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Knowledge Management, Change Management and Lean approach: an integrated view. The business case of an international company: Ansaldo STS

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Index

Acknowledgements pag. IV

Introduction pag. 1

Chapter 1

Knowledge Management concepts pag. 6

1.1 Knowledge Definition pag. 8

1.2 Knowledge Classification pag. 14

1.2.1 Explicit and Tacit Knowledge pag. 14

1.2.2 Explicit, Implicit and Tacit Knowledge pag. 17

1.2.3 Other Classifications pag. 21

1.3 Knowledge Management pag. 22

1.3.1 Defining Knowledge Management pag. 22

1.3.2 Knowledge Management Processes pag. 25

Chapter 2

Change Management theory pag. 37

2.1 Need for change pag. 38

2.2 Cultural change pag. 40

2.3 Resistance to change pag. 44

2.4 Change Management models pag. 52

2.4.1 Understanding change pag. 52

2.4.2 Planning change pag. 60

2.4.3 Implementing change pag. 63

Chapter 3

Lean methodology in an engineering environment pag. 66

3.1 Integrating KM, CM and lean approaches: a theoretical framework pag. 66

3.2 Overview on lean pag. 69

3.3 The concepts of *value* and *waste* pag. 74

3.4 Lean principles pag. 79

3.4.1 Flow pag. 81

3.4.2 Tack time pag. 82

3.4.3 Pull pag. 84

3.4.4 Zero defects pag. 85

3.4.5 Continuous improvement and employees enablement pag. 86

3.5 Lean tools pag. 91

3.5.1 Expose waste pag. 91

3.5.2 Address waste pag. 96

3.5.3 Sustain improvement pag. 97

Chapter 4

Integrating KM, CM, and Lean in an international company: the business case of Ansaldo STS pag. 98

4.1 Overview on Ansaldo STS pag. 98

4.2 The *Values to Actions* (*V2A*) change program pag. 100

4.3 The *Lean* workstream pag. 105

4.3.1 Processes selection pag. 107

4.3.2 Value streams (AS IS and TO BE) mapping pag. 108

4.3.3 Lean trainings for supporting implementation pag. 111

4.4 KM, CM and lean thinking in Ansaldo STS pag. 114

4.5 Change program results pag. 117

4.6 What next: will Hitachi continue in lean deployment across ASTS organization? pag. 118

Conclusions **pag. 121**

Bibliography **pag. 123**

Websites **pag. 140**

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Introduction

Nowadays many economic factors undermine organizations performance in a wide range of industries. Economic downturns, globalized markets, concentration trends are increasing competitive pressure on companies.

Among the several strategies adopted for facing such market challenges, the lean methodology has been having an increasing popularity over last three decades.

Originated from the Toyota Production System, lean is a Japanese methodology focusing on identifying and eliminating non value activities within a value stream in order to create additional value to customers. By eliminating waste and increasing value to customers, lean aims to reduce costs and lead time, boost quality and increase customers satisfaction and the overall organization performance.

To implement this methodology an entire company is required to make an huge effort in adopting a new way of working. In this process, organization knowledge is strongly impacted and many changes are brought across the whole company. In fact, lean is a philosophy which is clearly focused on knowledge creation and, by leveraging on this new knowledge, it aims to bring changes into an organization. During lean implementation, changes are supported by the knowledge and vice versa. A proper management of knowledge management (KM) and change management (CM) appears then crucial for an effective lean deployment within an organization.

The main objective of this thesis is to identify a clear connection among KM, CM and lean methodology emphasizing how fundamental is a proper management of KM and CM for boosting a successful lean deployment within an organization.

Therefore, an integrated view of KM, CM and lean is suggested as a solution for an effective lean methodology deployment that, based on an accurate knowledge management process, can bring positive organizational changes.

A business case focusing on the *V2A - Values to Actions* – the change program launched by Ansaldo STS S.p.A. – is then proposed for validating the theoretical framework.

In order to have a clearer overview on this thesis, hereunder presented the work structure which is composed of four chapters.

In the first chapter, a literature review of the knowledge management concept is presented. Once defined the concept of knowledge (Davenport and Prusak, 1998; Davidson and Voss, 2002; Nonaka and Takeuchi, 1995), main classifications are proposed – with a focus on *explicit* and *tacit* knowledge (Shankar *et al.*, 2003; Nonaka, 2007, Davenport *et al.*, 1998; Probst *et al.*, 2000; Awad and Ghaziri, 2004; Bierly *et al.*, 2000). Knowledge management processes description close this first part emphasizing the paradigm *creating*, *storing*, *sharing*, and *applying* knowledge (Alavi and Leidner, 2001), applied later on the work in the integrated framework KM, CM and lean approaches.

In the second chapter, a literature review of the change management is illustrated. Once highlighted when the need for change arises (Haveman, Russo and Meyer, 2001), the concept of cultural change is deepen (Cameron and Quinn, 2005) underlining its powerful effect on an organization long-term performance (Denison, 1990). The resistance to change – and its roots – is then presented as the main challenge for change management process, since main cause of the high change program failure rate (seventy per cent – Kotter, 2008).

In the end, referring to the different change phases (understanding, planning and implementing change), some significant change models are presented and – later on the thesis – embedded in the integrated framework KM, CM and lean approaches. A particular focus on Kotter's 8 step change model (Kotter, 1995) needed as framework later applied to the business case.

In the third chapter, the theoretical framework aiming to give an integrated view on KM, CM and lean approaches is presented. This part is then focused on the lean methodology explanation. An history overview from its origin (as a development of the Toyota Just-In-Time – Krafcik, 1988) to its application in a wide range of industries (manufacturing, services, engineering) takes place. The concepts of *value* and *waste* (Ohno, 1988) appear cardinal points in the methodology comprehension and, then, application. Later on, the lean principles (flow, tack time, pull, zero defects, continuous improvement and employees enablement) are deeply illustrated (Womack and Jones, 1996). By leveraging on an useful framework used in lean implementation (expose waste-address waste-sustain improvement), the main lean tools are presented to support a concrete methodology adoption within an organization. Definitely, one of the most powerful tool is the VSM (Value Stream Mapping – Rother and Shook, 1998) – deeply described in the chapter – which represents the common thread for integrating the KM, CM and lean approaches.

Finally, the chapter four (business case on Ansaldo STS S.p.A.) illustrates how an international engineering company has been (implicitly) adopting an integrated framework of KM, CM and lean approaches by running a three-year (2014-2016) change program (*V2A - Values to Actions*) with a focus on the lean methodology deployment across all the organization (28 countries, approximately 3,800

employees). Even though the – still in place – change program has been positively impacting Ansaldo STS S.p.A. performance, the further lean implementation across the company could be undermined by the possible forthcoming integration with the Hitachi group (already principal shareholder since November 2015). Indeed, doubts arise whether the Japanese company will continue to invest on lean (a Japanese methodology) or it will implement divergent strategies, shared among the numerous owned companies operating in several industries.

By ascertaining that the lean methodology creates new knowledge and brings changes (effecting both operative way of working and organizational culture), appears clear that some important aspects during lean implementation can be strengthened by KM and CM processes. This is the reason why the integration of these concepts has a relevant sense, which represents the main finding of this thesis work. Lean creates knowledge and stimulates changes: on one hand, KM supports in handling current and new knowledge, on the other hand, CM manages the transition between current and future scenarios.

The contribution for both scholars and practitioners is then related to the verification that the benefits of this integration are ascribable to the synergy value. An integrated implementation of these three approaches allow organization to reach an higher performance than a single methodology adoption. The business case of Ansaldo STS reinforces this theory. The performance improvement – on both quality and efficiency aspects – achieved by the company thanks to its main change program validates the relevance of this integrated KM, CM and lean framework.

Both the theoretical integrated framework and the business case implementation represent a meaningful research advancement on this research topic.

However, the positive results achieved by Ansaldo STS on integrating these three approaches is only a first evidence of the integrated framework effectiveness. The application of this integrated framework to only one business case represents the main limit of this thesis work.

A future research challenge is to expand such analysis on a wide basket of companies in order to be able to validate such theory.

Chapter 1

Knowledge Management concepts

SUMMARY: 1.1 Knowledge Definition – 1.2 Knowledge Classification – 1.2.1 Explicit and Tacit Knowledge – 1.2.2 Explicit, Implicit and Tacit Knowledge – 1.2.3 Other Classifications – 1.3 Knowledge Management – 1.3.1 Defining Knowledge Management – 1.3.2 Knowledge Management Processes

In order to answer to the central question in theory "why firms differ?" (Nelson, 1991), many explanations exist, depending on the theoretical background. Based on the transaction cost theory, firms' differences are mainly due to the difficulty of transacting certain types of goods and services.

More recently developed, the *Resource Based View* (RBV) of the firm (Wernerfelt, 1984, 1995; Barney, 1991; Amit e Schoemaker, 1993; Black e Boal, 1994; Brumagin, 1994; Grant, 2005) explains firm differences by means of the cost of imitating or acquiring resources which give other firms a competitive advantage. The RBV argues that a firm can gain advantage over its competitors thanks to the use of valuable, hard-to-imitate and hard-to-substitute assets (Patton, 2007). Both theories explain firm differences as a result of the profit-maximizing firm's lack of the ability to imitate other companies which are more profitable than themselves (Nonaka, Von Krogh and Voelpel 2006).

Despite some differences, several authors (Barney, 1991; Black e Boal, 1994; Brumagin, 1994), distinguish resources between tangible and intangible. Following studies focalized on intangible resources (Hall, 1992), especially knowledge (Kogut e Zander,1992; Leonard-Barton, 1992; Nonaka, 1994; Spender e Grant, 1996; Sanchez e

Mahoney, 1996; Szulanski, 1996; Nonaka, Toyama e Nagata, 2000). The growing interest in knowledge, increasingly considered the most valuable asset of companies (Drucker, 1994), led to the development of the *Knowledge Based View* (KBV) of the firm.

The KBV of the firm (Grant, 1996; Spender and Grant, 1996) was developed as an extension of the RBV of the firm. It argues that the primary reason for the existence of the firm is its superior ability to integrate multiple knowledge streams, for the application of existing knowledge to tasks as well as for the creation of new knowledge (Sabherwal and Becerra-Fernandez, 2003; Conner and Prahalad, 1996; Grant 1996, Kogut and Zander, 1992). Grant (1996) suggests that competitive advantage is based on the firms' ability to integrate the individual's specialized knowledge. Furthermore, trying to explain why firms differ, the KBV also suggests that profit is just one of a firm's special purposes (Nonaka et al., 2006). Firms are social institutions that satisfy the needs and meet the many and diverse intentions of their managers, organizational members, customers, suppliers and other constituencies (Kogut and Zander, 1992; Prahalad and Hamel, 1991; Spender and Grant, 1996)

Knowledge Management (KM) is now considered as one of the most important parts of any organization and a complement to the organization's business activities. With an economy increasingly becoming more knowledge-based, knowledge is becoming the most important asset for organizational success among other assets such as capital, materials, machineries, and properties (Kelleher and Levene, 2001).

Many organizations claim to have large savings from the adoption of KM techniques in their companies (Jennex, Olfman, 2006). Through successful knowledge creating-

storing-sharing-applying, companies can improve the process of organizational learning to enhance the performance and create more possibilities to gain competitive advantages (Li and Gao, 2003). Companies were encouraged to adopt KM techniques to maintain their competency against other companies. An organization's competitive advantages depend on the organization ability to learn faster than its competitors. The organizational learning process depends on the ability of the organization to collect and use knowledge, skills and behaviors which have the potential to enhance learning of its members and improve the organizational future performance.

1.1. Knowledge Definition

Although a voluminous literature on *Knowledge Management* (KM), there is no widely accepted definition of knowledge. Knowledge can be defined as the facts, skills and understanding that a person has gained, especially through learning or experience, which enhance ones ability of evaluating context, making decisions and taking actions (Awad and Ghaziri, 2004). Since knowledge combines information with experiences, leveraging on KM, organizations can provide their people with the ability to find and use methods and procedures that were created or used by others previously to solve similar problems, and to learn from past experiences, while maintaining the new created experiences to be used in the future (Tiwana, 1999; Davenport and Prusak, 1998; Baker *et al*., 1997). Several definitions have been developed in the KM

literature to help understanding of knowledge and distinguish it from other forms of contents such as data and information. Examples are given in Table 1.1.

Table 1.1 Definitions of knowledge in the literature

References	**Definitions**
Davenport and Prusak (1998)	"A fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information. It originates and is applied in the minds of knowers. In organizations, it often becomes embedded not only in documents or repositories but also in organizational routines, processes, practices, and norms."
Davenport *et al*. (1998)	"Knowledge is information combined with experience, context, interpretation, and reflection. It is a high-value form of information that is ready to apply to decisions and actions."
Nonaka and Takeuchi (1995)	"Information anchored in the beliefs and commitment of its holder."
Bath G. (2000)	"a changeable reality created through interaction and information exchange"
Tiwana (1999)	"Actionable (relevant) information available in the right format, at the right time, and at the right place for decision…… An understanding of information based on its perceived importance or relevance to a problem area."
Bennet and Bennet (2008)	"Knowledge is the capacity (potential or actual) to take effective action in varied and uncertain situations."
McInerney (2002)	"Knowledge is the awareness of what one knows through study, reasoning, experience or association, or through various other types of learning."
Dixon, (2000)	Knowledge represents the meaningful links people make in their minds between information and how it is used in a specific context
Brauner and Becker (2006)	Knowledge can be understood as the result of what has been experienced through perception or generated through thinking and reasoning, and which has been stored in memory
Tywoniak (2007)	Knowledge reduces uncertainty by creating connections between information and context and gains justification through successful action, i.e. it is not enough to know what to do, the challenge is to know how to use knowledge to generate results

Data, Information and Knowledge

In most literature the concepts of knowledge and information have been used synonymously and inaccurately (Alonderiene *et al*., 2006). According to Davenport *et al*. (1998), Probst *et al*. (2000), and Awad and Ghaziri (2004), data, information and knowledge have different attributes. The following Figure 1.1 illustrates the main ones.

Figure 1.1 Data, Information and Knowledge attributes

DATA	INFORMATION	KNOWLEDGE
More Structured	◄– – – – – – – –	More Unstructured
Context-independent	◄– – – – – – – –	Context-dependent
Low Human Participation	◄– – – – – – – –	High Human Participation
Unprocessed	◄– – – – – – – –	Processed
Less Actionable	◄– – – – – – – –	More Actionable
More Programmable	◄– – – – – – – –	Less Programmable
Algorithmic	◄– – – – – – – –	Nonalgorithmic

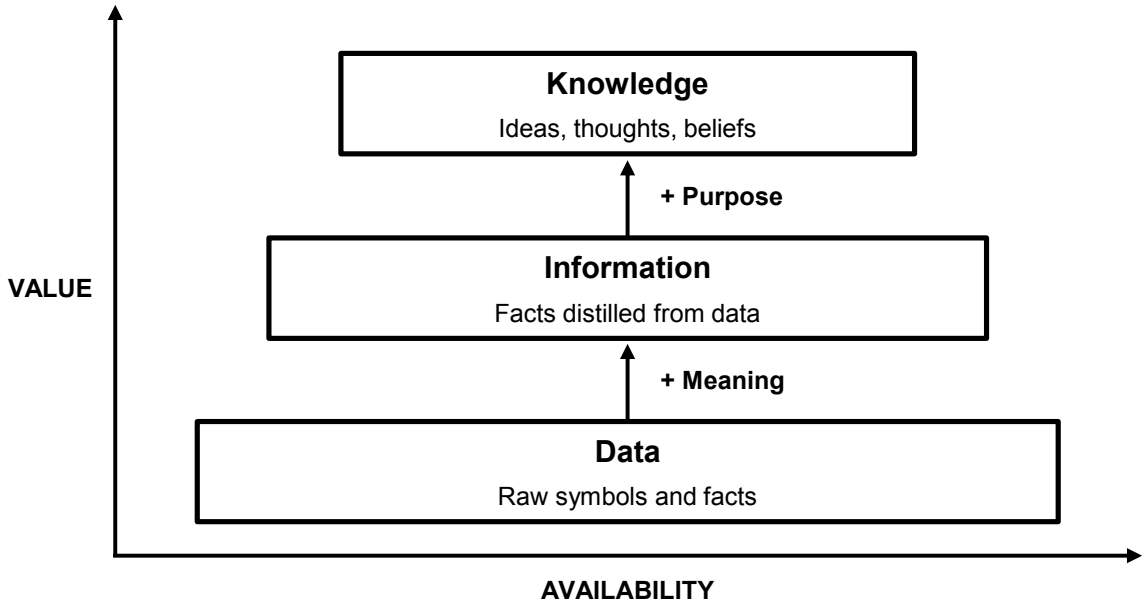
Source: elaboration on Davenport et al., 1998; Probst et al., 2000; Awad and Gahziri, 2004

The KM literature accounts different perspectives of the knowledge concept. One of the most recognized in the literature is the *hierarchical view of data, information and knowledge*, which explains knowledge in relation to the concepts of data and information. Based on this view, data can be understood as unrelated facts, not yet interpreted by a person, whereas information is conceived as data related to other data, thus adapting meaning and being understandable (Davenport and Prusak, 1998;

Davidson and Voss, 2002; Wickramasinghe and von Lubitz, 2007). Once information is integrated into an existing knowledge base and stored in memory, it becomes knowledge which can be used for various purposes. Therefore, knowledge is built through a useful aggregation of information (Wickramasinghe and von Lubitz, 2007). Therefore, it must be noted that data, information and knowledge are not interchangeable concepts (Davidson and Voss, 2002, Logan and Stokes , 2004).

The Figure 1.2 offers a graphical description of the three knowledge-related concepts.

Figure 1.2 The Hierarchical View of Data, Information and Knowledge



Source: elaboration on Davidson and Voss, 2002

Alavi and Leidner (2001) stated that the key to effectively distinguish between information and knowledge is not to be explored in the content, structure, accuracy, or utility of the supposed information and knowledge, but in the fact that knowledge

is personalized information and is information possessed in the mind of individuals.

Other authors (Bollinger and Smith 2001; Wu 2000) include an additional layer, *wisdom*, while some (Shankar et al. 2003) explore the concept of a knowledge value chain.

In this study, Shankar *et al.*'s (2003) built-up a knowledge value chain (as shown in Figure 1.3) for distinguishing between these relevant concepts. In particular:

Data is raw unanalyzed facts that are measures or attributes of phenomena, which are out of context and have no relation with other facts (Loshin 2001; Robbins et al. 2000; Zikmund 2000). Hence, Data is considered objective (James 2005; Tiwana 2002).

Information is analyzed and processed data that form a body of objective facts in a format suitable for decision making, or which are viewed in a context that defines the relationships between two or more pieces of data and possibly other information (Loshin 2001; Robbins et al. 2000; Zikmund 2000). In a given contest, like data, also information is objective (James 2005).

