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## **GLOBAL APPROACH FOR KNOWLEDGE MANAGEMENT IN DESIGN**

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**Resume:** In this paper we will find an original approach about knowledge in design process. It's not really a new field. It appears that the merge between design and knowledge management propose some very interesting questions. For example, in this paper we ask some questions about the role of collecting, reorganisation and using of knowledge from design process. What about knowledge and their management in some critical design situation? In this paper we propose to discuss with you from birth of data till the complete end product in using. Through one illustrative example, we propose you a new way to understand how the data changes into knowledge by some different information.

**Keyword:** Design, knowledge management in design, value chain.

# Décider ensemble : complexité des apprentissages et convergence des disciplines

## 1 - INTRODUCTION:

The environments close or far of the company are in constant evolution more or less fast and characterized by several phenomena: The globalization, the fast development of communication and information technologies, multiples variations of the markets, an exponential growth of the knowledge of each specific specialties of the company. It results from this, a mondialized market of products and services allowing a total access to the “knowledge”, to “know-how”, to technologies and capital. The firms must be increasingly reactive and flexible, to have a management of its personnel and generated knowledge. They must be able to be very reactive and must be able to manage the follow-up and increasingly complex solution to various problems.

The management of knowledge is increasingly considered as a main source of competitive advantage for corporation (Grant, 96), [Hedlund, 93), (Prahalad, 90), (Prusak, 96), (Roth, 96), (Spender, 96), (Winter, 87). It is argued that companies enjoy a competitive advantage if they know how to expand, disseminate, and exploit organizational knowledge internally (Bierly,96), (Szulanski, 96), if they know how to protect their knowledge from expropriation and imitation by competitors (Liebeskind, 96), if they know how to effectively share with, transfer to, and receive knowledge from business partners (Appleyard, 96), (Mowerry, 96), and if they are able to effectively source knowledge from distant locations (Almeida, 96).

## 2 - PROBLEMS:

Two different approaches: The Resource-based view affirms that an improvement of the performance on the long run is inevitably associated with the possession of specific resources within the firm. These resources have the characteristic to be rare and invaluable, to be inimitable, no substitutable. So, the knowledge-based view proposes an appreciably different approach. Knowledge is

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the most precious and strategic resource for the firm. To keep an always-renewed performance, the firm must to operationalize knowledge resulting from the production of artifacts and services. To consider this approach, a postulate is necessary: They are the individuals who create and maintain knowledge on good level; it's not organization only. Nonaka said: “The capacity to create and use knowledge is the most important levers of competitiveness and the business productivity” (Nonaka, 00). To do that, it is important to implement a process of knowledge management integrated into the business services. The knowledge management is present in the industrial engineering (Ermine, 08): Research and development, Management (service and quality, etc.), production (management of the data, document and know-how), human resources (competences).

Generally, the firm adopts KBV logic (knowledge based view) to avoid the loss of expert's knowledge (departure, retirement or transfer, ...) and to exploit the experiences gained during the preceding projects, to improve the information flow. It's a same think for the improvement of the employees learning process, the acquisition and the integration of new knowledge. It appears a concept still not very present in the literature: concept of added value resulting from the knowledge management. Indeed, by a deliberative and systemic coordination, the knowledge management can propose the processes, the technologies used by these employees within his structure. This system support re-use and innovation. Knowledge is seen like a production of data, experiments, and information's. Thus, it's possible to integrate industrially them by various operational applications. Thus by keeping the trace, the memory of these mental processes, it is possible to propose an operational and continuous organizational training.

### 3 - HYPOTHESIS FOR A GENERIC FRAME:

Three fundamental points for an initial process: the creation, the capitalization and the sharing. Some complementary comments on this tryptic: In first time, it is necessary that the firm can return knowledge manageable by facilitating its integration and its capitalization. The firm must make knowledge applicable and transferable by a learning process and a control named: absorption. The firm must change of learning structure and to involve its personnel in capacity to learn according to the various technological transformations. A cognitive process of training is essential with the purpose of allowing the creation and then the acquisition of knowledge. The knowledge is an essential part of design process. It becomes a multiform and multidisciplinary phenomenon. The firm or specifically the knowledge management service must be in should be in connection with philosophy, sociology, social psychology and cognitive sciences, economy, as management and organizational analysis.

