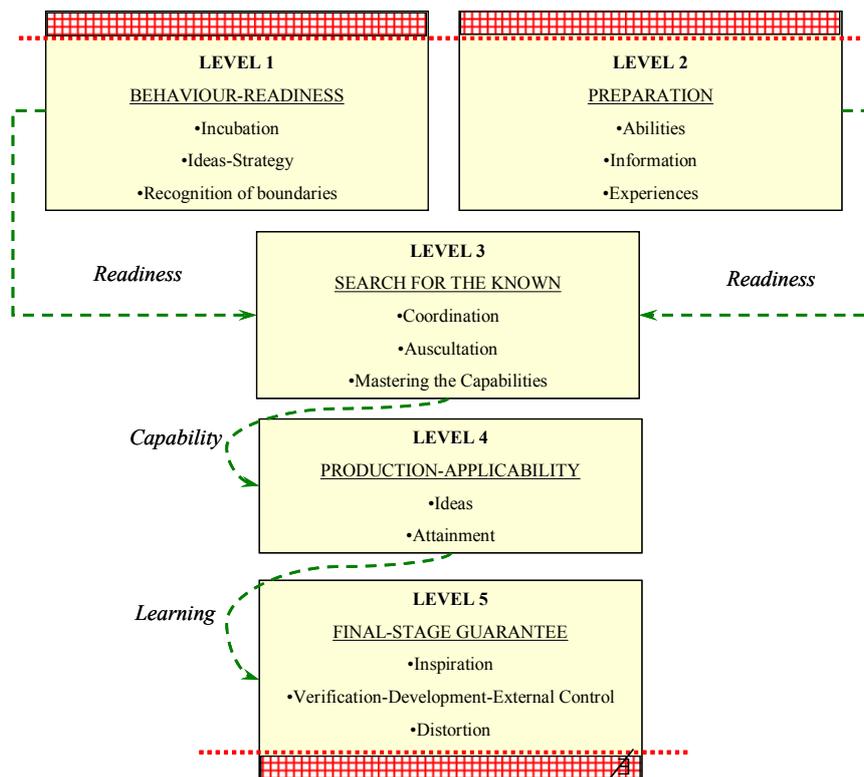


Figure 1: Model of the five levels of ideas creation (M5LIC)

Having arrived at this level means something more than the achievement of a goal for the workforce, it implies insight into their learning capability, a mechanism that immediately leaves them predisposed towards securing the last level in the ideas generation process, given that feeling trained, the individual immediately makes use of imaginative constructs and strives to be more creative, scientific and critical. However, it is important to point out that the end of the road is not at this fourth level although it might indeed seem so, given that the successful completion of the ideas generation process can only be ratified if whatever is prepared by the operator throughout the previous levels is feasible.

Level 5: Final stage guarantee. The end point of the proposed model is arrived at, referred to as the final stage guarantee. Inspiration, verification and preparation, as well as distortion (Guilford, 1979; Boden, 1994), appear to be the most suitable proposals in this setting in which the solution is of little or no use if it is not taken on board by the external subject. The objective at this level is to guarantee the veracity of the generated ideas, to certify that the end for which they have been created is the most suitable one. At the same time, whatever the contribution is said to guarantee is tested.

Taking as a reference the latter case, the path at this point is referred to as a learning state. This means that if the operator has passed through the state of readiness and capability and arrives at a state of learning, it implies that the latter has successfully reached the end of the cycle. The idea, the knowledge, is learnt, as not only has it been generated but it has also been approved by others and has been validated for its mission. As may be understood from the model, there are sections of the two phases in levels one, two and five that lie outside the general chart. The explanation for this is due to there always being a possibility that the individual has no aptitude or even that having arrived at the final result, it is not approved by the external agent. Under these circumstances, the ideas generation process will not yield any results even though the foreseen paths are properly followed.