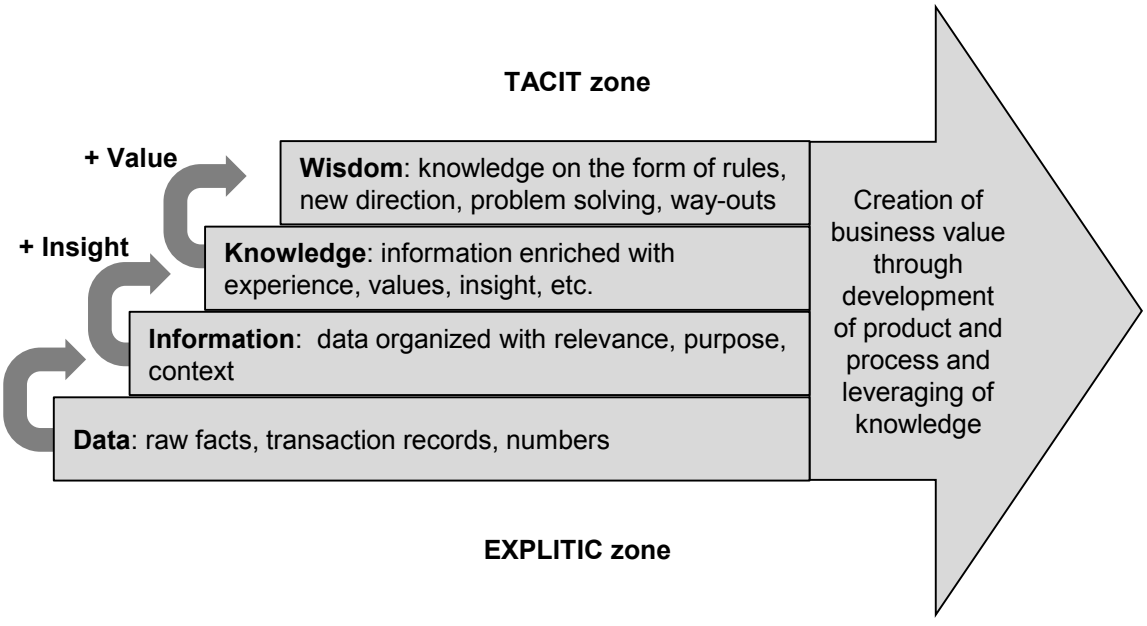
Davidson and Voss (2002) conceptualize information as simply "data invested with meaning" while Daveport and Prusak (cited in Tiwana 2002) propose a "five-C filter" for converting data to information, consisting of contextualization, categorization, calculation, correction, and condensation.

Knowledge, at a higher level, is an awareness, understanding or familiarity gained from a blending of information, experience, skills, principles, rules, value, insight, study, investigation and observation (Bollinger and Smith, 2001; Davenport and Prusak, 1998; Pemberton and Stonehouse, 2000; Robbins *et al.*, 2000). Since knowledge is a mixture of many things, it can usually be subjective (James, 2005).

The key link between knowledge and information as expressed in the business context is information at work, providing "a framework for evaluating and incorporating new experiences and information" (Davenport and Prusak, 1998) and "the capacity for effective action" (McElroy, 2003). Unlike information which only gives the facts, knowledge enable to make predictions, causal associations, or predictive decisions about what to do (Tiwana, 2002). In other words, it is information with a purpose (Davidson and Voss, 2002).

Wisdom, as the top layer of the hierarchy or value chain, is the judicious application of accumulated knowledge and experience integrated into people, organizations, and society, indicating the ability to see through complexity and discover the fundamental nature of issues or problems. Wisdom follows reflections after personal or physical experience or action (Bahra, 2001; Nonaka and Takeuchi, 1995).

Figure 1.3 Knowledge Value Chain



Source: Shankar et al. 2003

1.2. Knowledge Classification

Knowledge can be considered in a variety of ways. Classifying knowledge helps organizations to identify the different types of knowledge with different nature that may need different procedures, tools and activities to process and manage. Hence, classifying knowledge is an important issue to help the organizations to manage important and available knowledge resources successfully.

1.2.1. *Explicit and Tacit Knowledge*

*Explicit knowledg**e*** can be expressed in formal and systematic way, shared in a common language such as scientific formulae, specifications, manuals and so on and so forth. Explicit knowledge is easy to be captured, retrieved, shared and used because it can be expressed in words and numbers that can be managed more easily.

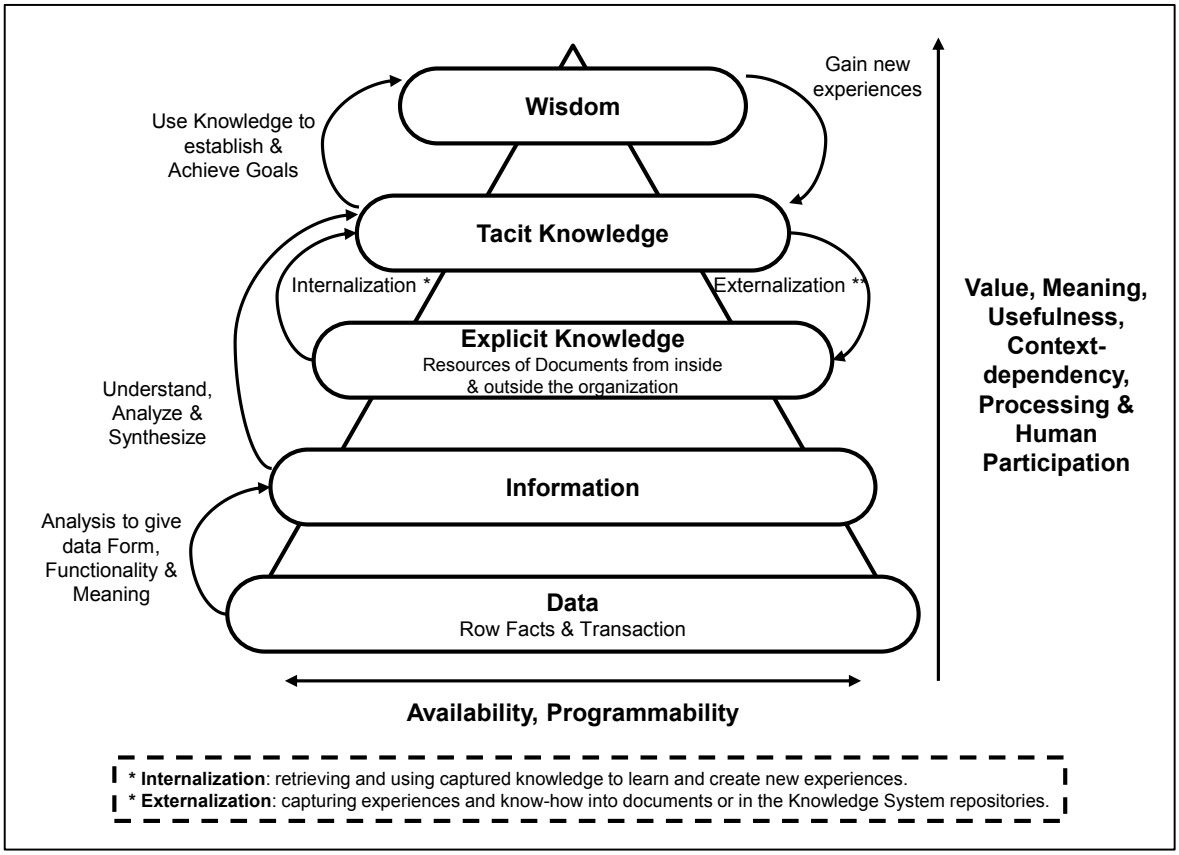
Tacit knowledge is the most valuable type of content since it combines information with experiences, skills and understanding of people, which can help people to find best solutions and reduce opportunities of repeating mistakes (Awad and Ghaziri, 2004; Tiwana, 1999; Davenport and Prusak, 1998; Baker *et al*., 1997; Gupta *et al*., 2000). Since highly personal, tacit knowledge is hard to be managed, shared or formalized because it includes experiences, know-how and perceptions, which normally reside in individuals' heads and memories (Nonaka, 2007). A formal language cannot articulate a tacit knowledge since it is a personal knowledge that is embedded in people experiences and involves intangible factors such as personal

beliefs, perspectives, and values. The best way for utilizing tacit knowledge is by using methods and tools that encourage and facilitate collaboration and knowledge sharing among the people of the organization (Nonaka, 2007).

However, some tacit knowledge can be identified and turned into explicit knowledge by using KM tools for capturing, publishing, categorizing and editing. These help to transfer knowledge into more available and accessible forms that may support the organization to progress rather than requiring its members to relearn from the same stage all the time (Gore and Gore, 1999).

Despite a clear split between tacit-explicit knowledge cannot be achieved (Nonaka and Takeuchi, 1995; Inkpen and Dinur, 1998), it is a useful way to understand the different feature and nature of different types of knowledge that require different processing, procedures and tools to be managed and dealt with. Figure 1.4 represents a hierarchy that has been developed to provide a useful way to understand the differences and relationships among data, information explicit knowledge, tacit knowledge and wisdom (Davenport *et al.*, 1998; Probst *et al.*, 2000; Awad and Ghaziri, 2004; Bierly *et al.*, 2000). This representation helps to understand the different characteristics and values of the different types of contents and how these contents can be transformed from one type to another. Blumentritt and Johnston (1999) suggested that in order to gain competitive advantages, organizations need to enhance the information-knowledge balance through the implementation of IT-based improvements to enhance information management and socially-based mechanisms to enhance knowledge management.

Figure 1.4 Data, Information, Explicit Knowledge, Tacit Knowledge, and Wisdom



Source: elaboration on Davenport *et al.*, 1998; Probst *et al.*, 2000; Awad and Ghaziri, 2004; Bierly *et al.*, 2000

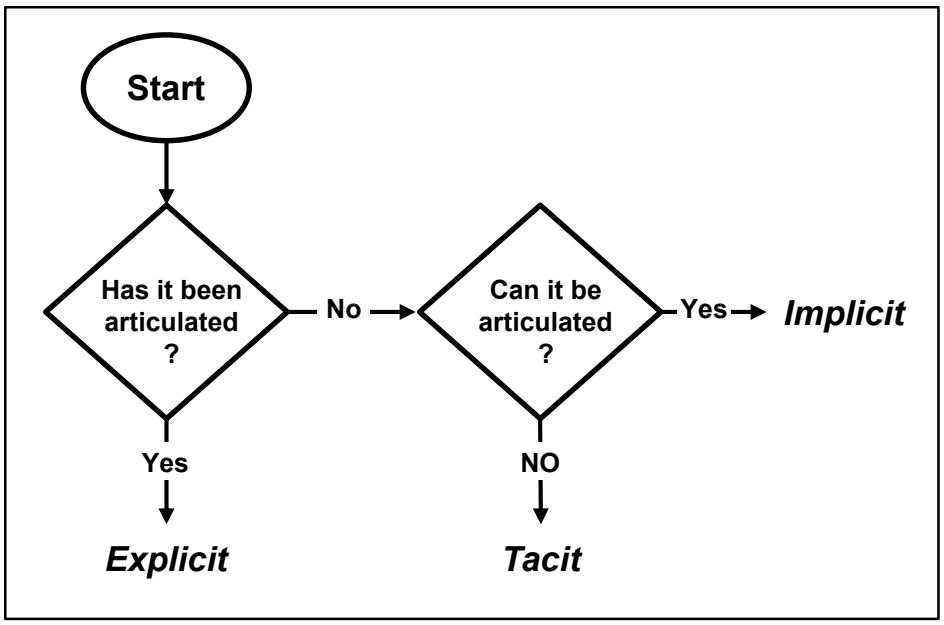
According to Nonaka and Takeuchi (1995), tacit knowledge can be deeply categorized into technical knowledge and cognitive knowledge. Technical knowledge depends on the experiences of individuals, which has been developed with time, so it can be captured in the form of "know-how", while cognitive knowledge depends on mental models, perspectives and beliefs therefore cannot easily be articulated (Nonaka, 2007). Technical knowledge contains many shapes of knowledge, such as descriptions of problems and solutions, experience notes and procedures. Cognitive knowledge includes ideas, viewpoints and innovations.

Given the difficulty in capturing tacit knowledge with normal tables, they can be stored in forms similar to articles, i.e. including those attached descriptions, pictures and videos that provide more details and clarifications to the knowledge contents. Another useful method is by encouraging sharing such knowledge through direct contacts, such as face-to-face meetings, e-chatting, video conferencing, etc., and indirect contacts, such as e-messaging, e-discussions, e-commenting, etc. Of course, although these methods have been proven more effective in facilitating knowledge collection and sharing, they require an huge organizations' effort for the application.

1.2.2. *Explicit, Implicit and Tacit Knowledge*

Even though in the literature the terms tacit and implicit knowledge have been used synonymously, some studies have differentiated among three knowledge dimensions, including explicit, implicit and tacit, emphasizing that tacit and implicit knowledge have significant differences and cannot be used interchangeably (Alonderiene *et al*., 2006; Nickols, 2000; Newman and Conrad, 1999; Bennet and Bennet, 2008). In particular, Nickols (2000) introduced a representation that provides a useful way to distinguish among explicit, implicit and tacit knowledge (Figure 1.5).

Figure 1.5 Explicit, Implicit and Tacit Knowledge



Source: Nickols, 2000

- *Explicit knowledge*: knowledge that has already been articulated or codified in the form of text, tables, diagrams, drawings, photos, audios, videos, etc., so they can be directly and completely captured, used or shared, such as documented articles, books, reports, best practices, manuals, specifications and standards (Nickols, 2000; Newman and Conrad, 1999).
- *Implicit knowledge*: knowledge identified that can be articulated and turned into explicit in the future but has not yet been articulated. All of that due to several possible reasons, such as the codification or capturing process has not been completed or even started yet, or the company has not decided to capture this form of knowledge yet or the company has decided that they do not currently need to capture this form of knowledge.

- *Tacit knowledge*: knowledge that people have, but they cannot articulate, express using language or make explicit, because articulating them will fail to capture its essence (Nickols, 2000; Polanyi, 1997; Alonderiene *et al*., 2006). Some examples could be people skills and experiences that cannot be easily described, such as how to deal with different people and read the reaction on their faces or the ability and speed to work under time pressure, solve problems, provide ideas and innovate.

Analyzing differences and relationships among explicit, implicit and tacit knowledge, Bennet and Bennet (2008) pointed out that explicit knowledge can be described accurately by words and/or visuals, while implicit knowledge is more complicated and not readily accessible. It is the knowledge that individuals do not know they have, but they discover it through questions, dialogues, reflective thoughts, or as a result of an external event. Once this knowledge has emerged, the individual can have the ability to capture it in the form of explicit knowledge, or may not have this ability and so the knowledge remains as tacit. In the end, tacit knowledge is the knowledge which even if individuals know they have it, they still cannot put it into words or visuals that can be useful for others to use and to create new knowledge.

The authors (Bennet and Bennet, 2008) deeply studied the tacit knowledge identifying four aspects: embodied, intuitive, affective and spiritual, where each of these aspects represents different tacit knowledge sources with different characteristics.

- *Embodied tacit knowledge* relates to the movement of the body, such as knowing a craft or how to use a tool, and the five human senses such as knowing the quality of a material or a finished work from its appearance. This kind of

knowledge can be learned through practicing and behavior skill training and through time it becomes embedded in memory and retrieved automatically when needed.

- *Intuitive tacit knowledge* is the knowing that may affect decisions and actions that comes from the individuals' sense and the actor cannot explain (unconscious) the reason for taking this action. Intuitive knowledge has developed in people's minds as a result of continuous learning through meaningful experiences that can be built up by practicing making decision and actions, collecting feedback on these decisions and actions, and interpreting this feedback. These practices will help people to develop intuitive skills such as developing the ability to evaluate situations quickly and to predict the consequences of such situations (Klein, 2003).
- *Affective tacit knowledge* refers to people feelings that may have impact on behaviors, thoughts and responses. Thus, affective tacit knowledge is related to other types of knowledge because feelings as a form of knowledge can influence decisions and actions, such as feeling fear or upset that could prevent the decision-maker from taking an action.
- Finally, *spiritual tacit knowledge* can be described as the animating principles of human life such as its moral aspects, the emotional part of human nature and mental abilities, which may affect thoughts and actions.

1.2.3. *Other Classifications*

The growing interest in managing knowledge, together with the increasing awareness of its usefulness and importance, led the development of many other methods for categorizing knowledge within the KM literature. Those methods of knowledge classification have been proposed to enhance managing and processing knowledge in the organizations by adopting KM techniques. For example, Musgrave (1993) proposed a method to distinguish among three different kinds of knowledge, i.e. knowledge of things and objects, knowledge of how to do things, and knowledge of statements or propositions.

Collins (1993) provided a different way of classification by distinguishing between codified and non-codified knowledge, and proposed four categories of knowledge including *symbolic*-type knowledge that can be transferred without loss such as books and documents, *embodied* knowledge that cannot be easily transferred because it is held within the body of humans, *embrained* knowledge which normally held within the brain, and *encultured* knowledge which relates to society and social groups.

For management purposes a number of classifications have been proposed to overcome the difficulty and inaccuracy of older methods. Lundvall (1996), for example, proposed four knowledge categories, i.e. *know-what* that is described as the knowledge that can be easily codified, *know-why* that includes principles and laws, *know-how* that refers to skills and capabilities to perform a given task successfully, and *know-who* which includes details about who knows how to do what.

Furthermore, Blumentritt and Johnston (1999) categorized knowledge into four types by distinguishing between codified knowledge and other forms of what is called

in that research “real” forms of knowledge. The knowledge types proposed by that research are: *codified* knowledge, which refers to knowledge captured or written in an explicit transferable format; *common* knowledge, which includes routines and practices learned through working in a particular context without capturing them in formal explicit formats; *social* knowledge refers to cultural issues and interpersonal relationships such as cooperation and coordination; and lastly, *embodied* knowledge, which includes experiences, skills and backgrounds of individuals that affect the way a person deal with a given set of information to build and create appropriate knowledge to solve problems.

1.3. Knowledge Management

1.3.1. Defining Knowledge Management

Knowledge Management (KM) provides tools and services for end-users to capture, share, reuse, update, and create new experiences, problem solutions and best practices to aid employees in processes such as problem solving, decision making and innovation without having to spend extra time, effort and resources on reinventing solutions that have already been invented elsewhere in the organizations.

Within the literature, many definitions and interpretations of the term *knowledge management* have been stated. Some of the most important examples are summarized in the Table 1.2

Table 1.2 Definitions of Knowledge Management

References	**Definitions**
Jashapara (2004)	"The effective learning processes associated with exploration, exploitation and sharing of human knowledge (tacit and explicit) that use appropriate technology and cultural environments to enhance an organization's intellectual capital and performance."
Wiig (1997)	"It is a set of distinct and well-defined approaches and processes. The overall purpose of knowledge management is to maximize the enterprise's knowledge related effectiveness and returns from its knowledge assets and to renew them constantly."
Teece (2000)	"It can be used to describe the panoply of procedures and techniques used to get the most from a firm's knowledge assets. The knowledge management requires the development of dynamic capabilities and the ability to sense and to seize opportunities quickly and proficiently."
Davenport and Prusak (1998)	"It consists of processes to capture, distribute, and effectively use knowledge."
Carlucci *et al*. (2004)	"The KM is a managerial paradigm which considers knowledge as a resource at the basis of a company's competitiveness. It identifies the capabilities to generate value for a company's stakeholders with the explicit and systematic implementation of approaches, techniques and tools for the assessment and management of intellectual capital."
Ruggles (1998)	"It is an approach to adding or creating value by more actively leveraging the know-how, experience, and judgment resident within and, in many cases, outside of an organization."
Lee and Yang (2000)	"It is an emerging set of organizational design and operational principles, processes, organizational structures, applications and technologies that helps knowledge workers dramatically leverage their creativity and ability to deliver business value."
McInerney (2002)	"Knowledge management (KM) is an effort to increase useful knowledge within the organization. Ways to do this include encouraging communication, offering opportunities to learn, and promoting the sharing of appropriate knowledge artifacts."
Quintas *et al*. (1997)	"It is the process of continually managing knowledge of all kinds to meet existing and emerging needs, to identify and exploit and acquire knowledge assets and to develop new opportunities."
Beijerse (2000)	"It is the management of information within an organization by steering the strategy, structure, culture and systems and

	the capacities and attitudes of people with regard to their knowledge. It is the achievement of the organization's goals by making the factor knowledge productive."
Massa and Testa (2009)	A process in general system theory with four categories including knowledge acquisition and creation, knowledge capture, storage and retrieval, knowledge dissemination, transfer and sharing, and knowledge application that organizations decide to manage to gain competitive advantage.
Debowski (2006)	"the process of identifying, capturing, organizing and disseminating the intellectual assets that are critical to the organization's long-term performance"
Jennex and Olfman (2006)	Management's thorough efforts to use tools and approaches to locate, refine, transfer, and apply the knowledge and experience available to the organization.
James (2005)	"the identification, acquisition, utilization, support, maintenance and disposal of knowledge assets for the purpose of adding value and benefiting all stakeholders"
Becerra-Fernandez, Gonzalez and Sabherwal (2004)	"performing the activities involved in discovering, capturing, sharing, and applying knowledge so as to enhance, in a costeffective, the impact of knowledge on the unit's goal achievement"
Walters (2002)	"the organizational capability which identifies, locates (creates or acquires), transfers, converts and distributes knowledge into competitive advantage"
Darroch and McNaughton (2002)	The management function that creates, locates, and manages the flow of knowledge within an organization to ensure that knowledge is used effectively and efficiently for the long-term benefit of the organization.
Rastogi (2000)	"a systematic and integrative process of coordinating organization-wide in pursuit of major organizational goals" including the acquisition, creation, storage, sharing, diffusion, development, and deployment of knowledge.