How firm approach a complex system as knowledge management in design process? In first time, we think that knowledge must be seen like a representation based on cognitive approach. Indeed by the theories of cognition and the organizational training, it seems like easier to implement and more interesting for the restitutions. To do knowledge management is not a fashion idea but it's a real idea in a real system. The first goal is to keep the memory of the design product. Knowledge can be considered like an additional convenience of management but it encounters an important and essential differentiation very quickly for each actor in the system. I produced knowledge, which results from several tacit or explicit registers. The frontier is not really clear and often it depends on the individual position in society and sociology characteristics. By a located approach, it's easier to describe acquired knowledge. For example, the knowledge identification is in identified, finalized and specified praxis. Moreover, in the service of design, the context can be considered like a formative or learning context. The actors, knowledge, structure, roles and goals are distributed in a precise way. This techno-scientific approach allows the appearance of the great wealth of the various technical solutions but small place for the

actors and their experimental dimension. In the case of a located approach, knowledge is related to the praxis. It is located in a formative context and is based on the knowledge held by the actors in an identified social network. This approach requires the construction of a particular architecture. Multiple theoretical executives and theory are proposed. Some researchers as (Nonaka, 00), (Grundstein, 03), talk about descriptive approaches whereas consultants such as (APQC, 00), proposes more prescriptive approaches. Multiple tools and techniques to help the firms were born. Computerized solutions (CommonKADS), capitalization method (MASK), tools to share and to link in external or internal knowledge network (groupware) allow keeping the knowledge track and different states of identified knowledge. However the methods are more theoretical than truly operational. They are often based on technological response (information management). It proves that they are less developed in the production companies (less structured). In conclusion, the majority of the KM projects fail. It became necessary to have a holistic, integrated and systematic vision. The model developed by Zack (Zack, 01) gives a clearer view of complexity and limits within information and knowledge are. (Figure 1)

When an uncertainty is identified, it will create an ambiguity of comprehension. The knowledge generated from partial and ambiguous information is transferable with much difficulty and usable. It is necessary to certify information so that knowledge is clarified and thus to become transmissible. Same manner, if information has a too complex structure, it will generate a knowledge ambiguity of the described situation. By one simplification of information (ex: primitive of information) (Brunel, 08), is allowed a standardization of interpretation and unification. The learning process is facilitating. On Figure 2 we show that the data collect varies according to the homogeneity or to the heterogeneity of those. This implies simplicity or a growing complexity. Therefore it is very early necessary to work to make it univocal. Acquisition faster and will only be facilitated of it. Because the organizations exist to face the complexity of a world moving, the knowledge management is naturally in a dynamic and ambiguous system. A clear vision

is very important to implement correctly a knowledge management in firm.

The postulates exposed previously make emerge main roads of reflection:

1. The economic and industrial context are characterised by knowledge
2. The knowledge is a strategic dimension
3. The knowledge has got a complex nature from tacit dimension to explicit dimension.

An interdisciplinary synergy of search is born in the various communities, which are interested closely or by far, to the KM. We had proposed in preceding work an added value chain of the knowledge creation (VCKC), (Moradi, Brunel, 08). Moreover, we propose in the continuation of this item a conceptual generic framework for the implementation of KM in firm based on the development of the "ingenition" concept (Brunel, 08).

In short, the KM is used in several disciplines and is present in all the business services. We are in the presence of several theories on the knowledge management, which have strong common points. The knowledge management reveals various fields in interaction and several compatible approaches; the ones with the others make it possible to unify them in one generic frame.

#### **4 - CONTRIBUTION FOR GENERIC MODEL:**

A learning firm is a transformation unit. It connects several entities. From an identified context in exact time, a place and actors, it transforms a great quantity of data, information, knowledge, competences, and capabilities. Our proposition is: by a simple theory named « ingenition » and based on new method named « triple instrumentation » (3i), (Brunel, 08), we decompose systematically all data, information, knowledge, competences and capabilities (DI3C) in three distinct parts:

1. Social point of view, instrumentation named: Iesc
2. Symbolic semantic point of view, instrumentation named: I2S
3. Objectal point of view, instrumentation named: Iobj.

Thus we obtain: DI3C increased and inter connected. The learning process is integrated into the firm by a simple decomposition and all the actors of all services can participate.