Following this level-by-level description of the proposed model, it may be affirmed that *learning capability is the space that represents an interlude between the states of “readiness” and “learning” in which human beings are active, which allows progress through the initial to the final stages of behaviour, readiness, preparation, search for the known, production, applicability and the guarantee of what is achieved to arrive at the generation and the creation of knowledge, the indisputable basis of learning capabilities and an essential human element.*

4. Parameterization of knowledge generated through the learning curve

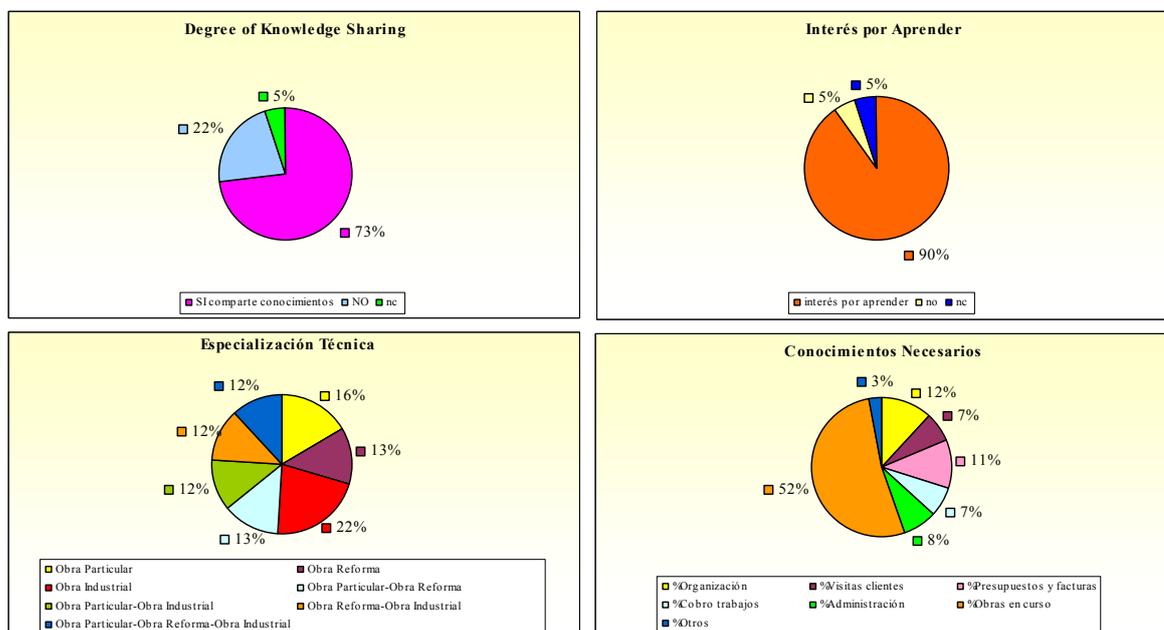
4.1. Mediatory and generative factors

The capability of a productive process, the time invested in undertaking an operation, worker aptitude and attitudes are some of the generic parameters that can be used when measuring learning levels. For the model and the particular case under study, a number of mediatory factors have been defined which among others are technical specialisation, the level of internal cognitive sharing and interest in learning more. The results of the study show positive progress and continuous improvement of these very unprotected sectors.

The results observed in a total of twenty-nine service-sector firms (the total population study being seventy-four for the region under study) in relation to these mediatory factors are those shown in figure 2. A high degree (73%) of readiness to share knowledge, high cognitive specialisation given the three principal types of activities in which they work (private work, renovation work and industrial work) and high on 100% interest in learning more.

However, there are shortcomings, motivated perhaps by fear of job losses, insecurity or competitiveness, which can be recovered through generative factors such as the challenge, the logic of the systems, innovation, shared ideas and knowledge, the oversight factor, capabilities, management of organisational change, working practice and the processing of tacit knowledge; these are oriented towards maximising learning; in other words, to improve the performance of these percentage quantifiers for a company's internal potential.