However, in this thesis the term KM is used as a general set of distinct and well-defined processes and techniques, which include systematic procedures based on technologies and practices, that motivate effective creation, capturing, organization, distribution, use and sharing of both useful tacit and explicit knowledge, to enable individuals of the organization to be more effective and productive in their work in order to generate value for the projects and the organizations.

1.3.2. Knowledge Management Processes

Underlying different concepts of KM, literature shows a wide range of *Knowledge Management Processes* that considerably differ in terms of numbers and labeling of processes (Alavi and Leidner, 2001). It is subsequently important to review this literature. For example, Grant (2005) identified only two key processes, namely the *generation* of new knowledge and the effective *application* of new and existing knowledge. From another perspective, Ruggles (1998) defines eight processes. There are many different approaches to label the KM processes and an overview about the different approaches is presented in the following Table 1.3.

Table 1.3 Overview about the different approaches to classify KM Processes

Researcher	**Classification**
Nonaka and Takeuchi (1995) Nonaka and Teece (2001)	• Creation; • Transmission; • Utilization
Leonard (1995)	• Acquire; • Collaborate; • Integrate; • Experiment
DeLong (1997)	• Capture; • Transfer; • Use
Ruggles (1998)	• Generate; • Access (from external sources); • Facilitate (through culture and incentive); • Present (in documents, databases and software); • Embed (in processes, products, and/or services); • Use (in decision making); • Transfer (into other parts of the organization); • Measure (the value of knowledge assets)

Skyrme and Aidon, (1998), Spender (1996)	• Create; • Transfer; • Use
Teece, 1998	• Create; • Transfer; • Assemble; • Integrate • Exploit
Gold, Malholtra and Segars, 2001	• Acquisition; • Conversion; • Application; • Protection
Grant, 2005	• Generation; • Application

At large, most concepts are considering the four basic processes of *creating*, *storing*, *sharing*, and *applying* knowledge as the key processes (Alavi and Leidner, 2001). The four knowledge management processes are hereunder further explained.

- *Knowledge Creation*

  Different theories explain the creation of knowledge, approaching this area from either a technology perspective, including the knowledge discovery in databases process and data mining, or from a people perspective, including *Nonaka's Knowledge Spiral* (Wickramasinghe, 2006).

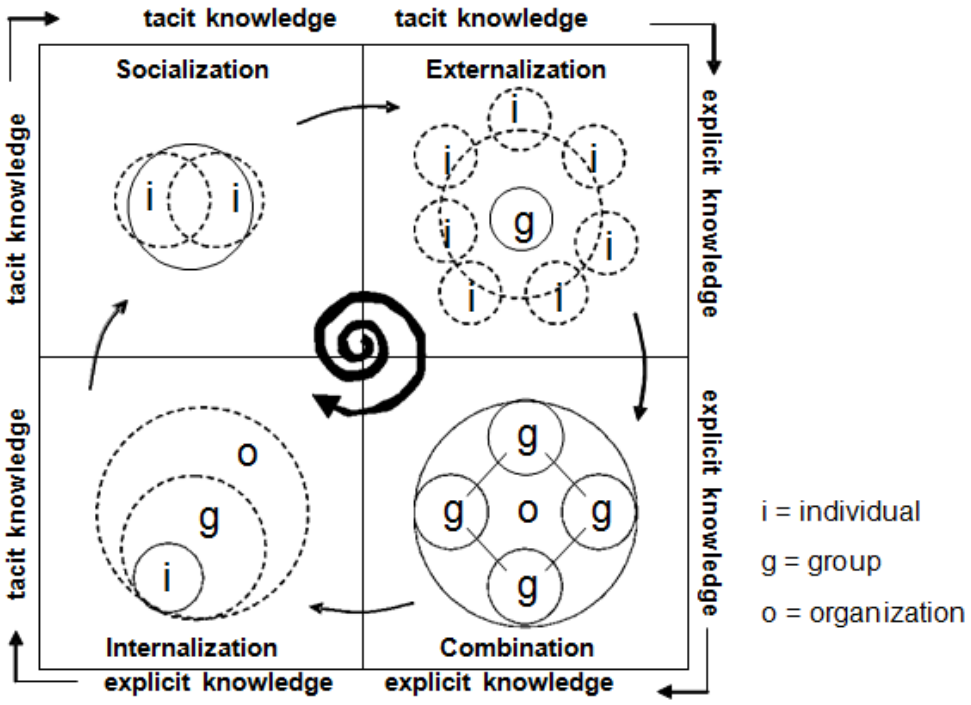
  Technology-oriented approach to knowledge creation: knowledge discovery in databases (KDD) - or data mining - focuses on how data is transformed into knowledge by identifying valid, novel, potentially useful, and ultimately understandable patterns in data (Wickramasinghe, 2006). KDD is primarily used on data sets for creating knowledge through model building, or by finding patterns and relationships in data using various techniques drawn from computer science, statistics, and mathematics (Wickramasinghe, 2006;

Wickramasinghe and von Lubitz, 2007).

According to the people-oriented approach to knowledge creation, instead, the knowledge can be only created by individuals (Wickramasinghe, 2006). This approach can be further divided into perspectives where knowledge is created only by individuals on one side and, on the other side, perspectives where knowledge can also be created by organizations. Many leading theorists in knowledge creation and management, and organizational learning assert that knowledge is created by individuals and cannot be created by organizations (Crossan *et al.*, 1999; Grant, 1996; Polanyi, 1996). Individuals acquire knowledge not only by actively creating and interpreting their experiences, but also through intuition (Crossan *et al.*, 1999; Polanyi, 1996). Knowledge is always embedded in the context in which it is created and is an individual and social process. Others reject this view where knowledge resides in individuals alone, arguing that knowledge is embedded in groups or communities (Dixon, 2000; Tywoniak, 2007). Within an organization, a set of relationships will create immediate knowledge connections. At the organizational level, for knowledge creation to occur, the organization must support creative individuals and provide contexts for them in which to create knowledge (Hargadon, 2003; Nonaka and Takeuchi, 1995). Thus, organizational knowledge creation is the process by which knowledge created by individuals is shared, and justified in the organizational setting (Nonaka and Takeuchi, 1995). As a result, knowledge creation involves a continual interplay between the tacit and explicit dimensions of knowledge and a growing spiral flow as knowledge moves through the individual, group and organizational levels. Four basic patterns of

creating knowledge in organizations have been identified which form the basis of Nonaka's *Knowledge Spiral* of knowledge creation (SECI model), namely socialization, externalization, combination and internalization (Nonaka, 1991, 1994; Nonaka and Konno, 1998; Nonaka and Takeuchi, 1995). The *Knowledge Spiral* is presented in Figure 1.6 and each of these basic patterns is discussed briefly in the following paragraphs.

Figure 1.6 The *Knowledge Spiral* of knowledge creation



Source: Nonaka and Konno (1998)

Socialization happens when tacit knowledge is shared among individuals through joint activities in a shared context, such as being together, pending time and living in the same environment (Nonaka, 1994; Nonaka and Konno, 1998; Nonaka and Takeuchi, 1995). A person learns skills through observing or imitating another person and practice (e.g. apprenticeship). As a result, tacit

knowledge from one person increases the tacit knowledge of another person and is therefore never transformed into explicit knowledge.

Externalization or articulation takes place when tacit and explicit knowledge interact. In this phase tacit knowledge is transformed in an explicit way, and therefore easily accessible to the organization (Nonaka, 1994; Nonaka and Konno, 1998; Nonaka and Takeuchi, 1995). The conversion of tacit to explicit knowledge uses metaphors, analogies, concepts, assumptions or models (Nonaka and Konno, 1998; Nonaka and Takeuchi, 1995).

Combination refers to the creation of new explicit knowledge by merging, categorizing, reclassifying, and synthesizing explicit into more complex combinations of explicit knowledge (Nonaka and Konno, 1998). Examples of combination are articulations through "best practices" or "lessons learned". While explicit knowledge is repackaged through combination, it does not necessarily extend the knowledge of the organization.

Internalization relates to the dissemination of explicit knowledge which then is internalized by staff and increases their existing tacit knowledge (Nonaka and Konno, 1998; Nonaka and Takeuchi, 1995). This is characterized by "learning by doing" (Nonaka and Konno, 1998; Nonaka and Takeuchi, 1995). When this internalized knowledge is shared by most members of an organization it becomes part of the organizational culture (Nonaka and Takeuchi, 1995).

Overall, the four patterns of knowledge creation are highly interdependent and all four of these patterns are involved in a dynamic interaction, which Nonaka (1991) and others (Nonaka and Konno, 1998; Nonaka and Takeuchi, 1995) refers to as the spiral of knowledge.

- *Knowledge Storing*

  The second main KM process identified within the literature is knowledge storing. Research has shown that many organizations, once created new knowledge, often lack in adequately tracking the acquired knowledge (Argote, Beckmann and Epple, 1990; Darr, Argote and Epple, 1995). Thus, effective ways to store and organize knowledge have to be found (Grant, 2005). Knowledge which is stored within the organization is often referred to as "organizational memory" (Stein and Zwass, 1995) and includes physical resources (like written documentation, structured information stored in electronic databases, codified human knowledge stored in expert systems, documented organizational procedures and processes) as well as non-physical sources (knowledge stored in the heads of the employees – also referred as individual memory) (Alavi and Leidner, 2001; Tan, Teo, Tan and Wei, 1998). Based on the discussion of the concept of knowledge it is evident that tacit knowledge cannot be codified and stored in physical resources, it has to be transformed into explicit knowledge (Cuel, Bouquet, and Bonifacio, 2006). Obviously, explicit knowledge which is stored in physical resources is more likely to be permanent than knowledge which is stored in the minds of individuals (Helleloid and Simonin, 1994).

  Organizational memory can have both positive and negative potential influences on behavior and performance of an organization (Alavi and Leidner, 2001). On one side, organizational memory helps to avoid the waste of organizational resources in replicating previous work (re-inventing the wheel) and diminishes the loss of tacit knowledge (Simon, 1991). While, on the other side, it can lead to maintain the status quo by reinforcing single loop learning (Argyis and Schoen,

1978) which leads to stable and consistent organizational cultures that are resistant to change (Alavi and Leidner, 2001). Thus, Simon (1991) argues that while employee turnover has an impact on long-term organizational memory, the natural erosion of individual memory over time is not entirely a disadvantage particularly in a changing environment. It serves to support unlearning, removes outdated knowledge and therefore opens the way for new knowledge.

Additional storages of organizational knowledge are external sources such as suppliers, consultants and contractors (Helleloid and Simonin, 1994). The importance of external knowledge is well recognized (e.g. Cohen and Levinthal, 1990) and becoming more and more important (Kraaijenbrink and Wijnhoven, 2006) given the increasing interconnectivity of organizations worldwide.

- *Knowledge Sharing*

  Following knowledge creation and storing, knowledge sharing represents another important KM process that has been widely discussed in the literature. It is not enough to create knowledge, there must be an intention to use and share it (Dixon, 2000; Machlup, 1980). Syed-Ikhsan and Rowland (2004) assert that knowledge transfer requires the willingness of a group or individual to work with others and share knowledge to their mutual benefit. Without sharing, it is almost impossible for knowledge to be transferred to another person or group. Knowledge transfer can only take place in an organization where its employees show a high-level of co-operative behavior (Goh, 2002). According to Davenport and Prusak (1998), knowledge transfer involves two actions which are the *transmission* (sending or presenting knowledge to a potential recipient)

and the *absorption* by that person or group. They also assert that both transmission and absorption have no value unless they lead to some change in behavior, or to the development of some idea that leads to new behavior.

Knowledge does not flow automatically through organizations. Indeed, people's time and energy is limited and they will choose to do what will give them the best return given their scarce resources (Davenport and Prusak, 1998). Broad explanations about why individuals and organizations share knowledge are that knowledge sharing reduces uncertainty (Gulati and Gargiulo, 1999; Tywoniak, 2007), turns individual learning into organizational learning (Nonaka, 1994), prevents reinventing the wheel (Bender and Fish, 2000) or/and creates shared understanding (Nickerson and Zenger, 2004). Cross and Sproull (2004) found through their research that knowledge sharing is the result of information search and problem solving in situations, where people must solve complex problems with short time horizons.

Within the literature, two knowledge sharing approaches are most commonly used: *codification* and *personalization* (Hansen, Nohria and Tierney, 1999).

Based on an objective view of knowledge, *codification perspective* presumes that knowledge can be disconnected from its source. Therefore, it focus on capture and storage of knowledge representations in electronic repositories/databases, independent from the individual who generated it. Repositories are databases of knowledge usually contributed by individuals, teams, or organizations for potential use by others.

Containing organizational knowledge, electronic repositories/databases facilitate knowledge transfer among organizational members. Benchmarking

through best practice databases are a good example for an instrument used by companies following the codification strategy. Replicating best practice is a key knowledge issue, because it is about identifying, transferring and using knowledge related to how to do things well (O'Dell and Grayson, 1998). Even before the development of KM, organizations used benchmarking of other organizations in their pursuit of knowledge and best practice (O'Dell and Grayson, 1998; O'Dell, Wiig and Odem, 1999). O'Dell and Grayson (1998) see internal benchmarking and the transfer of best practice as one of the most tangible manifestations of KM (O'Dell and Grayson, 1998). On the other side, Szulanski (1996) argues that the complexity of knowledge, particularly tacit one, represents the greatest barriers for an effective knowledge transfer.

Therefore, on the other hand, *personalization perspective* presumes that knowledge cannot be disconnected from its source (subjective view). Knowledge can be shared through person-to-person interactions or networks. Networks facilitate communication among team members or among groups of individuals who are not necessarily identified a priori. The interactions can be face-to-face with a shared context or mediated by technology as in email, instant messaging, text messaging, videoconferencing, groupware, etc. While the role of technology in codification strategy is to capture the knowledge representation and store it in a computer, its role in personalization strategy is to facilitate the communication of knowledge (Mueller-Prothmann, 2006). Given the growth of distributed work and global teams, personalization through technology mediation is becoming increasingly important.

Communication and collaborative tools and technologies are allowing

temporarily and globally dispersed individuals to work together and to engage in knowledge sharing through interpersonal communication.

The shift from technical and technological process view (codified perspective) to a more social view (personalization perspective), has given way to new approaches that examine social dimensions of knowledge creation, transfer, and management (Cross, Laseter, Parker and Velasquez, 2006; Mueller-Prothmann, 2006). Given that the majority of individual knowledge transfer does not follow formal process or forced hierarchies, but instead are driven by personal and informal communications, a growing literature has emerged on concepts related to communities of practice (Brown and Duguid, 1991; Lesser and Storck, 2001; Wenger, 1999), communities of knowledge (Botkin, 1999; Lesser, Slusher and Fontaine, 2000), and knowledge networks (Collison and Gregson, 2003; Nohria and Eccles, 1992; Powell, 1998; Seufert, von Krogh and Bach, 1999).

Gulati and Gargiulo (1999) suggest that being part of a networked community satisfies the need for knowledge as a way to deal with environmental uncertainty. Other researchers have effectively concluded that a membership within a networked community will allow organizations to realize superior economic gains from their increased access to knowledge relative to independent or non-aligned firms (Mueller-Prothmann, 2006).

Table 1.4 gives an overview about the distinctive characteristics of these two knowledge sharing perspectives as well as a short description of the medium used and the role of IT for both approaches.

Table 1.4 Characteristics of codified and personalized approach to knowledge sharing

	Codification Approach	**Personalization Approach**
Definition	Knowledge can be disconnected from its source	Knowledge cannot be disconnected from its source
View	Stored / shared through electronic repositories/ databases, knowledge is independent from the individual who generated it. Repositories are databases of knowledge usually contributed by individuals, teams, organizations for potential use by others. Knowledge transfer among the organizational members is facilitated by the electronic repositories/databases which contain organizational knowledge.	Knowledge can be shared through person-to-person interactions or networks. Networks facilitate communication among team members or among groups of individuals who are not necessarily identified a priori. The interactions can be face-to-face with a shared context or mediated by technology as in email, instant messaging, text messaging, video-conferencing, groupware, etc. Communication and collaborative tools and technologies are allowing temporarily and globally dispersed individuals to work together and to engage in knowledge sharing through interpersonal communication.
Scope	Capture the knowledge representation and store it in a computer	Facilitate the communication of knowledge

- *Knowledge Application*

  Knowledge application is the last of the four main KM processes identified through the literature to be discussed. The assumption that the source of competitive advantage resides in the application of the knowledge rather than the knowledge itself, is an important aspect of the *knowledge-based theory* of the firm (Alavi and Leidner, 2001; Grant, 1996). Grant (1996) identifies three key mechanisms for the integration of knowledge in order to create organizational capability (Alavi and Leidner, 2001): *directives*, *organizational routines* and *self-*

contained task teams.

Directives refer to a specific set of rules, standards, procedures and instructions developed through the conversation of specialist's tacit knowledge to explicit and integrated knowledge for efficient communication to non-specialists.

Organizational routines refer to the development of tasks performance and coordination patterns, interaction protocols, and process specifications that allow individuals to apply and integrate their specialized knowledge without the need to articulate and communicate what they know to others.

Self-contained task teams are formed for problem solving in situations in which task uncertainty and complexity prevent specifications of directives and organizational routines.

While knowledge creation, storage and transfer do not necessarily lead to enhanced organizational performance, effective knowledge application does because organizational performance often depends more on the ability to turn knowledge into effective action and less on knowledge itself (Alavi and Leidner, 2001).

Chapter 2

Change Management theory

SUMMARY: 2.1 Need for change – 2.2 Cultural change – 2.3 Resistance to change – 2.4 Change Management models – 2.4.1 Understanding change – 2.4.2 Planning change – 2.4.3 Implementing change

As widely discussed in chapter 1, knowledge represents more and more a strategic resource of organization, often a key factor for a sustainable competitive advantage. Furthermore, KM appears a core activity – in particular for knowledge-intensive organizations – also within change programs. Beside the central role of management in organizational change, increasingly important – especially for knowledge-intensive companies – appears the role of employees who want to play an active role in changes, and to understand reasons and opportunities (Kim and Mauborgne, 2003; Tampoe, 1993). For involving employees, an effective communication become key (Lewin, 1947; Sirkin *et al.*, 2004; Kotter, 1995), and by leveraging on employees' support (Katzenbach *et al.*, 2012), management is more likely to change culture, a key area to focus on for a successful change initiative (Cameron and Quinn, 2005).

Management is called to face *resistance to change* as one of the main causes of change initiative failure, whereas some (Waddell and Sohal, 1998; De Jager, 2001; others) highlight its positive impact.

The literature proposes several change models (Lewin 1947; Kotter, 1995; Sirkin *et al.*, 2004; others) for supporting management in successfully run change initiative within organizations.