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#### **5 - ADDED VALUE CHAIN OF KNOWLEDGE:**

Value must be used in analyzing competitive position since corporations often deliberately raise their cost in order to command a premium price via differentiation. Knowledge value chain consists of the basic elements of this semantic value chain, value processing activities, and output as final margin that here is knowledge performance. These processing components and activities are the building blocks by which a corporation creates a product or provides service valuable to its customers. We prefer here to use knowledge creation. If there exist a good knowledge creation process in the organization without linking this process to upper capability, it may be inefficacy. This is the reason why we explain the process from data extracted from reality to collective wisdom as overall capability. Figure 4 depicts components of VCKC.

##### **5.1 - Basic Components of VCKC**

In this paper, we will try to make a distinction between data, information, knowledge, individual wisdom as competency or expertise, and collective meta-cognition as capability. Although, always in organization there exist some endeavours to value creation from knowledge and intellectual capital either in KM activity or another notion as organizational learning, but we think that this framework is drawn upon consciously, systematically, and deliberate management of these activities.

##### **5.1.1 Data.**

Data are defined (Vernadat, 96) as something given, granted, or admitted; a premise upon which something can be argued or inferred. We define data as raw facts, and learning about data as the process of accumulating facts (Bierly, 00)

##### **5.1.2 Information.**

Information is defined (Vernadat, 96) as a representation, an outline, sketch, or giving form. The basis of the transferred meaning in any communication act is a function of the "field of experience" or knowledge of the sender and receiver. We define information as meaningful, useful data, and learning about information (our second level of learning) as

the process of giving form to data (Bierly, 00). Information can be viewed from two perspectives: syntactic (or volume of) and semantic (or meaning of) information (Nonaka, 94). The semantic aspect of information is more important for knowledge creation, as it focuses on conveying meaning.

### **5.1.3 Knowledge.**

Knowledge is defined (Vernadat, 96) as a clear and certain perception of something; the act, fact, or state of understanding. Knowledge involves both knowing how, which is generally more tacit knowledge, and knowing about, which is more explicit knowledge (Grant, 96). Knowledge is defined as a justified belief that increases an entity's capacity for effective action (Nonaka, 94). Knowledge may be viewed from several perspectives (1) a state of mind, (2) an object, (3) a process, (4) a condition of having access to information, or (5) a capability. Another approach posits that knowledge can be viewed along two dimensions: social/individual and explicit/implicit (Nonaka, 94), (Spender 96).

### **5.1.4 Meta cognition.**

Meta-cognition is defined as the faculty of making the best use of knowledge, experience, and understanding by exercising good judgment. Therefore, we define meta cognition as the ability to best use of knowledge for establishing and achieving desired goals and learning about meta cognition as the process of discerning judgments and action based on knowledge. We divided Meta cognition in two distinct parts.

### **5.1.5 Competency/Expertise.**

Competency is a standardized requirement for an individual to properly perform a specific job. Prahalad and Hamel (Prahalad, 96) in their seminal work defined competency as the roots of competitiveness. Then, competency can be defined as individual mobility, integration, and transfer of knowledge and capacity in order for obtaining the results.

### **5.1.6 Capability.**

Capability is the ability to perform actions. In human terms capability is the sum of expertise and capacity. We consider capability as high level of competency in organization level. In a large theoretical context, organizational capability defines as; absorptive capacity

(Cohen, 90) (organizational ability to assimilate new exterior knowledge), combinative capability (Kogut, 92) (organizational ability to aggregate actual internal knowledge), dynamic capability (Teece, 97), core competency (Prahalad, 90), organizational learning (Huber, 91), and agility (Roth, 96).

## **5.2 - Components of Transformation / Processing:**

### **5.2.1 - From Reality to Data:**

As explained in Figure 5, data is raw materials that were accumulated by person or machine based observation. The syntactic entities as codes, facts, image, sounds, discrete and unstructured symbols, bits of raw materials were selected from events, reality, or phenomenon by perceive filters, observation out of context, recording, and storage.

### **5.2.2 - From Data to Information:**

The information is data in the context with meaning. (Figure 6) The data processing as interpretation, representation, manipulates, organize, and analyze give form and functionality to data. Conceptual filters, meaningful context, relevance, and purpose are the main transformation of data that lead to produce information.