Figure 2: Quantitative results of mediatory factors in the services sector



These value-maximising factors of the learning curve are put to the test in different theories (De Treville 1987; Yeung *et al* 2000; Miller and Frieser 1984; Garratt 1987; Dixon 1994; Nonaka, Ichijo and von Krogh 2001). Table 1 shows the classification of four elements (motivation, continuous improvement, management of change and tacit knowledge) and the extent to which and under which generative factor (challenges, innovation, oversight factor, capacities, marginal, incremental or shared change) maximum, minimum or intermediate levels of learning take place.

Table 1: Factors that maximise the values of the learning curve

CLASSIFICATION	AUTHOR	GENERATIVE FACTOR OF THE LEARNING CURVE	MAXIMISATION OF LEARNING	
MOTIVATION	De Treville (1987)	CHALLENGE	If the challenge is a small one	MINIMUM LEARNING
			If the challenge is a big one	MAXIMUM LEARNING
CONTINUOUS IMPROVEMENT	Senge (1992)	SYSTEMS LOGIC	Causality circles	MAXIMUM LEARNING
	Yeung, Ulrich, Nason and von Glinow(2000)	INNOVATION	Initial innovation	MINIMUM LEARNING
			Advanced innovation	MAXIMUM LEARNING
		SHARE IDEAS AND KNOWLEDGE	Sin limites de espacio, tiempo y jerarquía	MAXIMUM LEARNING
			With no hierarchical, temporal or spatial limitations	MINIMUM LEARNING
	Lefcovich (2004)	OVERSIGHT FACTOR	Long term	MINIMUM LEARNING
TIME, PRODUCTION RATE VERSUS BENEFITS		Duplicated production, minimum time	MAXIMUM LEARNING	
CHANGE MANAGEMENT	Miller and Friesen (1984) Garratt (1987)	ORGANISATIONAL CHANGE MANAGEMENT	Evolutionary changes	MINIMUM LEARNING
			Revolutionary changes	MAXIMUM LEARNING
	Dixon (1994)	GESTIÓN DEL CAMBIO ORGANIZATIVO	Continuous change	MAXIMUM LEARNING
			Planned change	MINIMUM LEARNING
	Andreu, Ricart and Valor (1995)	WORK PRACTICES_MARGINAL CHANGE	Marginal change	MINIMUM LEARNING
		CAPABILITIES_INCREMENTAL CHANGE	Incremental change	MEDIUM LEARNING
CORE CAPABILITIES_RADICAL CHANGE		Radical change	MAXIMUM LEARNING	
TACIT KNOWLEDGE	Nonaka, Ichijo and von Krogh (2001)	MAKE TACIT KNOWLEDGE VISIBLE	Expand what is known	MAXIMUM LEARNING

4.2. Projection of the M5LIC results onto the learning curve

As from this point, the biunivocal relationship that should exist between learning capability and knowledge comes sharply into focus. However, as any factor that is susceptible to value generation in the firm, it must be measured and quantified, which will be done through the learning curve. It is able to reflect measurement of continuous improvement and its relation to the contribution made by strategic value to the business world at present (De Treville 1987). Reviewing the principal pillars upon which these authors centre the practical aspects of the

learning curve, it may be underlined that the theoretical focus of the learning curve is definitively based on the one hand, on human factors, such as the behaviour of the worker and the latter's learning capability and on the other, on technical factors, such as the magnitude of the problem to be solved.

Therefore, after having put the M5LIC model into operation (a simulation of the five stages in accordance with the mediatory and generative factors) the immediate result had to be an increase in knowledge on the learning curve. Such growth has been brought about in the first place because internal pooling of knowledge has taken place within the organisation, and, in second place, because new knowledge has been generated (through the M5LIC). This therefore justifies that growth in knowledge only takes place if external factors are introduced and, in turn, if they are transferred until what has come to be called a *positive knowledge gradient* is achieved - in this case as a contribution in itself. The benefits hidden within that curve (figure 3) lead us to interpret it in a new and interesting way.