2.1. Need for change

In order to reply to the question why does an organization need organizational change (Jones, 2004), the literature offers several perspectives. From a passive perspective, organizational change occurs as a reaction to an environment ever-changing so far. Facing *crisis* due to the economic recession with impacts on several industries. Coping with *performance gaps* when organization goals and objectives are not being met. Reacting to *internal and external pressure*: on one hand, management and employees – particularly those in organized unions – often make pressure for change; on the other hand, external pressures could come from customers, competition, changing government regulations, shareholders, financial markets, etc. *Mergers and acquisitions* require change in a wide number of areas, often negatively impacting employees when some department can appear redundant within an unique organization. Change could also be a result of *planned abandonment*, when market conditions lead organization leave declining products, markets, or subsidiaries, thus allocating resources differently.

On the other hand, a more proactive perspective is that change is driven by an inspired management. Identification of *new technology* and more efficient and economical methods to perform work. Identification of *opportunities* in the market place that the organization needs to pursue in order to increase its competitiveness. Another reason organizations may institute certain changes is that other organizations are performing good doing things differently. It *sounds good*, thus the organization tries it.

Furthermore, organizational change is especially evident when the organization has just experienced a transfer of executive power, like a new CEO designation (Haveman, Russo and Meyer, 2001). According to Van de Ven and Poole (1995), organization change can be explained by one of the following theories: teleological theory, life-cycle theory and dialectical theory. The teleological perspective believes that organizational change is an attempt to achieve an ideal state through a continuous process of goal-setting, execution, evaluation and restructuring. Life-cycle theory claims that the organization is an entity that depending on the external environment, cycles through stages of birth, growth, maturation, and declination. Dialectical theory hypothesizes that the organization is like a multi-cultural society with opposing values. When one particular force dominates over others, a new organizational value and goal is established, resulting in organizational change.

Overall, within the contemporary economic context, change in organizations can be considered pervasive since the degree and the rapidity of change in the external environment. The conditions in which organizations currently are called to operate, require a readiness to change without which organizational failure is likely the result. The rate of technological change is only one example of agent which has created an environment intolerant of the status quo.

Furthermore, many researchers (Cameron, 2003; Quinn, 2000) claim that change is not only ubiquitous and unpredictable, but its velocity will increase exponentially. Within a context of rapid and – often – dramatic change, organizations cannot survive by remaining the same. Thus, the current challenge is no more to determine whether to change but how to change for increasing organizational effectiveness.

2.2. Cultural change

Organizational researchers began to seriously pay attention to the concept of culture only in 1980s (Ouchi, 1981; Pascale and Athos, 1981; Peters and Waterman, 1982; Deal and Kennedy, 1982). Whereas in most cases practice lead research to document, explain and build models of organizational phenomena that are already being applied by management, the concept of culture is one of the few where organizational researchers led managers in identifying a crucial factor affecting organizational performance.

The reason why organizational culture was not considered as an important factor for organizational performance is that it encompasses underlying values, assumptions, expectations, collective memories and definitions present in an organization. It represents the prevailing ideology that people have inside their heads. It includes a sense of identity to employees, provides unwritten and often unspoken guidelines for how to get along in the organization, and it enhances the stability of the social system that they experience (Cameron and Quinn, 2005).

Within an organization, people are often unaware of their culture until it is challenged, until they face a new culture, or until it is represented and made explicit through a framework or model. Culture is most of the time undetectable, this is why it was ignored for so long by managers and scholars.

Literature identifies many levels of culture which affect individual and organizational behavior. At the highest level, a global culture can be identified – as a world religion's culture or the culture of the Far East. Within organizations, several researchers (Aiken and Bacharach, 1979; Trompenaars, 1992; Hofstede and Hofstede, 2001)

highlight significant differences among continents and countries, based on certain key dimensions. For instance, national differences exist among countries based on universalism versus particularism, individualism versus collectivism, neutrality versus emotionality, specificity versus diffuseness, focus on achievement versus ascription, focus on past versus present versus future, and an internal focus versus an external focus (Trompenaars, 1992). At a less general level, it is possible to identify subgroups, such as gender-based cultures (Martin, 1990; Cox, 1991), occupational cultures, (Van Maanen, 1975), regional cultures (Blauner, 1964), and industry cultures (Gordon, 1991). Each of these cultures generally expresses unique language, symbols, rules and ethnocentric feelings. Still more specific is the culture of a single organization. Each organization culture is reflected by what is valued, dominant leadership styles, language and symbols, procedures and routines, and definitions of success that make an organization unique (Cameron and Quinn, 2005).

Deeper inside an organization, an unique culture may also be expressed within a subunit, such as functional department, product group, hierarchical level, or even team. Coordinating and integrating organizational activities among different subunits – based on different culture – may be hard. For example, it is common in many organizations to hear about conflicts between marketing and manufacturing, about disparaging comments regarding the HR department, about skepticism on R&D budget, etc.. One reason is that each unit often has developed its own perspective, set of values, culture, as reported by several researchers (Van Maanen and Barley, 1984, 1985; Jeremier, Slocum, Fry, and Gaines, 1991). More these cultural differences are fragmented, harder it is for organizations to achieve high levels of effectiveness. However, in additional to their own unique elements, each subunit contains common

elements typical of the entire organization (Alpert and Whetten, 1985), a sort of *fil rouge* is embedded among all organizational subunits (Schein, 1985; O'Reilly, Chatman and Caldwell, 1991). Therefore, in assessing an organization culture, it is suggested to focus both on the entire organization as the unit of analysis, and also on different subunit cultures, identifying and aggregating the common dominant attributes.

Most organizational researchers claim that organizational culture has a powerful effect on the performance and long-term effectiveness of organizations. Empirical research has produced a wide range of findings demonstrating the importance of culture to enhance organizational performance (Cameron and Ettington, 1988; Denison, 1990; Trice and Beyer, 1993). Kotter and Heskett (1992) argue that culture is a critical factor also in long-term financial success.

Several studies (Caldwell, 1994; CSC Index, 1994; Gross, Pascale and Athos, 1993; Kotter and Heskett, 1992) report that one of the most frequent reason why change programs fail, is a neglect of the organization culture. In other words, by failing in change the organization culture, companies fail the other kinds of change initiatives in place.

For instance, Cameron (1997) studies the three most common organizational change initiatives implemented in the 80s-90s: TQM (Total Quality Management), downsizing and reengineering initiatives. The unsuccessful change rate organizations experienced in implementing quality initiatives led companies to label TQM a failure and to cut back their quality budgets (Cameron, 1997). Another attempt to improve productivity, efficiency, competitiveness, and effectiveness that was on average a failure was organization downsizing (Cameron and Quinn, 2005). A third common

approach for enhancing organizational performance has been reengineering: redesign processes and procedures in an organization. However, as for the first two initiatives (TQM and downsizing), evidence suggests that also this approach was not so successful. A survey conducted on reengineering projects by a consulting firm (CSC Index, 1994), including companies in US and Europe, reported that 85 percent of those firms accounted little or no gain from their efforts. The authors argue that reengineering was not enough to achieve desirable change. It had to be integrated with an overall approach to change an organization culture. In other words, the failure of reengineering (as well as other change initiatives, i.e. TQM and downsizing) occurred in most cases because the culture of the organization remained the same. The change initiative was treated as a technique or program of change, not as a fundamental shift in the organization direction, values and culture (Cameron and Quinn, 2005).

Without focusing on a change in organizational culture, there is little hope of successfully running a change initiative in order to improve organizational performance. Although a correct application of tools and techniques, and a vigorous strategy implementation, many efforts to improve organizational performance fail because the fundamental culture of the organization (values, ways of thinking, managerial styles, paradigms, approaches to problem solving) remains the same (Cameron and Quinn, 2005). Some argue (Katzenbach, Steffen and Kronley, 2012) that organization culture is not to be revolutionized in all cases. They recommend managers to start from organizational culture strengths, focusing on changing only few key behaviors rather than looking for a wholesale transformation.

Empirical studies (Cameron, 1995, 1998; Cameron, Bright and Caza, 2004; Cameron, Freeman and Mishra, 1991) demonstrate that only by embedding culture change, change initiatives – as TQM, downsizing and reengineering – could be successful. This dependence of organizational improvement on culture change is due to the fact that "when the values, orientations, definitions, and goals stay constant – even when procedures and strategies are altered – organizations return quickly to the status quo" (Cameron and Quinn, 2005, pag.11). In other words, working on organizational culture is a key for a successful change program implementation.

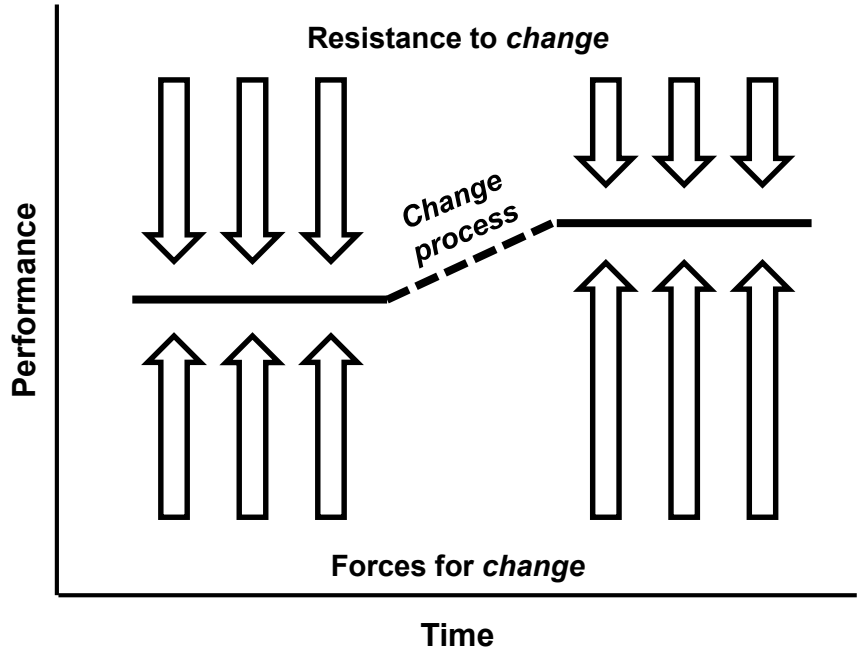
2.3. Resistance to change

It is widely known in both academic and business words that many of the change initiatives implemented have produced poor results. Researchers (Hammer and Champy, 1993; Beer and Nohria, 2000; Kotter, 2008) state that the average rate of fail in organizational changes is around seventy per cent. Always more researchers, consultants, academicians and managers are interested in analyzing why such large number of organizations are unable to realize their change plans. Given the complex nature of the activity of transforming an organization, identifying a unique solution applicable in all contexts appears difficult. However, among several causes, *resistance to change* can be considered one of the most important causes why re-organization processes fail.

One of the first researcher who introduced the concept of resistance to change was Lewin (1947). Within his three-step change model (later described in paragraph

2.4.1), Lewin presented a theory, namely force-field theory, focusing on resistance during the process of organizational change. According to Lewin (1947), two different types of forces are embedded in an organization. While one group works in favor of change, the other group opposes it. When these two groups of forces are balanced, the organization experience inertia, and in order to change this equilibrium, forces for change need to be strengthened and resisting forces should be weakened. The responsibility of managers running an organizational change is to work towards diminishing the power of resistance forces while reinforcing the forces for change, as shown in Figure 2.1.

Figure 2.1 Lewin's Force Field Theory



Source: elaboration on George, Jones (2002)

Focusing on mitigate resistance forces can allow organization to achieve an higher performance.

While Lewin talks about opposing forces, Zander (1950) examines resistance by focusing on individuals and their attitudes towards change. He perceives resistance as a type of behavior of an individual who aims to protect himself and his interests from possible impacts of the change efforts. The author makes a strict difference between the causes and the symptoms of resistance. Therefore, he suggests managers dealing with resistance in change implementation to focus on causes instead of merely eliminating the symptoms of resistance. Six are the main reasons why resistance to change occurs (Zander, 1950):

- ambiguity in the mind of those who will be affected by change about the nature of change;
- existence of diverse interpretations about the change and its impact;
- existence of strong forces preventing individuals from changing;
- strong top-down imposition on individuals who will be influenced by change, lack of participation;
- existence of personal interests towards change;
- ignorance of pre-established institutions in the group.

Among the early empirical studies conducted on resistance, Coch and French (1948), based on their several empirical studies, basically claim that individuals and groups that are given the opportunity to participate in creation and development of change activities are less likely to resist in implementation than those who are kept away from these processes. Instead, Lawrence (1954) evaluates findings of the study conducted by Coch and French (1948) in a quite different way. He claims that the main reason for employees to perform poor and to resist change was about the loss of social status within the organization and the ignorance of their skills in the previous

setting. Furthermore, Lawrence (1954) argue that a change initiative has two different dimensions – namely technological and social – that need to be evaluated. Then, he identified key points to be considered by managers dealing with change process and resistance:

- managers need to take the interests of employees into consideration during implementation;
- managers should communicate with employees to make them understand the meaning of change;
- an alternative approach to resistance can be guiding because not all employees resist change in the same way, differences between staffs and department have to be considered;
- new job definition can facilitate generation and implementation of new ideas;
- managers have to recognize their role in providing communication with the staff at different levels to achieve successful implementation.

Later, Flower (1962) puts emphasis on managers' responsibility in change attempts failure. He argues that managers fail in overcoming resistance because they think change process as quite straight forward, like moving one situation to another. However, for successful transition it is important to understand how this attempt had been conceived by the employees. According to Flower (1962), when a change initiative is introduced, employees usually experience different problems which are not completely understood by managers:

- clarity of the idea of change. Unless employees grasp the meaning and the necessity of change they tend to resist;

- rigidity, in terms of the way change intended to be implemented. If the manager insists on one single way of operation and tends to dictate, the possibility of resistance increases;
- changes in social status at the workplace. Employees may see change as a threat which can lead to loss of their social status at work;
- individual workload, because employees tend to associate change only with extra-work increasing resistance to change.

Kreitner (2004) also approaches the resistance to change by analyzing possible reactions from employees side. He basically identifies three different stages in a change process. The first one refers to the situation that when managers present the new strategy it usually creates a sense of optimism, often an unrealistic optimism. Managers tend to describe the idea of change as a quite unique way of doing their business which can contribute to develop the organization. Later, employees start to realize that the initial idea is not as good and realistic as it is presented by managers and they are likely to be shocked and disrupted by actual conditions. During this second phase, probability to face resistance increases. Finally, driven by managerial effort, organization can move towards a more constructive direction where employees understand the difficulty of achieving new targets but at the same time they tend to commit their energy to follow this new direction.

Differently from the most part of the literature, Strebel (1996) does not approach to the change resistance elaborating a receipt for eliminating it, but he gives a different perception of resistance. The author focuses on the relationship between managers and employees, arguing that "employees and organizations have reciprocal obligations and mutual commitments, both stated and implied, that define their

relationship" (Strebel, 1996, p.87). He called these mutual agreements as personal compacts and argues that employees are likely to resist an idea which can damage these personal compacts. Talking about this concept, Strebel (1996) addresses three different aspects of relations between employees and managers. The first one is the formal nature of relationship and it involves explicit agreements between managers and employees (job description, required resources determination for the accomplishment, financial and operational targets, rewards, etc.). The author claims that many managers believe that revising these formal structures is sufficient for obtaining commitment from employees side within an organization. However, these structures are supported by psychological and sociological means, it is difficult to make employees believe and work towards the common goal of the organization. The second aspect of personal compacts refers to implicit agreements and to employment relations (trust, dependency, etc.). Employees are likely to expect things different from money, such as personal appraisal. In return, employers expect their subordinated to remain loyal the organization. The third aspect of personal compact deals with the sociological necessities in relations between employers and employees. The author emphasizes the importance of consistency between its vision, mission and value statements, and the actions of management team in gaining commitment of employees. According to the author, the success of a change initiative is strictly linked to the managers ability of revising these personal compacts in an appropriate way. Firstly, managers have to draw the attention of their employees to the urgency of change, secondly they need to start up a new process in which new characteristics of personal compacts can be grasped and idea of change is understood by employees.

Finally, they need to obtain commitments of employees to the new strategic goal by using revised personal compacts.

In addition to these views, Kegan and Lahey (2001) explain employees resistance to change by relying on individual psychologies. They identify source of resistance in what they define "competing commitments" which refers to two opposing motivations embedded in the minds of people. While on one hand, employees usually seem to understand suggested change initiatives, on the other hand the hidden beliefs that they have conflict with the idea of change and therefore hinder implementation. Therefore, the authors claim these commitments prevent individuals from achieving their goals. Kegan and Lahey (2001) definitely compare the role of a manager to psychologists' and suggest managers to disclose the employees' hidden beliefs to implement change effectively.

Although resistance has been usually conceived as an impediment to change, significant number of arguments which emphasize the positive role of resistance have been explained in literature. Within classical organization theory, there is a general tendency to consider coherence as a fundamental prerequisite for performance maximization, thus categorizing resistance as a problem to be eliminated. Therefore, discrepancy and pluralism in terms of ideas and attitudes are considered to have a negative impact on organizational performance (Waddell and Sohal, 1998). However, starting from 1970s, several researchers, rather than conceiving resistance solely as an obstacle, they focused on understanding dynamics embedded in resistant behaviors and attitudes. They came up with the idea that resistance could also be a positive element in change process because it enables managers to revise bad aspects of a change initiative. The assumption behind this approach is that not every change

idea is capable of producing valuable outcomes, and therefore resistance to such ideas can be used in a constructive way. Of course, almost all researchers who advocate the constructive value of resistance, emphasize the necessity of understanding and controlling resistance in a proper way to benefit from it.

Hultman (1979) claims that considering change as something intrinsically good is definitely an error because its success depends on the results it can bring and he suggests to assess the performance of a change effort during a certain time frame. Since organizations are continuously exposed to internal and external forces to change, during this period, the author claims that resistance may function as a stabilizer and balance these internal and external demands.

Waddell and Sohal (1998) argue that people resist uncertainties rather than the idea of change. They argue that what makes individuals hesitate about the change is possible negative outcomes that are embedded in the idea. From this point of view, the authors perceive employees resistance as an opportunity to revise proposed strategy and to fix its defects that are overlooked initially. The advice they present for managers is about the importance of considering resistance as a warning signal rather than seeing it solely as a problem that needs to be eliminated.

De Jager (2001) reaffirms that not all change initiatives are necessarily good. He claims that for a successful change, different alternatives are necessary to let managers choose the best one. According to the author, thus, resistance plays an important role in selecting the correct path of change by creating a discussion atmosphere. Therefore, managers need to focus on causes of resistance and to consider concerns of employees to manage change effectively.

2.4. Change Management models

2.4.1. Understanding change

Change Curve

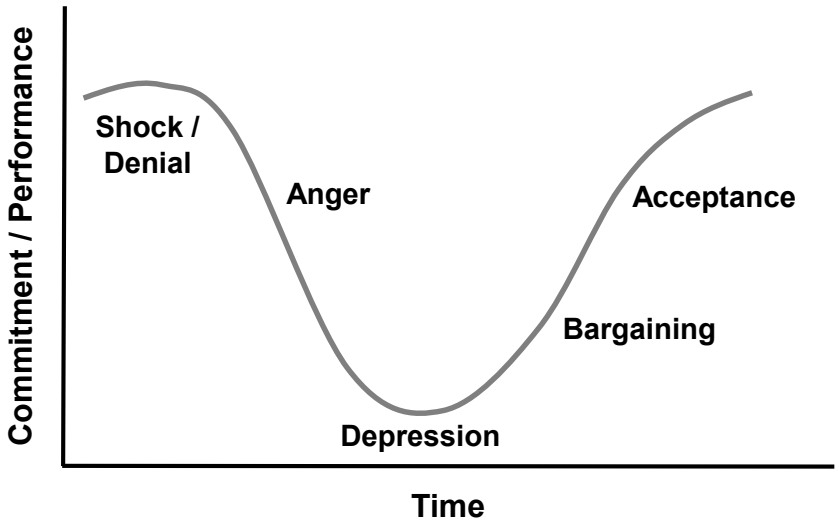
When people within an organizations are called to face change they are likely to react in very different ways. In any effective change management process it appears crucial for the leaders of change to understand this situation. One of the key points for making this process smoother and maybe a little faster is to understand the psychological and emotional components of change.