### **5.2.3 - From Information to Knowledge:**

Understanding, realization, modelling, insight, authentication, application, testing and refining, and utilization make the basic transformation activity in generation of knowledge. (Figure 7) Information processed, experiences, and theory in the semantic and meaningful context made upper level of knowledge. Knowledge is a function of a particular stance, perspective, or intention. Then, knowledge is about content, context, and intent.

### **5.2.4 - From Knowledge to Competency:**

Making knowledge in practice by an action and reflection process leads to people with more skills and expertise that means competency. If competency defined as fast and accurate advice, explanation and justification of results, and reasoning for decisions, so the transformation activity is extensive adaptation to environments, intuition and experience, learning, memorization and utilization of knowledge in problem solving.

### 5.2.5 - From Competency to Capability:

A strategy that is developed exclusively by only a few top executives and is not communicated to other employees does not guide the employees' actions and does not become an organizational strategy. We think that individual meta-cognition is transformed into organizational meta-cognition through several means, three of the most important being: Transformational leadership, Organizational culture and structure, and Knowledge transfer (Bierly, 00).

### 6 - CONCLUSION:

The managers of the firm must take a whole series of measure based on 4 dimensions. Indeed, a clear strategy to keep the leadership to the choices of adapted approaches to the structures, which they control like with the roles and responsibilities, which they are able to manage. (Figure 9)

While making a clear analysis of the context in which the firm evolves/moves, they will be able to connect in synergy the actors and the trainings which they need to create the culture from which they result, disposal technology and which they control and obviously all this integrated in an organizational infrastructure which they know perfectly. Then the phase will come the operationalization of the contents. At the time of the active phases of design, production, the technology transfer or competences, various integrations of the actors in different processes allows a real efficient application in knowledge creation process. By a total systemic vision of what represents knowledge in the total business process, it appears fundamental to manage in better-adapted condition these complete human resources, functions and organizational structure.

### 7 - REFERENCES:

Almeida, (1996), Knowledge Sourcing by Foreign Nationals: Patent Citation Analysis in the US Semiconductor Industry. Strategic Management Journal, 17(Winter Special Issue): p. 155-165.

Appleyard, (1996), How Does Knowledge Flow? Interfirm Patterns in the Semiconductor Industry. Strategic

Management Journal, 17(Winter Special Issue): p. 137-154.

- APQC, (2000), Successfully Implementing Knowledge Management. Consortium Benchmarking Study, Final Report: American Productivity and Quality Center.
- Bierly, Chakrabarti, (1996), Generic Knowledge Strategies in the US Pharmaceutical Industry. Strategic Management Journal, 17(Winter Special Issue): p. 123-135.
- Bierly, Kessler, Christensen, (2000), Organizational Learning, Knowledge and Wisdom. Journal of Organizational Change Management, 13(6): p. 595-518.
- Brunel, (2008), Etude des activités collaboratives de conception en tant que situation d'apprentissage : application à l'ingénierie des produits et à l'ingénierie didactique. Thèse N°3680, Bordeaux I University, France. ISBN 978-613-1-50850-9, Éditions universitaires européennes, Verlag
- Cohen, Levinthal, (1990), Absorptive Capacity: a New Perspective on Learning and Innovation. Administrative Science Quarterly, 35: p. 128-152.
- Ermine (2008) Ermine J.L., Management et ingénierie des connaissances. Hermès Lavoisier, ISBN : 978-2-7462-1945-8, 2008.
- Grant, (1996), Toward a Knowledge-Based Theory of the Firm. Strategic Management Journal, 17(Winter Special Issue): p. 109-122.
- Grundstein, (2003), Grundstein M, Rosenthal-Sabroux C, Pachulski A - European Journal of Operational Research, – Elsevier, 2003.
- Hedlund, Nonaka, (1993), Models of Knowledge Management in the West and Japan, in Implementing Strategic Process: Change, Learning & Cooperation., P. Lorange, Chakravarthy, B., Roos, J., Van de Ven, A., Editor., Oxford: Basil Blackwell. p. 117-144.