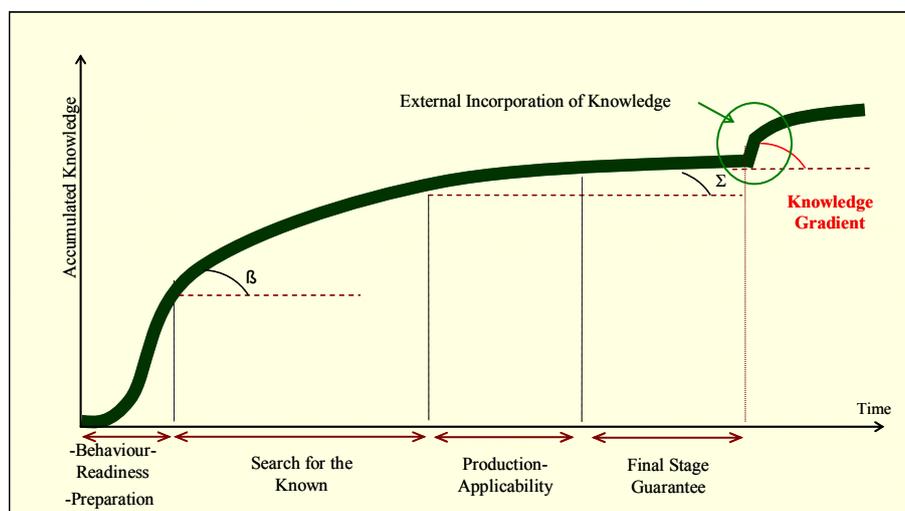


Figure 3: The learning curve and the knowledge gradient

To conclude this presentation, the *knowledge gradient* is defined as *the inflection point that appears on a learning curve, once the pooling of knowledge between interdepartmental sections of a firm is complete and the maximum achievable level of internal knowledge is reached, when external incorporation of knowledge appears that enables new vital fluids to be generated and learning to grow.*

5. Discussion

In view of the investigative results, it may be deduced that the services world is an extremely permeable field with excellent attributes that are suited to the application of this kind of management, and, in consequence, to reaping its benefits. New knowledge not only generates value, but it also lends strength to the firm, brings confidence to the workers in the way they perceive their status in the firm, provides assistance and support to the creation of new ideas, and encourages collaboration and the generation of cultures based on pooled knowledge; it is only in this way that the firm becomes dynamic, flexible, innovative and competitive. The investigation carried out has helped to unmask the wealth of knowledge hidden in the field of services from which two key lessons may be learnt:

- The lynchpin that connects the concept of learning and knowledge as a generative process of individual and group values is unbreakable. Its intermediary level referred to as learning capability is that which channels the data and the information towards

the generation of new ideas, which is to say, creativity and new expertise. The ideas do not arise from nothing. They require a controlled, ongoing process for their effectiveness to take hold.

- The amount of accumulated knowledge in a firm will increase over the course of time until it reaches a stage of maturity, a moment in which it stagnates or may diminish were it not because of the knowledge gradient; which is to say, the fact that the slope of the curve decreases means that in this section the knowledge within the firm is limited and increases slowly or may even decrease, which is why only if external factors are introduced can knowledge notably increase. Whilst this continues, its growth will follow a positive, but limited gradient, and, in consequence, will generate the extinction of value at the angle. Only by introducing new knowledge from the outside will the growth cycle come to repeat itself again.

In conclusion, it should be said that a disciplined desire to create knowledge management tools for all of these firms must exist, which will serve to overcome the difficulties that can be found in the use and the application of innovative management systems. Listing its corporate value is no longer the exclusive domain of income or trading accounts, but of its positive knowledge gradient and its capability to generate new ideas.

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