The idea that humans go through a psychological process during change became evident due to research in the area of terminally ill patients published by Kubler-Ross (1969). By studying the death – the greatest crisis faced by humans (Elrod II *et al.*, 2002) –, she argues that when facing change in the external world an individual can experience a variety of internal psychological states (five stages), which may vary from person to person.

After her contribution, that concept was widely accepted and it was considered valid in a majority of cases and situations relating to change. Individuals going through changes within organizations can have very similar experiences, though perhaps less dramatic and less traumatic. Indeed, when an organization faces change, employees too are called to adapt and change accordingly. Every organization needs to support its employees in this process of making transitions or changes. These individual transformations can be traumatic and may involve a lot of power loss and prestige issues. The easier it is for employees to deal with these transitions, the easier will be for the organization to move towards success. Thus, effectively managing change

effects on employees can positively impact on success rate and overall profits experienced by an organization. The *change curve* (Figure 2.2) is thus a powerful model that can reduce the negative impact of change helping management to understand and deal with employees personal changes and transitions. It helps managers to deeply understand how people can react to change and how to provide support during the process of change, allowing managers to have an higher control of the change process.

Figure 2.2 Changing Curve



Source: elaboration on Kubler-Ross (1969)

Kubler-Ross (1969) argues that people do not move along the five stages in a linear direction neither step by step. A person could also move into stages in a random order and may sometimes even return back to a previous stage after a certain period of time. Each stage can last for a different time frame, and it is possible that a person

gets stuck in a particular stage and he is not able to move forward. Hereunder briefly described the 5 stages:

Step 1 – Denial

In this stage employees may not be able to digest the fact that they have to undergo change and adapt to something new. They may need time to adjust to change, they may also deny that they need any. Managers are now called to help employees understand why that change is happening and how it can be helpful. Communication is extremely relevant in this stage so that employees can have full knowledge and can have their questions answered. Managers should feed employees with information slowly and gradually.

Step 2 – Anger

When finally the gravity of the situation appears clear, employees may begin to feel fear from what will follow, and this may also turn into anger and resentment. They have been in a comfort zone for so long and knowing that they need to learn, change and adapt may make them angry. This stage has to be managed very sensibly by managements and organizations because some employees tend to vent their anger a little too harshly. Even in this stage, clear communication and support should still be the focus for organizations in order to avoid chaos. Organizations must understand that this is just a natural reaction and with time, it shall pass away and make way for acceptance.

Step 3 – Bargaining

Once employees finally have understood the change and realized how they must adapt to new situations and circumstances, they may try to find the best possible scenario for them to fit in and adapt to. They may try to bargain with the management

so that not a lot is compromised. They may try to learn only what they think is important but management should ensure that everyone gets the best of training so that the change incorporated can run successfully. The training stage may take time and for employees and organizations cannot expect one hundred percent productivity during this phase.

Step 4 – Depression

Learning phase may not always be a comfortable zone for all employees. This phase could bring low energies at the workplace due to low morale and excitement. It is important for the management to understand that this phase is not easy for the workforce as well. Hence, the more exciting the training can be made, the better would it be for the employees to move ahead and give their best. Employees may have realized by now that there is no way out of the situation, and this may prove difficult for some of them to handle.

Step 5 – Acceptance

This is the stage that managers wait for after having introduce a new change into an organization. Finally, employees begin to embrace the change, accept the situation and start building new hopes and aspirations. They realize and understand the importance of the change and resign towards it. While some may resign because of lack of any other option, others may resign to the reality in a positive way. Management will finally begin to see the benefits of the hard effort put in by them so far. Organization is now showing improvements, and the overall productivity begins to improve. Despite the path may have been challenging, organization achieved its goal of changing.

Kurt Lewin change model

One of the first change model appeared in the literature is the one developed by Kurt Lewin (1947). He tried to represent the change process thanks to a three steps model: unfreeze, change and refreeze.

The model represents a very simple and practical way for understanding the change process. The author argues that the process of change entails creating the perception that a change is needed, then moving forward the new desired level of behavior and finally, solidifying that new behavior as the norm. Despite some critiques, the model is still widely used and serves as basis for many modern organizational change models.

Step 1 – Unfreeze

Due to his physics background, Lewin uses the analogy of changing the shape of a block of ice. Before changing its shape, melting the ice is needed. The same approach can be adopted for organizational change. Before a change can be implemented, it must go through the initial step of *unfreeze*. Because many people will naturally resist change, the goal during the unfreezing stage is to create an awareness of how the organization status quo and the current level of acceptability is. All current behaviors, ways of thinking, processes, people and organizational structures must be carefully examined in order to show employees how necessary a change is for the organization to create or maintain a competitive advantage in the marketplace. Communication plays an essential role during the unfreezing stage in order to make employees informed about the imminent change, the logic behind it and how it will benefit each employee. The more organization employees know about a change, the more they will feel it is necessary and urgent, the more they will be motivated to accept the change.

Step 2 – Change

Once organization structure, process and people are "unfrozen", an organization can begin to change. Lewin focuses on the concept of *Force Field Analysis* explaining that there are lots of different factors (forces) "for" and "against" making change an organization needs to be aware of (analysis). Only if the factors for change outweigh the factors against change, organization is motivated to move forward a change process. Lewin recognizes that change is a process where the organization must transition or move into this new state of being. Here there is the concrete change implementation, where change becomes real. It can be considered the hardest step to overcome given also because employees struggle with the new reality, face uncertainty and fear. During this time frame, employees begin to learn the new behaviors, processes and ways of thinking. The more prepared they are for this step, the easier it is to complete. For this reason, education, communication, support and time are critical for employees as they become familiar with the change. Lewin puts emphasis on the fact that change is a process that must be carefully planned and executed. Throughout this process, employees should be reminded of the reasons for the change and how it will benefit them once fully implemented.

Step 3 – Refreeze

Lewin originally called the final stage of his change model "freeze", but many researchers (Schein, 1996) refer to it as refreeze to symbolize the act of reinforcing, stabilizing and solidifying the new state after the change. The changes made to organizational processes, goals, structure, offerings or people are accepted and refrozen as the new norm or status quo. Lewin finds the refreeze step to be especially important to ensure that people do not revert back to their old ways of thinking or

doing prior to the implementation of the change. Organization must make adequate efforts for guaranteeing the change is not lost; rather it needs to be cemented into the organization culture and maintained as the acceptable way of thinking or doing. Positive rewards and acknowledgment of individualized efforts are recommended to be used for reinforcing the new state because it is believed that positively reinforced behavior will likely be repeated.

Despite this model is still widely implemented and used as basis of more modern change models, some (Dawson, 1994; Pettigrew *et al.*, 1992; Wilson, 1992) argue that the *refreeze* step is obsolete in contemporary business due to the need for change organizations are continuously experiencing. They deem it unnecessary to spend time freezing a new state when there are many chances it will need to be reevaluated and possibly changed again in the immediate future. However, without the *refreeze* step (as underlined also by Burnes, 2004), there is a high chance that people will revert back to the old way of doing things. Taking one step forward and two steps back can be a common theme when organizations overlook the refreeze step in anticipation of future change.

DICE model

In order to respond to a very high rate of fail in organizational changes, Sirkin, Keenan and Jackson (2004) introduced a process-oriented approach for assessing and managing risks associated with change initiatives. Based on an empirical study conducted upon 225 companies, they developed a four-factors model for predicting the success of a change initiative. They called it the DICE framework, hereunder described.

Duration expresses the time passed between milestone reviews. Of course, the shorter, the better. Thanks to frequent reviews, a possible problem may be identified at its first sign or trouble, allowing an higher chance to success in a change initiative.

Integrity refers to project team's skill. A change program success is strictly linked to an high integrity and an high quality project team. For increasing change initiative success, a team with the right portfolio of skills is required. Problem-solving skills, results oriented and methodological approach, as well as organizational savvy and willingness to accept responsibility are required.

Commitment includes both senior and operative managers dedication to the change program. Without a commitment from top management side, employees will not support any change initiative. An effective communication is also an essential aspect. Management are called to continually remind why change is needed ensuring consistency and clarity in all messages, both in plenary and one-to-one.

Effort regards the extra work employees are called to perform following the change initiative directions. Of course, the lower, the better. A potential too high extra-effort requirement will push employees to resist to change. Management is recommended to ensure that no one's workload increases more than ten percent. Otherwise, if necessary, employees playing a key role in change program can see their workload reduced by nonessential regular work. In case not possible, the authors recommend to leverage on temporary workers to cover any additional workload.

By evaluating each element of the DICE model before launching a change initiative, management can identify potential problem areas and make the necessary adjustments to ensure the program success. The model can also be used during the

implementation phase of the change program, allowing management to make ongoing corrections if the program is not following the expected path.

2.4.2. Planning change

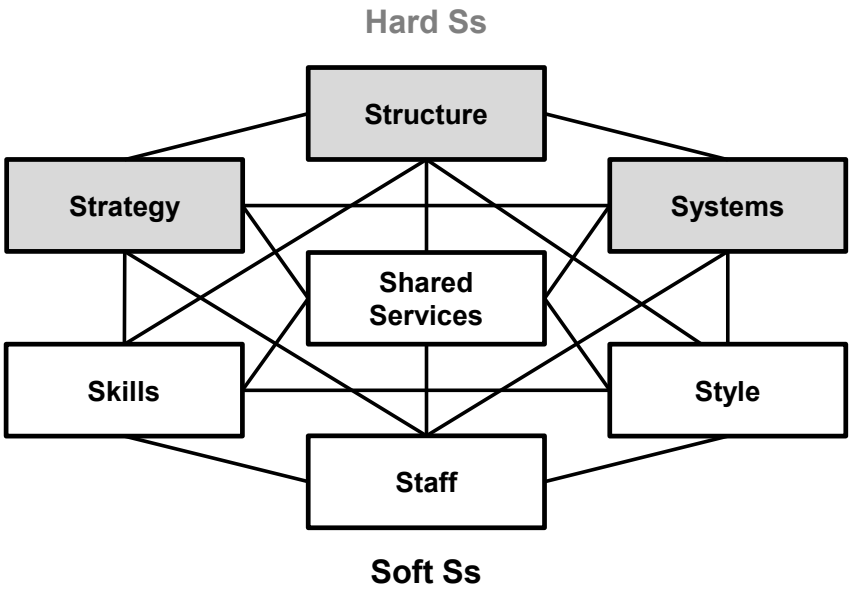
McKinsey 7s Model

McKinsey 7s model is a tool which analyzes firms' organizational design by investigating seven key internal elements: *strategy*, *structure*, *systems*, *shared values*, *style*, *staff* and *skills* in order to identify if they are effectively aligned and allow organization to achieve its objectives of change.

Since its introduction in 1980s by some McKinsey consultants[1], the model has been widely used by both academics and practitioners and nowadays it continues to represent one of the most popular strategic planning tools. It puts emphasis on human resources (Soft S), rather than the traditional mass production tangibles of capital, infrastructure and equipment, as a key to higher organizational performance. The goal of the model is to show how these seven elements of the firm should be aligned together to achieve effectiveness in a company, underlying that all the seven areas are strictly interconnected and a change in one area requires change in the rest of a firm for it to function effectively.

[1] Tom Peters, Robert Waterman and Julien Philips supported by Richard Pascale and Anthony G. Athos.

Figure 2.3 The McKinsey 7s Model



Source: Peter and Waterman (1982)

Academics and practitioners leverage on that model for facilitating organizational change, supporting new strategy implementation, identifying how each area may change in a future, facilitating organizations merger.

Peter and Waterman (1980) defined two main areas "Soft Ss" and "Hard Ss" structuring a shape which emphasizes interconnectedness of the elements.

Hard elements are much easier to be identified and managed compared to soft elements. However, soft areas, although harder to be managed, are the foundation of the organization and are more likely to create a sustainable competitive advantage.

In order to achieve the best results, must be given equal importance to all the seven elements, hereunder briefly described.

Strategy is a plan developed by a firm in order to achieve sustainable competitive advantage and successfully compete in the market.

Structure represents the way business divisions and units are organized and who is accountable to whom. In other words, structure is the organizational chart of the firm. It can be considered one of the most visible and easy to change elements of the framework.

Systems are the processes and procedures of the company, which show business' day-by-day activities and how the decision process is structured. Systems are the area of the firm that reveals how business is run and it should be one of the main focus for managers during organizational change.

Skills are the abilities that firm employees perform very well. They also include capabilities and competences. During organizational change, the question often arises of what skills the company will really need to reinforce its new strategy or new structure.

Staff element is concerned with what type and how many employees an organization will need and how they will be recruited, trained, motivated and rewarded.

Style represents the management style of company leaders, the way top management run the company, how they interact, what actions do they take and their symbolic value.

Shared Values are at the core of McKinsey 7s model. They are the norms and standards that guide employees behavior and company actions and thus, are the foundation of every organization.

2.4.3. Implementing change

Kotter's 8 step change model

Kotter (1995) states that major firms change efforts unfortunately do not always bring the desired outcome. Based on its research, companies have only a 30% chance of success. He introduces his model with the scope of improving organization ability to change and increasing its chances of success.

Even though employees do not always experience change as something positive, they play an important role in the change implementation phase. Looking at the Kotter's 8 step change model, the first three steps are about creating the right climate for change, steps 4 up to 6 link the change to the organization and steps 7 and 8 are aimed at the implementation and consolidation of the change.

Step 1 – Create a sense of urgency

Kotter (1996) considers this first step as one of the most important. By making employees aware of the need and urgency for change, their support will be created. An open, honest and convincing dialogue – discussing about potential threats and possible solutions – can persuade employees of the importance of taking action.

Step 2 – Create a guiding coalition

A project team dedicated to changes the organization wants to implement is needed. This group manages all efforts and encourages the employees to cooperate and take a constructive approach. Preferably, this coalition should made up from employees working in different departments and positions so that all employees can rely on the group and identify themselves with the team members. Leveraging on an open

character, the team can also work as a sounding board, which enables an open communication.

Step 3 – Create a vision for change

Defining a clear vision can help everyone understand what the organization is trying to achieve within the agreed time frame. The vision makes changes more concrete and creates support to implement them. The ideas of employees can be incorporated in the vision, so that they will accept the vision faster. Linking the adopted vision to strategies will help employees to achieve their goals.

Step 4 – Communicate the vision

The most important goal of this model is to create support and acceptance among employees. This can only be achieved by sharing the new vision with the employees at every possible chance by taking in consideration their opinions, concerns and anxieties. The new vision must be fully adopted across the entire organization.

Step 5 – Remove obstacles

For making change accepted at all organization levels, it is crucial to change or, if necessary, remove obstacles that could undermine the vision. By supporting an effective dialogue with all employees, it will become clear who are resisting the change. Incorporating employees' ideas in the change process definitely encourage acceptance of the vision by the employees.

Step 6 – Create short-term wins

Nothing motivates people more than success. Creating short-term goals is suggested for giving employees a clear idea of what is going on. When the goals have been met, the employees will be motivated to fine tune and expand the change. By

acknowledging and rewarding employees who are closely involved in the change process, it will be clear across the board that the company is changing course.

Step 7 – Consolidate improvements

Kotter (1995) argues that many change trajectories fail because victory is declared too early. Whereas, change is a slow-going process and it must be driven into the overall corporate culture. Quick wins are only the beginning of a long-term change. An organization therefore needs to keep looking for new improvements. Only after multiple successes have been achieved, it can be established that the change is paying off.

Step 8 – Anchor the changes

According to the last step of the Kotter's model, a change will become part of the corporate culture only when it has become a part of the core of the organization. Values and standards must be aligned with the new vision as well as employees' behavior. Employees must continue to support the change; regular evaluation and discussions about progress help consolidate the change.

Chapter 3

Lean methodology in an engineering environment

SUMMARY: 3.1 Integrating KM, CM and lean approaches: the theoretical framework – 3.2 Overview on lean – 3.3 The concepts of value and waste – 3.4 Lean principles– 3.4.1 Flow – 3.4.2 Tack time – 3.4.3 Pull – 3.4.4 Zero defects – 3.4.5 Continuous improvement and employees enablement – 3.5 Lean tools – 3.5.1 Expose waste – 3.5.2 Address waste – 3.5.3 Sustain improvement

3.1. Integrating KM, CM and lean approaches: a theoretical framework

Once introduced Knowledge Management (KM) and Change Management (CM) theories, appears interesting to highlight how the Lean methodology is strictly interrelated to both these two approaches.

As deeper described later on this chapter, lean is a Japanese methodology which leads organizations to focus on value creation for the customer by eliminating waste through the whole value stream. Lean is a philosophy which is clearly focused on knowledge creation and, by leveraging on this new knowledge, it aims to bring changes into an organization. During lean implementation, changes are supported by the knowledge and vice versa.

The employees' knowledge (*employees enablement* in lean methodology) plays a crucial role in lean implementation, supporting the detection of waste and the identification of improvement actions to implement across the production flow. Both lean principles and tools rely on a proper KM to drive organization performance.

Furthermore, lean is a methodology strictly linked to CM since it pushes organizations to look constantly for change. Indeed, another basic lean principle is the

continuous improvement, i.e. the constant research for actions to improve the organization performance. One of the main lean tool supporting this scope is the Value Stream Mapping (VSM)[2], a technique which allows to identify room for improvement along a value stream and to put lean principles in place in order to define a new – more efficient and effective – value stream.

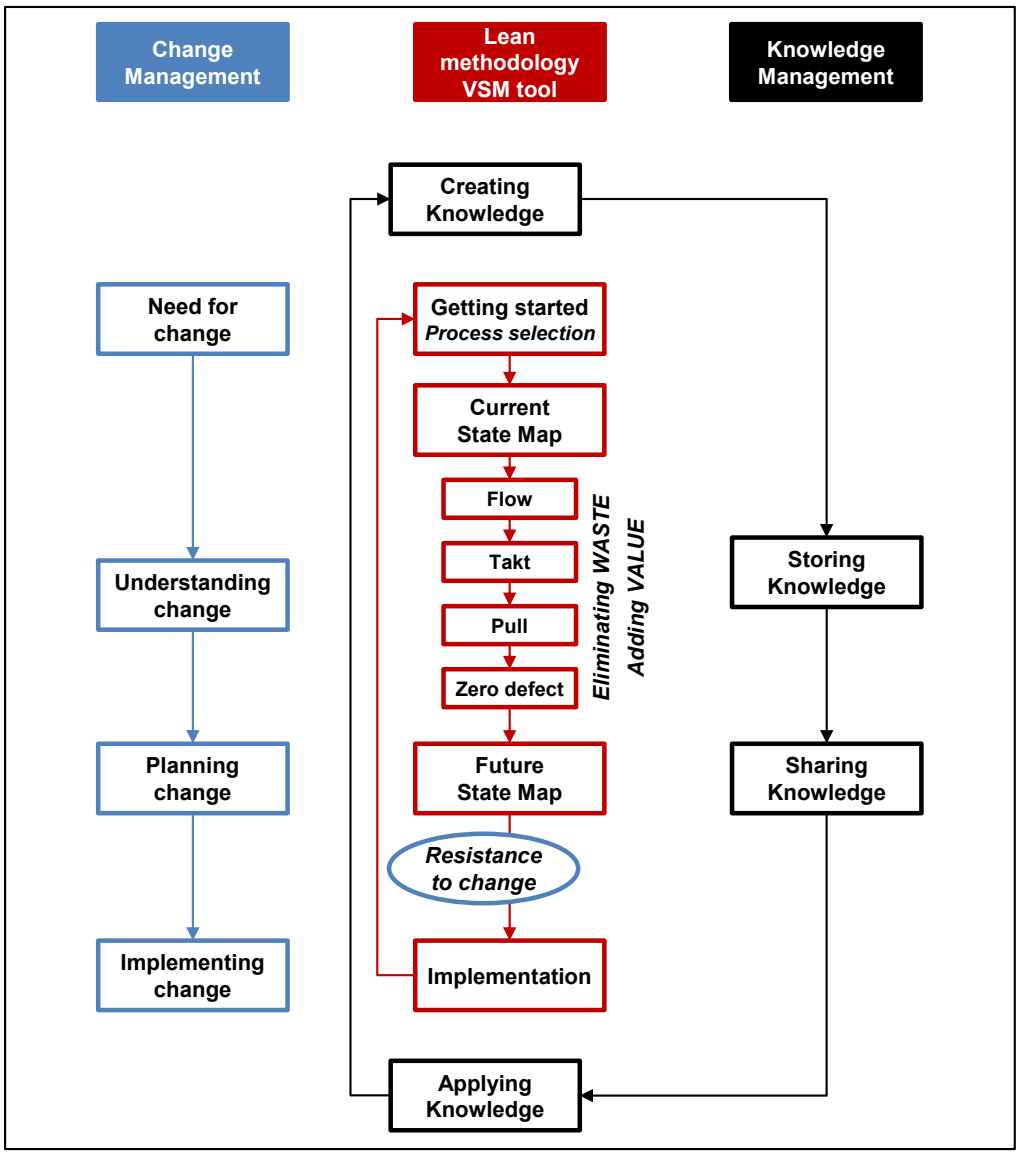
A proper CM process is needed for preparing the ground inside an organization to receive the changes a lean approach will bring. Both CM and KM are required to manage and overcome likely resistance to changes from employees and stakeholders.