- Huber, (1991), Organizational Learning: an Examination of the Contributing Processes and the Literatures. *Organization Science*, 2: p. 88-115.
- Kogut, Zander, (1992), Knowledge of the Firm, Combinative Capabilities, and the Replication of Technology. *Organization Science*, 3: p. 383-397.
- Liebesskind, (1996), Knowledge, Strategy, and the Theory of the Firm. *Strategic Management Journal*, 17(Winter Special Issue): p. 93-107.
- Moradi, (2008), Value chain approach to semantic process of knowledge creation : a perspective from data to capability, 16-18 Janvier 2008, 29th McMaster World Congress, Hamilton, Ontario, Canada hal-00232698.
- Mowery, Oxley, Silverman, (1996), Strategic Alliances and Interfirm Knowledge Transfer. *Strategic Management Journal*, 17(Winter Special Issue): p. 77-91
- Nonaka, (1994), A Dynamic Theory of Organizational Knowledge Creation. *Organization Science*, 5(1): p. 14-37.
- Nonaka, (2000), Toyama and Konno: SECI, "Ba and Leadership: a Unified Model of Dynamic Knowledge Creation", *Long Range Planning* 33, pp 5-34, 2000.
- Prahalad, Hamel, (1990), The Core Competence of the Corporation. *Harvard Business Review*, p. 79-91.
- Prusak, (1996), The Knowledge Advantage. *Strategy and Leadership*, 24: p. 6-8.
- Roth, (1996), Achieving Strategic Agility through Economies of Knowledge. *Strategy and Leadership*, 24: p. 30-37.
- Spender, (1996), Making Knowledge the Basis of a Dynamic Theory of the Firm. *Strategic Management Journal*, 17(Winter Special Issue): p. 45-62.
- Spender, Grant, (1996), Knowledge and the Firm: Overview. *Strategic Management Journal*, 17(Winter Special Issue): p. 5-9.
- Szulanski, (1996), Exploring Internal Stickiness: Impediments to the Transfer of Best Practices within the Firm. *Strategic Management Journal*, 17(Winter Special Issue): p. 27-43.
- Teece, Pisano, Shuen, (1997), Dynamic Capabilities and Strategic Management. *Strategic Management Journal*, 18(7): p. 509-533.
- Vernadat, (1996), Enterprise Modeling and Integration: Principles and Applications. London: Chapman & Hall.
- Winter, (1987), Knowledge and Competence as Strategic Assets, in *The Competitive Challenge: Strategies for Industrial Innovation and Renewal*, D.J. Teece, Editor. Cambridge, MA: Ballinger. p. 159-184.
- Zack, (2001), If Managing Knowledge Is the Solution, Then What's the Problem? In *Knowledge Management and Business Model Innovation*, Y. Malhotra, Editor. Idea Group Publishing: Hershey, PA. p. 16- 36.