Since one of the main cause of the seventy per cent failure rate in change program[3] is the lack of a structured change process, an integrated approach involving KM, CM and lean methodology is suggested to successfully run a change program within an organization.

Lean, as a single approach, aims to create knowledge and bring significant changes into an organization but before, during and after this methodology implementation, there are missing some important aspects which can be supported and strengthened by an effective deployment of KM and CM. This is the reason why the integrated view (proposed in Figure 3.1) of these three concepts has a relevant sense. Starting from the lean implementation framework through one of its tool – namely VSM – it is possible to observe how KM contributes to create the knowledge needed to understand what is adding value and eliminating waste through the whole value stream, converting tacit knowledge into explicit one. It also leads to store that knowledge in a structured way in order to share it across all the organization.

[2] Later described in paragraph 3.5.1
[3] As deeply described in paragraph 2.3

Figure 3.1 KM, CM and Lean approaches: an integrated view



Source: elaboration on Rother and Shook (1998)

While new knowledge is being widespread, a set of improvement actions – within lean methodology – have been identified for defining a more effective and efficient future state, aiming to the perfection. The CM can support the lean strategy identifying and analyzing change phases, but it also helps to plan and implement those changes with the scope of managing employees' preparation to changes and overcome likely resistance.

After a deeper illustration of the lean methodology hereunder, in chapter 4 an integrated approach of KM, CM and lean methodology is presented applied to a business case.

3.2. Overview on lean

The lean concept was originated from the Japanese automaker, Toyota Motor Company and its manufacturing system, named Toyota Production System (TPS) (Ohno, 1988; Holweg, 2007; Shah and Ward, 2003).

The definition of *lean* was introduced firstly by Krafcik (1988), in order to raise the idea of using less resources to increase the efficiency and productivity in organizations. As clarified by Womack *et al.* (1990), this means using less human resources, inventory, space, investment in tools and time spend to develop products.

In 1950s-1970s, the TPS evolved as an alternative to the existing mass production system – launched by Henry Ford in 1920s (Ford, 1927) – due to the necessity of overcoming some challenges faced after World War II (Ohno, 1988). The domestic demand for mass produced vehicle was low (Dale *et al.*, 2007; Petersson *et al.*, 2010), and even demanding high product variety, Japanese companies were unable to make huge investments in western technologies, experiencing difficulties in competing with well-established foreign brands such as General Motors and Ford (Cusumano and Studies, 1985).

The TPS, also known as Just-In-Time (JIT), was developed to survive with the minimum amount of resources during that time. All mistakes were unaffordable and

reduction of wastes became the mission for survive due to resources shortage. Furthermore, the TPS emphasized on process to build several models for each product in small volume with low investment, as well as minimizing the cost and even shortening the lead time.

This theory helped Toyota to minimize cost, maintain the quality and provide several models to satisfy different customer requirements (Slack *et al.,* 2007; Melton, 2005; Dale *et al.*, 2007; Petersson *et al.,* 2010).

The TPS was the beginning of lean practices in manufacturing, which was developed further to reduce and eliminate waste in the processes within the organization (Holweg, 2007; Womack *et al.,* 1990; Melton, 2005; Dale *et al.*, 2007; Petersson *et al.,* 2010).

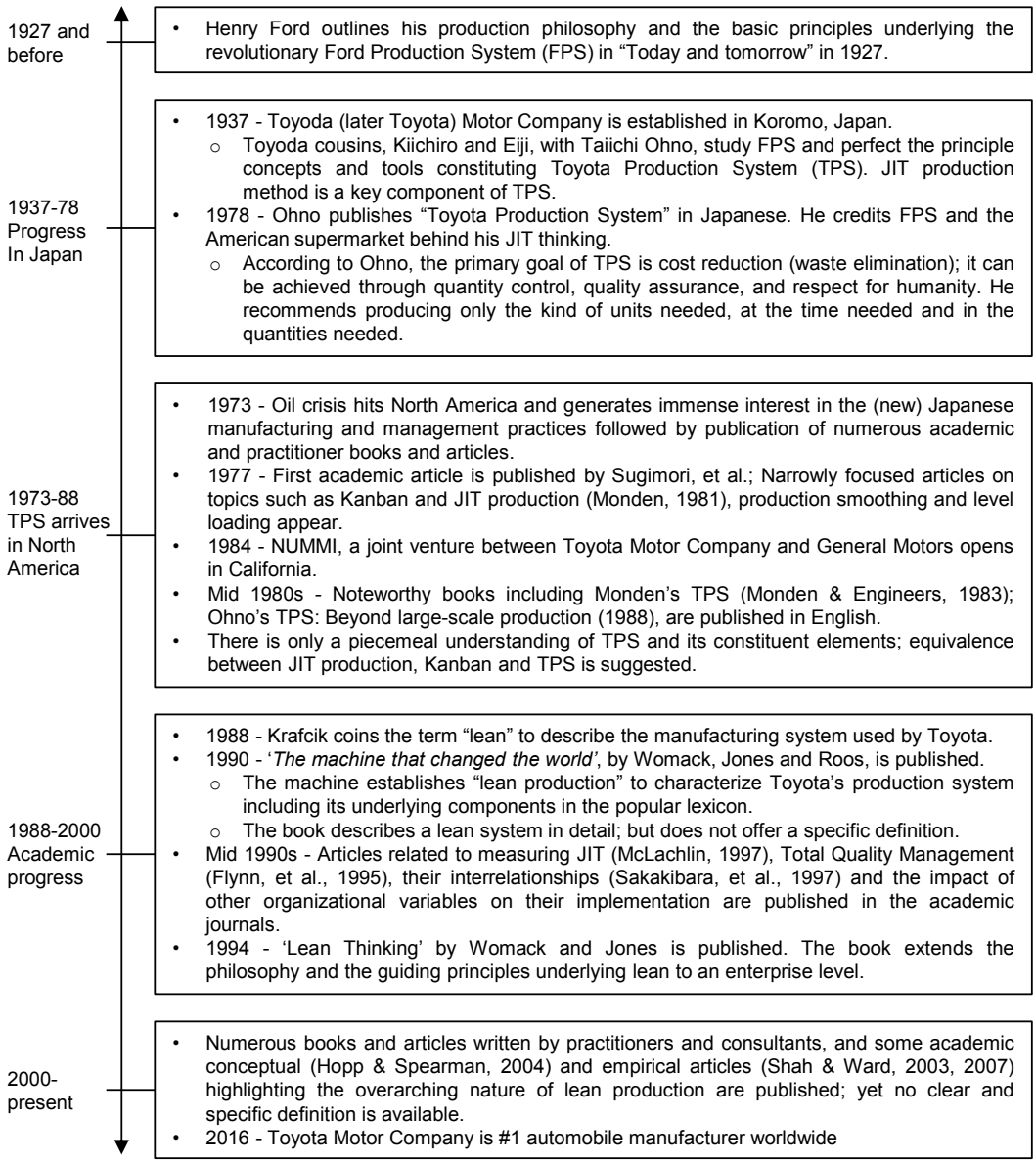
By investigating the success of TPS in the 1980s, a research group in MIT[4] – led by Womack – pointed out that the term *lean production* was coined to describe the highly efficient production system which uses less of every resource to produce the same amounts of product of good quality.

Table 3.1 shows the history of lean production starting from 1927 – Ford Production System – until the 2010s, mentioning some key events in lean diffusion.

Lean production is focused on identifying and eliminating non value activities in products and services in order to create value to customers. Lewis (2000) emphasizes that lean is considered a set of management principles for production with the aim of reducing waste (called *muda* in Japanese). Lean involves different techniques of design, such as leadership to direct the process that involves multi-skilled employees;

[4] Massachusetts Institute of Technology

Table 3.1 Timeline showing the main phases of the lean production evolution



Sources: elaboration on Shah and Ward (2007)

teamwork to assign workers from different functions in groups; communication to resolve critical design trade-offs and prioritize resources; and simultaneous development that involves a process with less tools, inventory and human resources (Womack *et al.,* 1990).

After had been adopted in manufacturing companies, Lean theory was adapted and implemented in a wide range of organization environments. In fact, the effectiveness of the lean principles has been demonstrated in a broad range of work environments, not only production, but also supply chain management, finance and general administration, education, health, engineering and systems engineering (Womack and Jones, 1996; Oppenheim, 2004; Murman, 2002).

Therefore, taking in account diversity in industries, lean can be successfully implemented in manufacturing, service and engineering sectors. In deploying lean methodology in an organization, management is called to deal with some differences. Table 3.2 highlights main differences among manufacturing, service and engineering industries.

Table 3.2 Main differences among manufacturing, service and engineering industries

Features	Manufacturing	Service	Engineering (projects)
Flow	Visible (flow and waste), physically on-site	Invisible, decentralized (multi-site)	Invisible, decentralized with several parallel streams
Financial Driver	Warehouse with impact on balance sheet (working capital)	Cycle time (WIP) with impact on P&L (penalties)	Predictability is a critical driver of resources and quality
Production	Make to forecast (ideally to order)	Serve to order	Design to order
Product	Standard, quantity and repeatability	Catalog, some customizations	Unique or highly customized
Defect	Visible	Invisible	Invisible, risk increase at last minute
Client	Does not intervene in the process	May intervene in the process	Strong influence on the process

Source: elaboration on Ansaldo STS file

One of the most easily understandable difference among these sectors is the flow. While it is visible and physically on-site in manufacturing, the flow appears invisible and often decentralized in both service and engineering sectors. In the engineering industry, it is likely to have also several parallel process streams.

The impact manufacturing warehouse has on working capital is immediately reflected on balance sheet while work in progress hidden in a longer cycle time production impact on a *profit and loss statement* in a more concealed way. Predictability becomes a critical driver in engineering for mitigating impacts on resources' staffing.

Based on forecast, manufacturing companies realize high quantity of products, on average in a more standard way, where defects appear visible. Instead, service organizations serve customers to order based on catalogue plus customizations with a possible error not easy to be investigated. An additional effort is required to engineering organizations which are called to design unique and highly customized services for their customers, facing an even higher probability of error.

In the end, customers' influence on companies processes is very high in the engineering sector with a decreasing power in service and manufacturing context.

Lean companies are called to deal with all these different features in implementing lean thinking in their organizations.

3.3. The concepts of *value* and *waste*

One of the most popular definition in literature of the analysis of value, meant as a measure of the operating effectiveness of a company, was provided by Porter (1985). The author used the *value chain* concept to identify the contribution of each business activity for the production of the total value to be transferred to the customer. The final goal for organizations is to maximize the margin (or added value) as the difference between the good (product or service) price and all related costs generated by the various business activities, recognized as *value-adding activities*.

Porter identified the *cost leadership* and the *differentiation* as two alternative strategies for achieving the competitive advantage and, thus, maximize internal efficiency, by reducing costs or raising premium prices. Therefore, the *value chain* concept promotes a broader meaning of value, taking in consideration all connections/relationships along the supply chain.

It is agreed that several – and continuously changing – variables contribute in (re)defining the "rules of the game" in the marketplace. Technological, socio-political, and market pressures pushed market operators to face competitiveness by reducing costs and time-to-market, by enhancing quality and, thus, maximize value. One of the organization model which best embodies this *modus operandi*, was theorized in the 1990s by Womack *et al.* (Womack, Jones and Roos, 1990; Womack and Jones, 1996) within the *lean thinking* theory. In particular, Womack and Jones (1996) describe lean as a production practice that considers absolutely wasteful the expenditure of resources for any goal different from the creation of value for the end customer. According to the authors, value is "a capability provided to a customer at the right

time at an appropriate price, as defined in each case by the costumer" (Womack and Jones, 1996).

Thus, waste is considered a target for elimination. The lean approach, then, focuses on two main concepts: *value* – defined by the customer – meant as any activity performed by a company the client is willing to pay for, and *waste*, meant as any activity performed by a company, which absorbs resources and does not create *value* for the end customer (Ohno, 1988).

The eight most common types of waste are related to:

Waste 1 – Over-production

Over-production occurs when a company produces more than its customer – or next step in production – requires. It refers to both producing items for which there are no orders and producing more than is required at the correct time. This is the one of the worst waste as it has a damaging effect in multiplying all the other wastes. Over-production could increase defects, negatively impact on inventory costs, waiting time, unnecessary motion and transportation.

In an engineering context, over-production refers to producing and distributing more information than needed by the next process. Lack of re-use expertise (each time *reinventing the wheel*), a tendency to *over-design*, sending all information to everyone, rather than to meet specific needs, also are common causes of over-production.

Waste 2 – Inventory

Inventory is the quantity of parts required to manufacture a product, or finished good and products held in stock. When not in use or not being utilized in production, they take up valuable space/volume. They may become obsolete whilst in stock and detract raw materials and parts from use elsewhere. Competitive companies make

sure that IT systems control their inventory so that money is not wasted on unwanted or unnecessary materials, parts or finished goods.

In an engineering context, inventory refers to keeping more information than needed; collecting, processing and storing every element of data with a tendency for everybody to maintain their own files. All information unused or *work in progress* are considered inventory.

Waste 3 – Rework

Any defect found along the production chain will be reworked or disposed, implicating a costly process. Error – as a result of poor processes quality or human mistakes – takes additional time and therefore increases the cost of the finished product.

Most common cause of rework in an engineering context are errors in data reporting/entries, errors in information provided to customers (lack of disciplined reviews, tests, verification), but also in poorly designed input templates. Any erroneous data, information, reports are cause of rework.

Waste 4 – Waiting

In a manufacturing process, every task is linked and dependent on the processes that take place upstream and downstream. If operators, equipment, information or materials delay the production process for any reason, time is wasted and cost of production will increase further impacting, cumulatively, on company profitability.

Idle time due to unavailable information is the waiting waste experienced in an engineering context. Some examples can be people waiting for information due to lack of access or multiple approvals required; poorly designed or executed process to

provide information; information created too soon becoming obsolete by the time it is used.

Waste 5 – Transportation

The unnecessary movement of information, items, materials, parts and finished goods from a place to another creates wasted time, resources and money. Unnecessary transportation usually implicates also unnecessary motion, damaging the whole production efficiency.

In an engineering context, transportation refers to unnecessary movement of information between people, organizations, or systems. Some example can be data re-formatting or reentry, switching computers to access information, disjointed facilities, information handled by multiple people before arriving at user.

Waste 6 – Motion

Unnecessary motion relates to staff and, in particular, to operators, moving around the work space wasting time and effort. All unnecessary motion can be caused by poor standard procedures and practices, poor process design or poor work area layout.

Applied in an engineering environment, motion refers to any unnecessary movements of personnel. During task execution, people asked to move for gaining access to information; managing manual intervention to compensate lack in the process; dealing with too much information to sort through and with incompatible software suites, are all causes of waste for motion.

Waste 7 – Over-processing

Over-processing refers to running any unnecessary steps during the manufacturing process. It can also mean producing parts or products of a higher quality than

required. This may be due to malfunctioning equipment, errors in re-working, ineffective processes, poor communication and not benchmarking against the customers' requirements (including internal customers further down the process).

In an engineering context, over-processing involves any information processing beyond requirements. Likely due to lack of standardization, numerous or fragmented reports, excessive number of approvals for information release.

Waste 8 – Underutilization of skills

Often organizations lack in a correct use of staff and their abilities. Not properly utilizing the skills and abilities of staff – also missing their commitment – makes organizations lose time. By non-leveraging on staff skills and ideas, organizations miss improvement and learning opportunities. Staff need to be integrated with organization for an efficient production process, whether that be manufacturing or service. Staff – and their ideas – could be the source for overcoming the other seven wastes. An effective staff engagement will help to improve organizations processes and staff development continuously.

Staff play a critical role especially within engineering organizations. Underutilization of skills is in this case link to the use of skilled personnel for standardized tasks; the use of highly trained skill groups for performing repetitive tasks (such as data entry); a mismatch of competences within the team, an unclear roles and mandates.

3.4. Lean principles

As described in the earlier paragraph, *value* must be considered the starting point for an effective implementation of lean principles. Starting from customers' perspective, organizations are called to identify *value* in all the features and characteristics of a product/service customers are looking for in a specific time and at a given price.

The main error organizations can make is to internally define value, without a structured feedback method on customer needs and requirements. In this case, organizations must rethink their business based on value from the customer perspective, even ignoring their existing assets and technologies.

For achieving a long term profitability, lean organizations define the *voice of the customer* (Yang, 2007) as the driver of everything they do. Customers' demand also sets the pace of demand fulfillment pushing organizations for making their products / services available for a given time, based on customers' needs. This concept will be further analyzed following on this chapter (the lean principle of *takt time*, paragraph 3.4.2).

Therefore, in order to create an high level of value, lean companies often work with their customers, creating a close relationship.

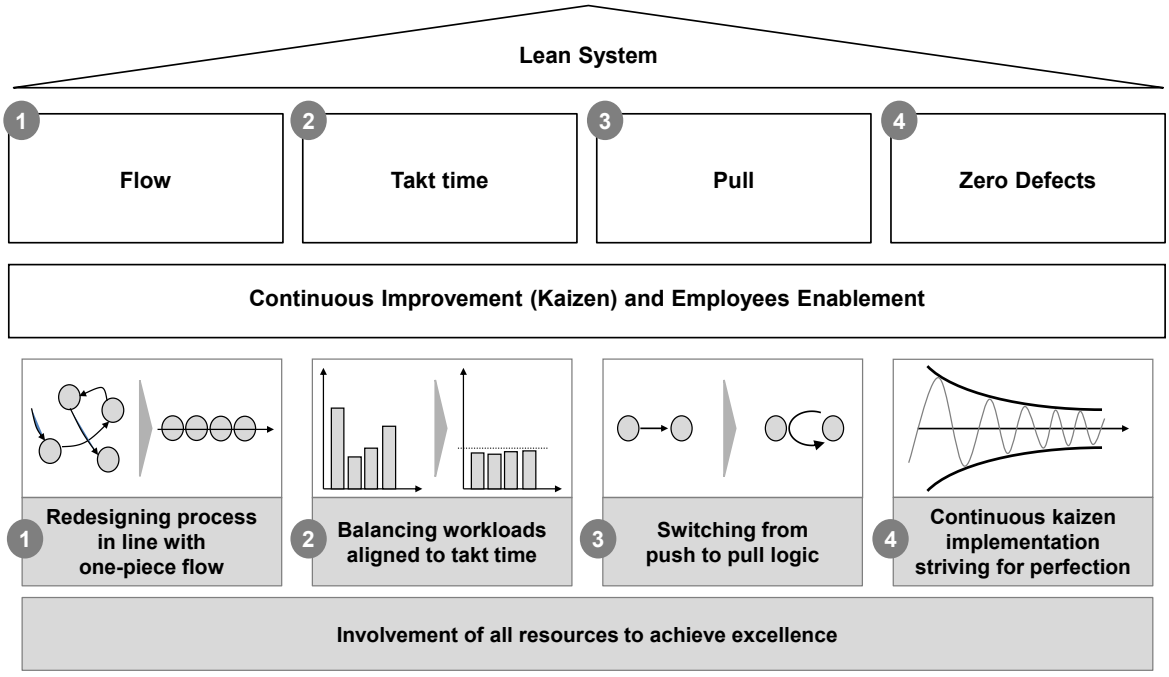
Once value for customer is clearly identified, lean organizations are called to define the *value stream*, i.e. all the activities required to create customer value for a product family or service offering. It includes all the processes needed following an end-to-end process, from a customer order to product/service realization and delivery. Once the value stream is defined, lean organizations are called to organize their operations in order to maximize the value created for the customer and minimize the waste in

these processes. Traditional organizations focus on optimizing single working stations rather than the whole end-to-end production process. Therefore, maximizing value for customer minimizing wastes in the end-to-end process appears the goal of the lean approach.

Womack and Jones (1996) firstly defined lean principles (value, value stream, flow, pull, perfection) within their work. In order to give a clearer view on lean thinking, hereunder proposed a different structured representation, based on a lean implementation within an international company.

As stated at the beginning of this paragraph, once clearly identified what *value* is for the customer and which activities companies need to perform for creating such value (*value stream*), lean organizations must focus on the *house of lean* (Figure 3.2) in order to effectively put in place a lean approach.

Figure 3.2 The house of lean



Source: elaboration on Ansaldo STS file

3.4.1. Flow

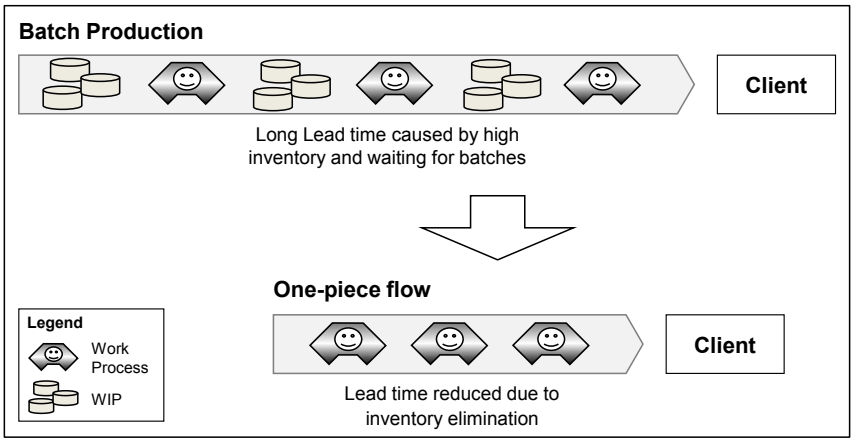
One-piece flow can be described as an ideal state of efficient operations, where batch production is replaced by working on one product at a time. One-piece flow production is achievable by identifying and eliminating waste within the production chain.

Moving from a batch production to a one-piece flow production (see Figure 3.3) allows organizations achieve several benefits:

- improved quality with fewer defects: once batch production is eliminated, there is less opportunity to face defects. Since the batch will be just one, there is not huge amount of inventory to count, move, store and pick. Furthermore, thanks to one-piece flow, quality problem can be easily fix given that any possible defect will affect only one single part, without obligating the organization to spend much effort in isolating and testing other semi-finished products within the same production in order to check batch quality;
- reduced inventory: implementing one-piece flow will lead company to produce only what is needed, avoiding the creation of inventory;
- required less space: as inventory levels are reduced, less space and manpower will be required to manage (receive, count, stock, price, pick and deliver) it.
- enhances overall production flexibility: the less inventory an organization has, the shorter the lead-time will be from customer demand to product delivery. Thanks to one-piece flow, companies have more time to react to customer needs;

- makes identifying future *kaizen*[5] simpler: in a one-piece-flow production, it will become easier for organizations fix production problems.

Figure 3.3 One-piece flow application



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3.4.2. Tack time

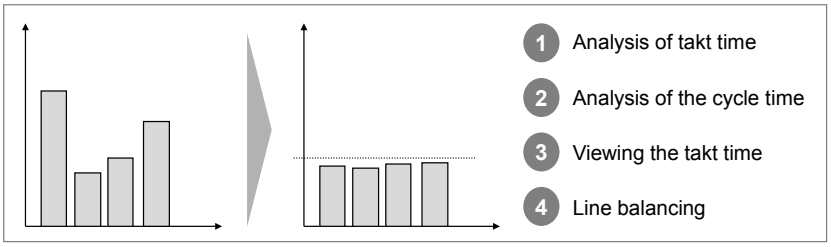
Another foundation of lean organizations is the application of a *takt time*. The takt time is the pace at which company runs production, based on customer requirement. In other words, customer demand sets the pace of demand fulfillment. Then, lean companies organize their products – both physical and service products – in order to make them available when the customer requires them. The takt time is estimate divided available production time by the rate of customer demand[6]. If a product has a one-hour takt time, this means that (on average) customers need one per hour

[5] *Improvement actions* in Japanese, deeply described later in the chapter.
[6] For instance, if a customer requires 20 products per year and a company has 240 working days per year, the *takt time* will be 12 days, calculated as working time (240 days) divided by customer demand (20 products).

throughout the working day. Therefore, in lean organizations the takt time sets the pace of production to match the rate of customer demand and becomes the heart of any lean system. Organizations establish their processes so that products and services are made or provided at the same rate as the customer is requiring (or pulling) the products. This takt time applies to all production steps along the end-to-end chain. Furthermore, the takt time applies not only to primary processes but to all support processes (order entry, engineering, purchasing, scheduling, and so forth).

In order to rationalize the working flow, lean organizations work on re-balancing the workload of their process steps for being aligned with takt time (see Figure 3.4). Aligning the cycle time[7] of each production process to the same takt time, will allow organizations to follow the one-piece flow.

Figure 3.4 Takt time application



Source: elaboration on Ansaldo STS file

Thanks to a proper takt time application through the end-to-end process, an organization can achieve several benefits:

- making the *lead time* more stable: normalizing the time organization needs to run an end-to-end process;
- minimizing inventory level;

[7] The time required to complete one production process.

- increasing transparency on bottlenecks;
- easily identifying waiting time (waste);
- synchronizing materials and information flow within organization processes.

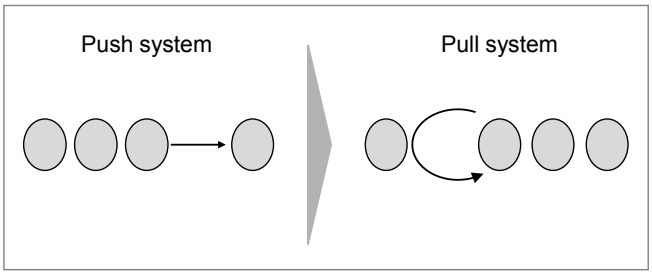
3.4.3. Pull

The principle of pull is – in contrast with old organizations (push production) – a way of controlling a process and reacting quickly to changes without relying on inventory. In a pull system, each stage of a process produces exactly what the immediate downstream stage requests (see Figure 3.5); in effect, material and/or information are pulled through the process by each stage, producing only what is demanded of it from the next stage. This contrasts to push production wherein every stage produces according to a preplanned schedule then pushes material/information to the next stage, whether that next stage is ready for it or not.

The main benefits lean organizations experience by applying a pull system are:

- minimizing inventory and WIP (work in progress) level along the end-to-end process;
- reducing the *lead time* to go to market earlier;
- increasing flexibility to match customer requirements quicker;
- reducing company need in working capital.

Figure 3.5 Pull system vs Push system



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3.4.4. Zero defects

One more fundamental principle of the lean thinking is the pursuit of zero defects, i.e. of perfection. Lean organizations' objective is not to make sporadic leaps of improvement but to focus on making incremental improvement in their own processes day by day (Karlsson and Ahlstrom, 1996). The employees must understand that it is their responsibility to improve the quality (Forza, 1996), because they are often the ones who know the process best. Based on lean thinking, employees play a critical role in quality control along the whole end-to-end value chain.

Even though small improvements could not significantly change a process, the aggregate effect of these changes is a radical improvement in quality, cost, service, flow and customer value. Although perfection is a challenging target, it is the goal of any lean organization. Therefore, lean organizations look for zero waste, zero loss of information and zero defects. It is critical that workers receive information concerning customer requirements and current process performance in order to

strive for perfection. Information architecture and standard operating procedures are key to providing necessary information. Later in the next chapter how critical the role of an effective lean architecture is, will be further explained.

Zero defect can be achieved only if organizations strongly focus on the following lean principles, the continuous improvement.

3.4.5. Continuous improvement and employees enablement

Supporting the previous four principles (flow, takt, pull, zero defects), *continuous improvement* and *employees enablement* appear fundamental enablers, representing the basis of the *house of lean* (see Figure 3.2).

According to the *continuous improvement* principle, all the improvements an accurate implementation of lean principles could bring to a company, can be always enhanced through a continuous research for the better. Following the lean thinking, there is always room for improvement. Lean organizations are called to continuously challenge their status quo and to fine-tune processes and practices on an everyday basis. Therefore, organizations are called to continuously put in place improvement actions, named *kaizen* in Japanese. Literally, *kaizen* stands for change (*kai*) for the good (*zen*), then change for the better, i.e. *continuous improvement*.

In order to guarantee effective *kaizen*, lean organizations should work on continuous improvements relying on multi-functional / cross-functional teams depending on operations (Karlsson and Ahlstrom, 1996). Summers (2000) name these groups as an interdisciplinary problem solving or quality improvement team. Some authors (Forza,

1996; Sànchez and Pérez, 2001) argue that any large team has to be divided into smaller groups for being effective in problem solving issues. Furthermore, some researchers (Sohal and Egglestone, 1994) also suggest as optimum group size for problem solving team of six persons, arguing that in larger group, individual might "disappears". The working group should meet regularly and work in a standardized way.

One of the most popular model supporting the work of continuous improvement is the PDCA model (see Figure 3.6).

Figure 3.6 PDCA model

Source: elaboration on Ansaldo STS file

In late 30s Shewhart and Deming (1939) introduce the concept of a three-step cycle (specification, production and inspection), for hypothesizing, carrying out an experiment and testing the relative hypothesis. The three steps process is defined as a "dynamic scientific process of acquiring knowledge" (Shewhart and Deming, 1939). Starting from this first framework, Deming (1952) enhances that model realizing the four-steps PDCA cycle, standing for Plan-Do-Check-Act, as a problem-solving approach to the goal of continuous improvement.

Step 1 – Plan. The goal of the first phase is to analyze and investigate the current situation and deeply understand the nature of any problem to solve. Once identified an improvement target, the purpose is to develop potential solutions to the problem to be tested.

Step 2 – Do. The second phase is the implementation of the defined action plan.

Step 3 – Check. In this phase, the improvement team is called to analyze the effect of the intervention. By comparing new performance data to the baseline data, is it possible to determine whether an improvement was achieved, and whether the target was met. Useful tools can support this analysis.

Step 4 – Act. Once planned, tested and analyzed, in this phase improvement team is called to determine whether the improvement is achieved as articulated at the beginning of this cycle process. The purpose is to act upon what has been accounted: standardizing the improvement and make it regularly adopted or returning to step 1 (*plan*) for re-examining the process to learn where it can be further improved or whether a more successful approach can be implemented.

The PDCA model allows lean organizations to deal with a problem systematically where the data collected will support the decisions and solve the problem. By leveraging on the PDCA cycle, lean organizations do not jump to conclusions but they continuously look for the root causes of a problem. The PDCA model can also be used to manage and monitor the progress of a project. By following the four steps, a lean organization has an higher chance to complete the project in compliance with deadline and quality target.

Further authors deeply analyze that model. For instance, Besterfield (1999), within the PDCA four-step cycle, identify seven different phases: identify the opportunity,

analyze the process, develop the optimal solution(s), implement, study the results, standardize the solution and plan for the future. Another interesting analysis of the PDCA model (see Table 3.3; STA, 1996) propose eight steps be follow. The results achieved are checked at step 7 (*evaluate results*). In case results do not meet the expected target, the team need to go back to step 5 in the *plan* stage to find out why the target has not been met.

The second strategic enabler is the employees enablement. Involving employees within lean initiatives appears fundamental. Transforming an organization to a lean one requires so much effort that everyone must be engaged in the continuous improvement process. Lean organizations recognize that operative people are the process experts. In order to achieve the fastest and most effective improvements, lean organizations need to engage these people's talents and ideas. Lean organizations move from *command and control* approach of the traditional management style to an empowered teams logic. In order to be aligned on goals and methodology, lean organizations must face an initial effort in training people on lean principles and tools, and in standard improvements methodologies.

Table 3.3 The four PDCA stages broken down into eight steps (STA, 1996)

Stage	Activity	Explanations
PLAN	Step 1:Select Theme	- Topic is selected through consensus - Reasons for choosing the topic must be explained
	Step 2:Plan Schedule	- Plan activities and time schedule - Allocate manpower resources
	Step 3:Grasp Present Situation	- Collect data to determine present situation - Where possible, data should be collected to support how "bad" the situation is
	Step 4:Set Target	- Set target for improvement
	Step 5: Analyze and Determine Problem and Plan Corrective Action	- Suggest possible causes - Investigate - Isolate actual causes - Give as many solutions as possible
DO	Step 6:Implement Plan	- Try out best solution
CHECK	Step 7:Evaluate Results	- Record findings
ACT	STEP 8: Standardize Actions Taken / Review	- Observe any side effects - Collect data - Evaluate effectiveness of solution - If target is not met, return to Step 5 and start again - If objectives are met, solution should be standardized and put in official manuals - Monitor the process periodically to ensure that the desired results are maintained

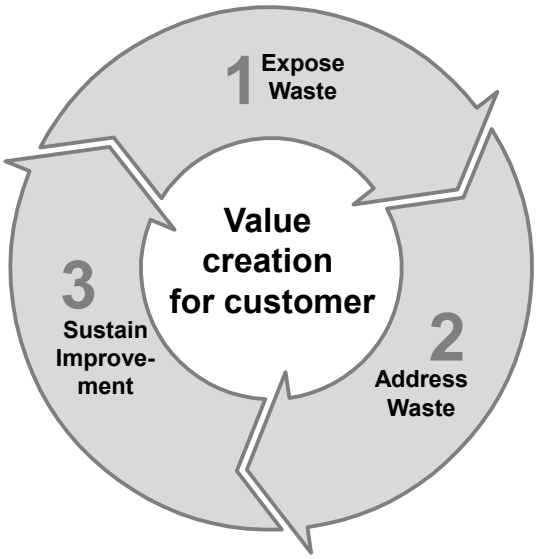
Source: elaboration on STA, 1996

Then, employees must be empowered to really realize the changes required to improve their processes, with the scope of creating more value and eliminating waste. Thanks to a constant performance monitoring (*visual management*, later described in paragraph 3.5.3) employees will be also accountable for their activities.

3.5. Lean tools

Several are the tools supporting the implementation of lean principles within an organization. The intent of this paragraph is not to define a complete list of possible tools to implement, but to present an useful framework organizations may use for a successful lean implementation (see Figure 3.7).

Figure 3.7 Three-step cycle



Source: elaboration on Ansaldo STS file

3.5.1. Expose waste

One of the main powerful tool for exposing waste within a value stream is the Value Steam Mapping (VSM) technique. The VSM is one of the most effective tool to represent and, then, analyze the value stream of a process. It is a technique for visualizing and, then, improving the flow of information and materials between

activities, through the identification of possible waste and non-value added activities. These activities must be reduced (in case they are unavoidable due to current technologies or production methods / assets) or eliminated (in case they are immediately avoidable).

Rother and Shook (1998) define the *value stream* as "all actions (both value and non-value added) currently required to bring a product from raw material to the arms of the customer or through the design flow from concept launch". The VSM is a technique for representing these activities and the related flow of information and product. The VSM is "the simple process of directly observing the flows of information and materials as they now occur, summarizing them visually, and then envisioning a future state with much better performance" (Jones and Womack, 2002). By leveraging on such tool, lean organizations pursue the goal of improving the whole end-to-end process and not only of optimizing single parts. Improvement teams must follow a production / development path from supplier to customer and draw a visual representation of every process in both material and information flows. The VSM representation can be created merely using paper and pencil; however, more advanced representations are drawn based on soft copies.

Rother and Shook (1998) suggest four steps for applying VSM in a manufacturing environment. As described later on the chapter, these phases can be implemented also in an engineering environment with minor adjustments.

Step 1 – Getting started

Before starting a VSM, lean organizations must clearly identify a product / process to address. With the scope of analyzing the whole end-to-end process, the improvement team has to explicitly trace object boundaries.

Tracing an end-to-end process will probably involve different departments from the same organization. Given that companies tend to be organized by departments and functions (instead of based on a value-creating flow), often there is not a responsible within organization accountable for a value stream perspective (Rother and Shook, 1998). In these cases, it appears even more critical the role of the *value stream manager*, the person who will lead responsibility for analyzing and improving a product / process value stream.

Step 2 – Current-state map

Once the product / process is clearly identified, the map of the current state can be drawn. The scope is to record and map all the actions performed for realizing the product / process, the transport links, all information flows. The time required to run all of these steps / activities will represent the total product / process cycle time.

Through an accurate analysis of the current state mapping, lean organizations can find possible waste and identify improvement actions to put in place, based on the lean principles (Slack, 1998) already described early on this chapter.

Step 3 – Future state map

The third VSM step is to map the future state, based on all the analysis performed on the current state flow. The scope is drawing an *ideal state* representing the best way a process could be run starting from the current state flow.

The improvement team – within lean organizations – is called to highlight where waste is, reducing and, if possible, eliminate it.

Step 4 – Achieving the future state

The implementation of the improvement actions can also be gradual. In this case, lean organization must focus on the most problematic areas and on improvement actions with high impact expected and low effort required.

The VSM approach proposed by Rother and Shook (1998) focuses on investigating value creation flow based on a single plant perspective. Underlying that waste can also be hidden between different facilities and plants, Jones and Womack (2002) – based on the same VSM structure – introduce an *extended value stream mapping* expanding the scope of VSM to multiple facilities / plants / companies.

The VSM is a very powerful tool not only in manufacturing environments but also for optimizing the process of product development (Morgan, 2002). Leveraging on such tool, lean organizations can draw the whole system and visualize a more complex system of interactions. In fact, complexity in process appears as one of the most hard obstacle to improve product development process. By simplifying this complexity, the VSM allows improvement team to identify cross-functional activities as well as hidden interdependencies.

For applying the VSM technique in a product development context, few adaptations are needed. One of the main contribution from literature on VSM implementation within product development context is provided by McManus (2005). The author introduces a practical guidance for applying such technique in product development process. By trying to adopt lean concepts and principles in a product development environment, McManus (2005) proposes 6 steps for applying VSM in a product development context:

Step 1 – Getting started

Step 2 – Mapping the current state Value Stream

Step 3 – Identifying Waste

Step 4 – Improving the process

Step 5 – Beyond the future process

Step 6 – Striving for perfection

There are two kinds of flow in a manufacturing environment: information and material flows. According to Slack (1998), also in product development there are physical material flow (like prototype) and information flow, that – in this case – can be further subdivided into two categories: product information flow and program information flow. While product information flow relates to the value stream which defines and develops a specific product (corresponding to manufacturing material flow), the program information flow is related to information used to control and manage the process like scheduling and reporting (corresponding to manufacturing information flow).

Due to the complexity of a product development environment, Morgan (2002) argues that the VSM can be even more useful than in a manufacturing context. The author states that, by leveraging on such tool, organizations can fix some specific issues of a product development context:

- pervasive task in long queues and data-in-process inventories;
- non-value added activities hidden in longer time frames and highly complex nature of the activities;
- capacity and scheduling related issues.