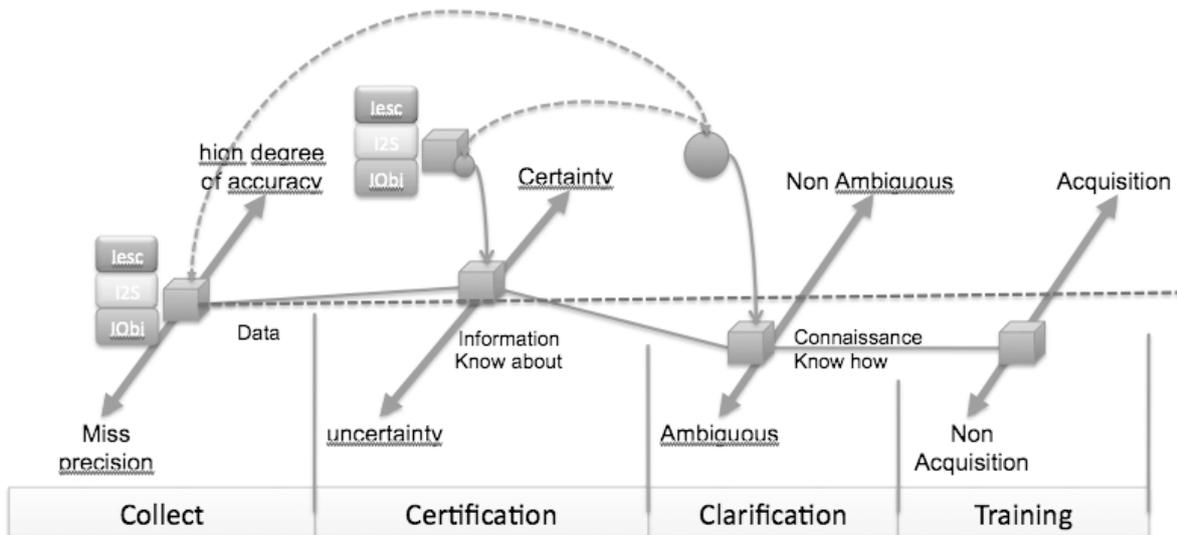


Figure 1: From collect to training 1

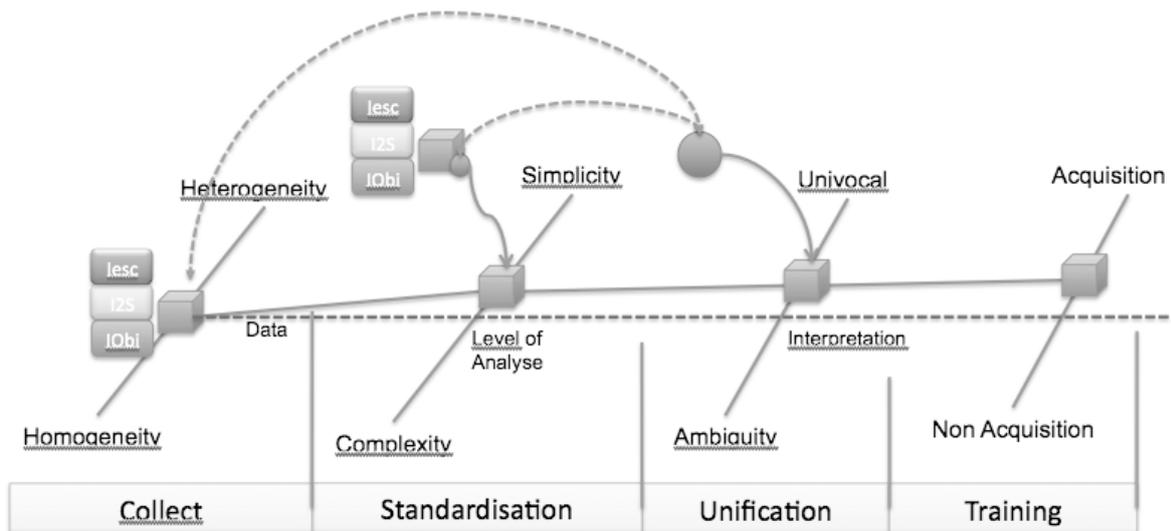


Figure 2: From collect to learning 2

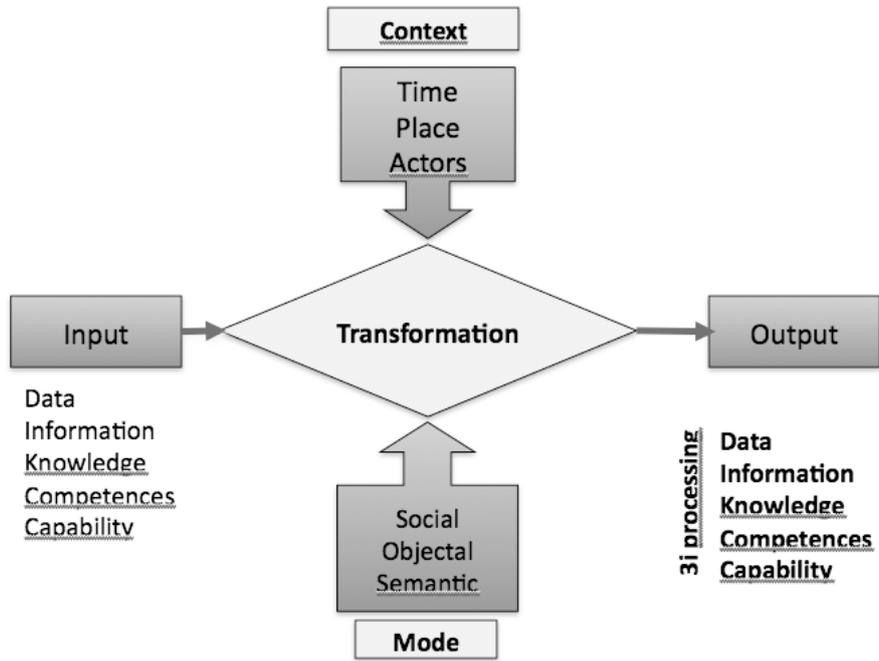


Figure 3: DI3C transformations in learning firm.

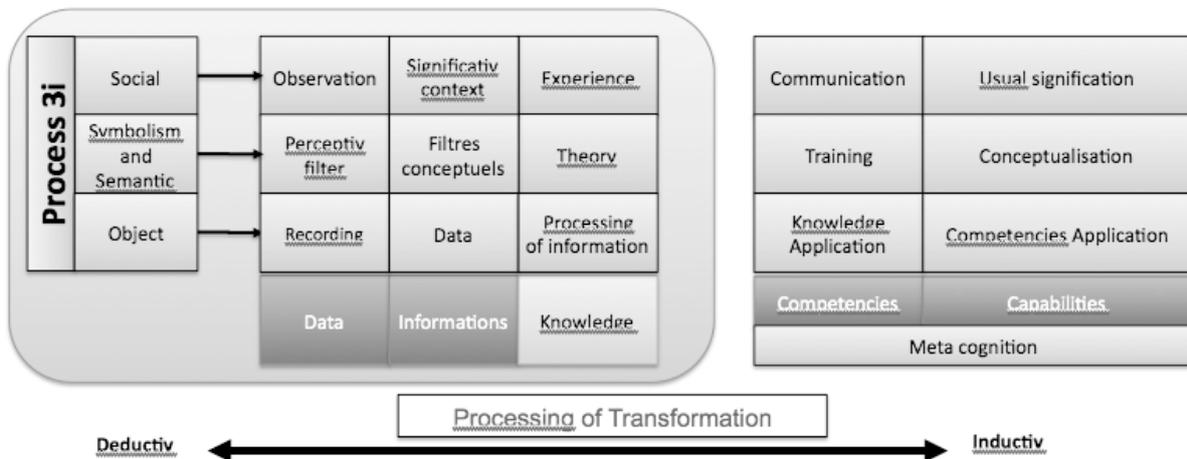


Figure 4: Value Chain of Knowledge Creation (VCKC)

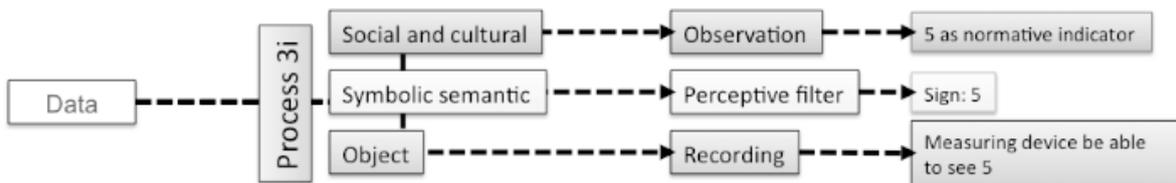


Figure 5: Data

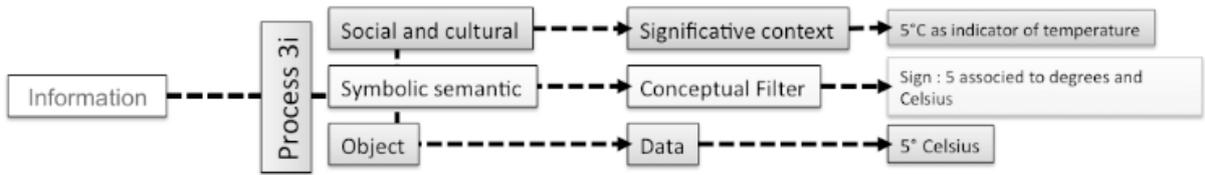


Figure 6: Information

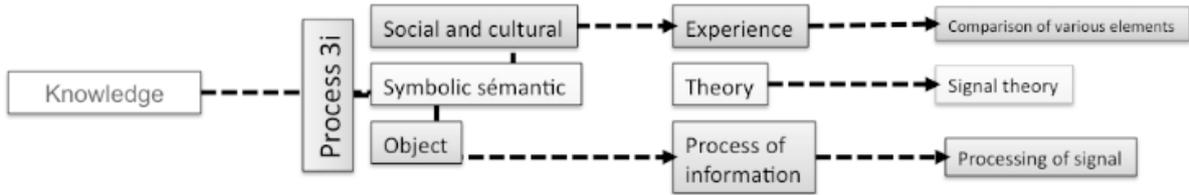


Figure 7: Knowledge

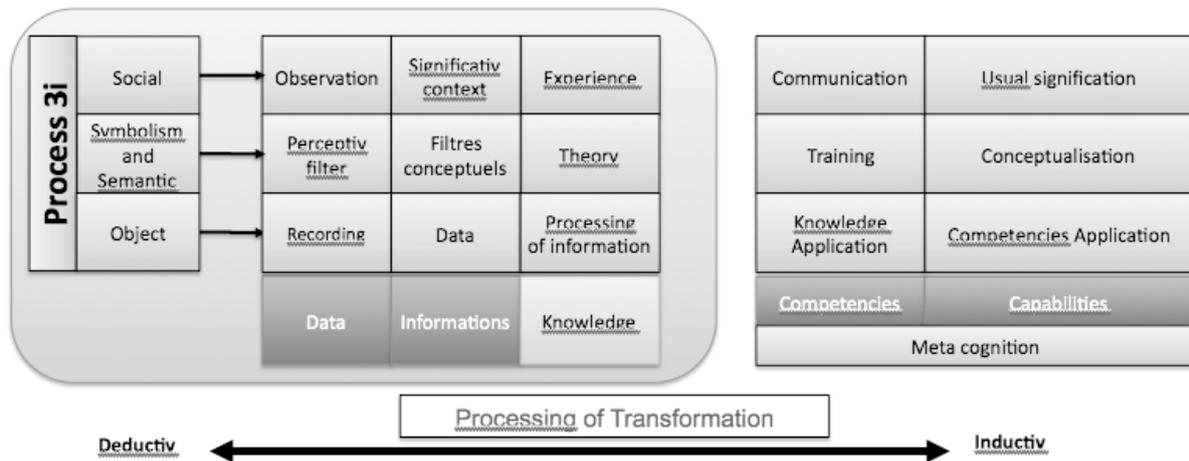


Figure 8: VCKC

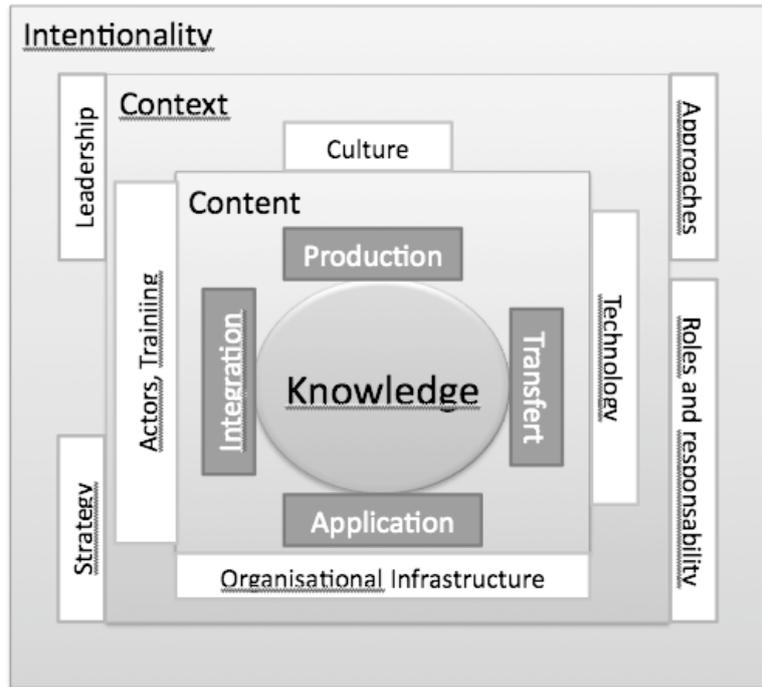


Figure 1: Global vision of Knowledge environment in Learning enterprise.