3.5.2. Address waste

Once waste has been exposed through an effective VSM implementation, the improvement team then is called to address waste by applying lean principles, deeply described earlier in paragraph 3.4.

Firstly lean organizations' goal is to re-design the activities flow by following the one-piece flow logic, where each production step must be a value adding one. Once obvious waste has been removed through the value stream – with fist improvements on process flow –, lean organizations need to focus on make the production match the customer requirement by re-balancing the production line. Based on takt time, the improvement team has to level the workload across all processes through the value stream in order to remove bottlenecks (in case a *workstation* requires more time than the tack time) or to fix excess of capacity (in case a *workstation* requires less time than the tack time).

In order to address one of the most affecting waste, inventory – often also cause of other wastes – lean organizations needs to switch from a batch production to a pull system. The continuous improvement approach will finally lead lean organizations to continuously put in place improvement actions (*kaizen*) in order to strive for perfection.

3.5.3. Sustain improvement

With the scope of sustaining the continuous improvement (Bessant and Francis, 1999; Suzaki, 1993; Imai, 1997) and evaluating how the kaizen are really affecting a company performance, a lean organization has to put in place a proper Visual Management (VM) system. By leveraging on proper VM tools, a lean organization can visually manage progress and performance at any stage of the value stream.

The scope is to set-up a proper bunch of key performance indicators (KPIs) able to quickly show the current status of each working station across the value stream.

Some authors (Grief, 1991; Schonberger, 1992; Flynn *et al.*, 1994) also emphasize how important VM is in stimulating employees' involvement to manage and improve value streams quality. Indeed, thanks to a proper VM implementation, a complete information on current performance is provided to everyone in a working team, allowing every one of the staff to make questions, raise issues, propose new ideas / solutions (Mann, 2005). A more shared information also improves employees' morale and promotes teamwork.

Thanks to a continuous KPIs monitoring, lean organizations are able not only to verify the performance adherence to the required standards, but it also allows employees to observe the deviations from the standards easily (Grief, 1991).

By measuring progress, identifying trends and analyzing performance, a lean organization can define goals and focus on continuous improvement.

Chapter 4

Integrating KM, CM, and Lean in an international company: the business case of Ansaldo STS

SUMMARY: 4.1 Overview on Ansaldo STS – 4.2 The Values to Actions (*V2A*) change program – 4.3 The *Lean* workstream – 4.3.1 Processes selection – 4.3.2 Value streams (AS IS and TO BE) mapping – 4.3.3 Lean trainings for supporting implementation – 4.4 KM, CM and lean thinking in Ansaldo STS – 4.5 Change program results – 4.6 What next: will Hitachi continue in lean deployment across ASTS organization?

4.1. Overview on Ansaldo STS

Ansaldo STS S.p.A. (i.e. Ansaldo Signalling and Transportation Solutions) is an "international leader with a global presence in signalling and the implementation of integrated transport systems for Freight, passenger Railways and Mass Transit" (Ansaldo STS Company Profile). The company designs, manufactures and implements signalling systems for the management and control of freight and passenger traffic on mainline railways as well as metros. Thanks to its technological leadership, Ansaldo STS designs, develops and plans the work needed to provide the latest technology for railway or metro system.

Founded in 1853 (as "Gio. Ansaldo e C."), Ansaldo STS is – since 2006 – a public company listed for the 60% of its share capital on the Milan Stock Exchange the Italian Stock Exchange (included on STAR segment and listed on FTSE Italia Mid Cap). Up to October 2015, Finmeccanica was the principal shareholder with approximately 40% of the share capital, while in November 2015 the company sells its share of Ansaldo STS to Hitachi Rail Italy Investments S.r.l. (part of the group Hitachi Ltd.).

At the beginning of January 2016, Hitachi Rail Italy Investments launched the Mandatory Tender Offer for the remaining shares of Ansaldo STS S.p.A. with the intention to acquire the entire share capital and delist the company. Due to transaction reasons, the Consob[8] postponed twice the bid deadline, that currently is expected for March the 14th.

Ansaldo STS (ASTS) is headquartered in Genoa and has approximately 3,800 employees in 28 different countries (ASTS Annual Report 2014). On December 31, 2015 (ASTS Consolidated and draft financial statements 2015) the Ansaldo STS Group posted a net profit of € 93.0 mil. euros, Revenue for € 1,336 mil. euros, and a backlog of 6,410.4 mil. euros.

Mainly based in Italy – with approximately 41% of employees among Genoa, Naples, Turin and Potenza – ASTS has a strong presence in the rest of Europe (22%, with a principal location in France equal to 16%), but also in USA-Canada (18%), Australia (10%) and India (6%), while the other 4% is spread out along Malaysia, China and other locations (Consolidated Interim Financial Report at 30 September 2015).

By operating in an international market, ASTS is exposed to risks resulting from changes in the global macroeconomic scenario and in the reference markets. Therefore various macroeconomic factors may have an impact on company activities, such as growth rates in reference markets and public programs of infrastructure investments. Due to several factors, as macroeconomic and financial uncertainty, plans to reduce public debt – which lead to a reduction in public infrastructure investments – as well as a competitive pressure, ASTS accounted a drop in

[8] Consob (Commissione Nazionale per le Società e la Borsa) is the public authority responsible for regulating the Italian financial markets

performance in the period 2010-2013. In particular, some economic indicators in such time frame (CAGR[9] 2010-2013) showed a difficulty not only from a top line stand point (Revenues: -1.4%; New orders: -9.2%) but even regarding the processes effectiveness and efficiency (EBIT[10]: -5.1%).

Also driven by a need of improving company performance, on 15 April 2014 the Board of Directors appointed a new Chief Executive Officer (CEO – Ing. Stefano Siragusa), already company general manager from the beginning of the same year.

4.2. The *Values to Actions* (*V2A*) change program

Taking in charge this key role in the organization, the CEO Ing. Stefano Siragusa launched at the beginning of 2014 the change program *Values to Actions* (V2A). Planned for a three-year period (2014-2016), *V2A* still is the company most important strategic change program. Strongly backed by the CEO, it strategically links company values to its transformation project.

As reported in the 2014 Sustainability Report, the project aim is "to increase Ansaldo STS efficiency and effectiveness ultimately making more competitive in the market. It drives important, innovative and challenging changes in how the company manages its operations and allocates its resources, its commercial strategy and supply management while ensuring its values and people focus are maintained".

V2A consists of three macro workstreams: *Top Line*, *New Road* and *Lean*.

[9] Compounded Average Growth Rate
[10] Earnings Before Interest and Taxes

The *Top Line* workstream aims to find new market opportunities which ensure good margins and relatively short life cycles (from the order to revenue generation) compared to traditional signalling and/or turnkey projects.

The *New Road* workstream is the natural continuation and development of other past supplier optimization projects. It aims to cut overall external purchase costs.

Within this workstream, some cost macro-categories are selected since considered strategic. For each macro-category of costs, specific possibilities to create efficiency are identified, with an expectation of generating results in the medium and long term. Several department areas are involved in the project on a global scale, promoting and strengthening best practices in external cost management throughout the entire organization.

The third workstream, instead, aims to optimize internal costs over their entire life cycle. It is the *Lean* workstream, a three-year program with over €120 million target of saving. It includes some of the program most complex and challenging initiatives, aimed at simplifying the delivery process by reducing waste. By identifying areas with potential for improvement, this workstream aims to boost product quality, cut internal costs and speed up delivery times.

In 2014 I joined Ansaldo STS, full involved in the *V2A Program*. After a first period as *V2A PMO*[11] referent for initiatives on the *Lean* workstream, I took effectively part of the *Lean team*.

This work experience gave me the opportunity to closely study the *V2A* change program with some interesting findings. A deeper explanation of how this change program has been launched in 2014 and how it is still going on in 2016 is here

[11] Project Management Office, in this case Program Management Office

needed. Whereas, later in the chapter, it will be particularly interesting to highlight how Ansaldo STS has implicitly adopted an integrated approach of KM, CM and lean methodology while running this change program.

In order to properly contextualize the *V2A Program*, the Kotter's 8 step model appears the consolidated framework which best fit such change program.

Step 1 – Create a sense of urgency

Creating a sense of urgency is the first step for making employees aware about the need for change in order to gain their support.

The first need for change arisen by the ASTS organization was the designation of a new CEO with the aim of improving company performance.

Once in charge, in order to make employees aware about the urgency of changing, the new CEO restricted yearly salary reviews.

Those actions raised the awareness of the whole organization regarding the current not satisfying company performance.

Step 2 – Create a guiding coalition

Under the responsibility and the direction of the *Strategy, Quality & Improvement* unit, CEO created a *change program team* full dedicated to drive the change into the entire organization.

In order to guarantee a wide range of competencies and skills, this team was composed, on one hand, by employees working in different departments and positions (in terms of seniority) – with a deep knowledge on company processes and culture; on the other hand, by new hired people with both technical and management background – able to be effective change agents for the ASTS organization.

Step 3 – Create a vision for change

With the scope of allowing everyone understand what the organization was trying to achieve within a scheduled time frame, the CEO defined his clear vision by launching the *V2A Program*. Three workstreams – *Top Line*, *New Road*, *Lean* (early explained) – for describing the expected changes and structuring the path to achieve it.

Step 4 – Communicate the vision

In order to create support and acceptance among employees, sharing that vision was crucial. A specific communication campaign dedicated to the *V2A Program* was set-up, "bolstered by constant messages from the CEO to all company personnel, in order to spread awareness of Ansaldo STS new approach" (ASTS Annual Report 2014). *Share the passion, a call for action!* was the campaign slogan: "a call to all Ansaldo STS personnel to participate in the change, each with their own professional contribution" (ASTS Annual Report 2014). Linked to the different stages of the communication process, also a specific image campaign took place through emails, intranet, in-house screens, desk calendars, meetings with management.

The goal was to make the new vision fully adopted across the entire organization.

Step 5 – Remove obstacles

Incorporating employees' ideas in the change program was the key for encouraging acceptance of the vision by all company personnel. During program deployment, all employees were asked to contribute in increasing effectiveness and efficiency on company processes by identifying new improvement ideas. With this aim, the *Lean team* published on the company intranet the *Lean & Staffing Catalogue* – a collection of improvement actions to put in place into organization projects – to be continuously updated based on employees' feedbacks and suggestions.

Step 6 – Create short-term wins

In order to motivate people, short-term goals were defined. The whole program aimed to change ASTS way of working by re-designing some organization processes. Some identified improvement actions could be implemented in the short term, resulting in quick wins even from an economic perspective. The first results project teams experienced were a fundamental motivation driver for all in the organization in spreading out the changes within the whole company. A company policy to reward the employees most involved in the change process was an additional factor for motivating all personnel.

Step 7 – Consolidate improvements

ASTS top management were properly aware that quick wins can be considered only the beginning of a change program. In fact, despite yearly economic target, the *V2A Program* was set-up as a three-year program since some changes were considered slow-going processes to be driven into the overall corporate culture. In order to constantly increase effectiveness and efficiency within the organization, all the employees are asked to continuously looking for new improvement ideas.

Step 8 – Anchor the changes

Only once the advantages brought by changes have been validated and consolidated, ASTS organization pushed – and still it is pushing – to anchor those changes. In this phase, it is required a full changes deployment into the whole organization. Even though changes are consolidated, employees were – and still are – continuously asked to support the change, provide feedbacks and new ideas for further improving the current status.

At the beginning of 2016, due to the different status of the *V2A* improvement initiatives, ASTS is living these two last phases. While some *improvement initiatives* are in consolidation phase, others – already validated – are under a full deployment stage across the whole organization, ensured by a structured KPIs monitoring system. Within the *V2A Program*, the *Lean* workstream clearly represents the most disruptive initiative ASTS is running since it aims to change operative processes in projects delivering.

4.3. The *Lean* workstream

The *Lean* workstream purpose is to optimize internal costs over their whole life cycle, by simplifying the delivery processes. Thanks to the identification of areas of improvement within organization processes, the Lean workstream aims to put in place actions for improving the AS IS Processes, cutting internal costs and speeding up delivery time but also guarantying quality of deliverables.

The ASTS "*leanification*" is a real cultural change challenge on which the company top management is strongly committed, as stated in the ASTS Annual Report 2014: "Ansaldo STS' Lean Methodology is a bona fide cultural revolution in how company activities and processes are managed and requires the entire company workforce to change their approach".

Launched at the beginning of 2014, as part of the *V2A Program*, the *Lean* workstream is still now under execution across the whole organization, following the initial three-year deployment plan (2014-2016).

At the *V2A* launching phase, in order to build a structured *lean architecture*, a team full dedicated to such workstream was composed – the *Lean team* – with the intent of leading and driving lean initiatives across the company and representing a reference point for the entire organization. The *Lean team* – together with the whole *V2A Program* organization – was institutionalized into the company organizational chart, under the *Strategy, Quality & Improvement* unit.

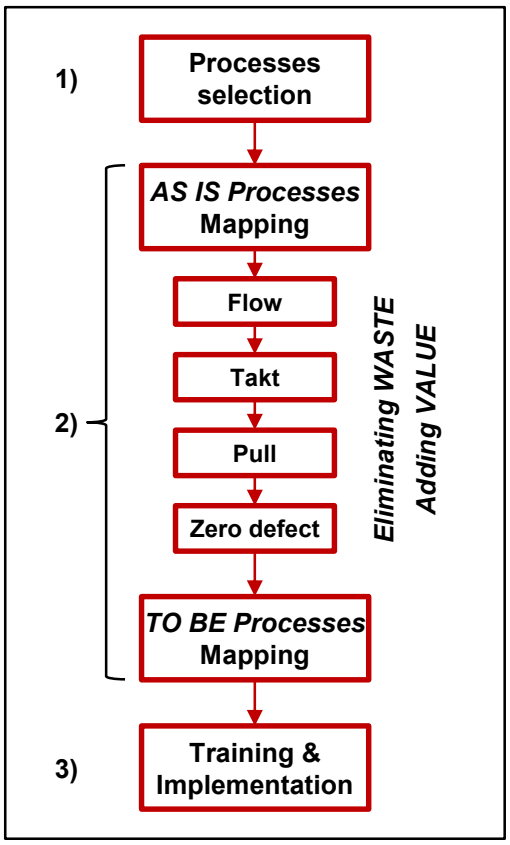
For ensuring a miscellaneous of competencies and skills, the *Lean team* involved personnel with a solid technical background, co-opted an employee from the Controlling department and hired some people with a strong experience in change program deployment.

In order to physically cover all the main company geographies, a referent was selected for all main regions: Italy, France, USA and India.

In order to improve ASTS way of working, based on lean principles, the *Lean team* – as shown in Figure 4.1 – has:

1. identified the main company processes to address;
2. run – and it is still running – VSM activities looking for improvement actions able to optimize processes;
3. done lean trainings – still taking place – for employees, in order to enable them to absorb lean principles and apply improvement actions on processes, thereby enhancing performance in projects delivery.

Figure 4.1 Lean implementation in Ansaldo STS



Source: elaboration on Rother and Shook (1998)

4.3.1. Processes selection

The first step for applying lean methodology in the organization has been the identification of the main company processes (= technologies) along both *Signalling* and *Transportation solutions* business units.

Starting from the products portfolio, *Lean team* has identified seventeen main technologies run by the company in delivering projects. In order to facilitate all the efficiency initiatives to be run along the company, the *Lean team* has nominated – for

each technology – an *Initiative Leader* (IL), a Functional Manager responsible for the lean methodology deployment into his/her technology.

Based on lean principles, the *Lean team* has focused the analysis to the entire end-to-end processes, certain to be able to improve processes by addressing a bigger room for efficiency. By addressing the end-to-end processes, the *Lean team* analysis touches all main functions/departments involved in the processes, which are Engineering (ENG), Development (DEV) and Reliability, Availability, Maintainability and Safety (RAMS).

Starting from the main seventeen technologies, a first wave of VSM events have been run in 2014, involving seven technologies. A second wave, including five technologies, has been run across the end of 2015 and the beginning of 2016. A third wave – to be run in 2016 – is under planning.

4.3.2. Value streams (AS IS and TO BE) mapping

A VSM event has been set-up for each technology. In order to facilitate participants' attendance, those events have been located at the company regional office where the most of the technology expert employees were based.

Indeed, the first wave of seven VSMs took place in France (3), USA (2) and Italy (2), while the second wave of five VSMs have been run in Italy (3) and France (2).

The key roles in a VSM event deployment are:

- the technology IL, leader and responsible for the VSM event;
- one *Lean team* member, in the role of event facilitator;

- one/two referent(s) for each function (ENG, DEV, RAMS) involved in that technology.

In selecting the VSM participants the intent has been to involve only key technology figures in order to avoid useless crowded round table, but to only have people who can, based on their role/knowledge/competencies, really add value to the event thanks to a proactive behavior and a decision making attitude.

In accordance with lean principles, the VSM event agenda is basically threefold:

a) AS IS mapping:
   - tracing activities flow, including interactions, reiterations and re-work interactions (see example in Figure 4.2);
   - calculating the whole process lead time = cycle time + not-value added activities / waste (rework, waiting time, etc.) of each activity.

b) Lean principles application to the AS IS Process:
   - identifying *improvement actions* (IAs);
   - prioritizing IAs based on impact (in terms of saving on projects) and feasibility (in terms of cost), identifying:
     - quick wins: actions to be immediately implemented with a short-term impact;
     - long-term improvements: actions that require more effort and time to be implemented with a long-term impact.

c) TO BE mapping:
   - collecting the identified improvement actions in the *Lean & Staffing Catalogue* in order to support all employees in the IAs implementation;
   - tracing the new activities flow (interactions, reiterations and re-work);

- calculating the new – more efficient – whole process lead time.

  Based on wave 1 VSM events, the percentage of reprocessing (waste) into AS IS Processes on average was roughly 20-30% (ASTS Annual Report 2014).

Figure 4.2 AS IS Process Mapping example

Source: Ansaldo STS VSM event

Published on the company intranet, the *Lean & Staffing Catalogue* started to collect all improvement actions gathered during VSM events. But it is a dynamic collection tool, ready to receive all the feedbacks / new improvement ideas any employee may find and suggest to the *Lean team*, according to the lean principle of the *continuous improvement*.

Once defined the TO BE Processes, a piloting phase was required to validate the new flow agreed during VSM events.

Only once the piloting phase have validated the consistency of what drawn during VSM events, the implementation phase was ready to be launched. Of course, a proper training is required for enabling employees to implement IAs based on lean principles.

4.3.3. Lean trainings for supporting implementation

In order to enable all employees to effectively implement improvement actions – based on lean methodology – on projects, a *Lean training* has been set-up in the company.

With the scope of spreading-out lean principles as far as possible in ASTS organization, the *Lean team* has fixed lean training sessions around all the main company regions.

Starting from Italy, lean trainings were run in 2014 also in France and USA. Early 2015 a session took place in Australia and a second round again in Italy and France, while since July 2015 I personally took the leadership of this lean training running three sessions in India and one more in Italy. A plan for additional lean trainings to be run in 2016 is currently under definition.

In order to run such cultural change within a big international company (as ASTS), a strong commitment from top management is strictly required. This is the reason why Ansaldo STS top management has been the first group to follow the lean training. Following lean trainings have been addressed to the rest of the company by running down the organizational chart, layer by layer. Based on both theoretical topic and

role-play simulation (as shown in Figure 4.3), lean training has been touching an increasing number of personnel since its launch. Approximately 400 company employees from all the geographies have been trained on lean principles and enabled to effectively implement improvement actions on projects. A cascading communication from lean training attendees to their colleagues is clearly needed in order to spread-out as much as possible lean methodology across the entire company and boost the desired cultural change.

Figure 4.3 Lean trainings run in India

Source: Ansaldo STS lean trainings

In order to deploy the lean methodology into the whole organization in a structured way, a framework has been adopted. The entire company is asked to achieve

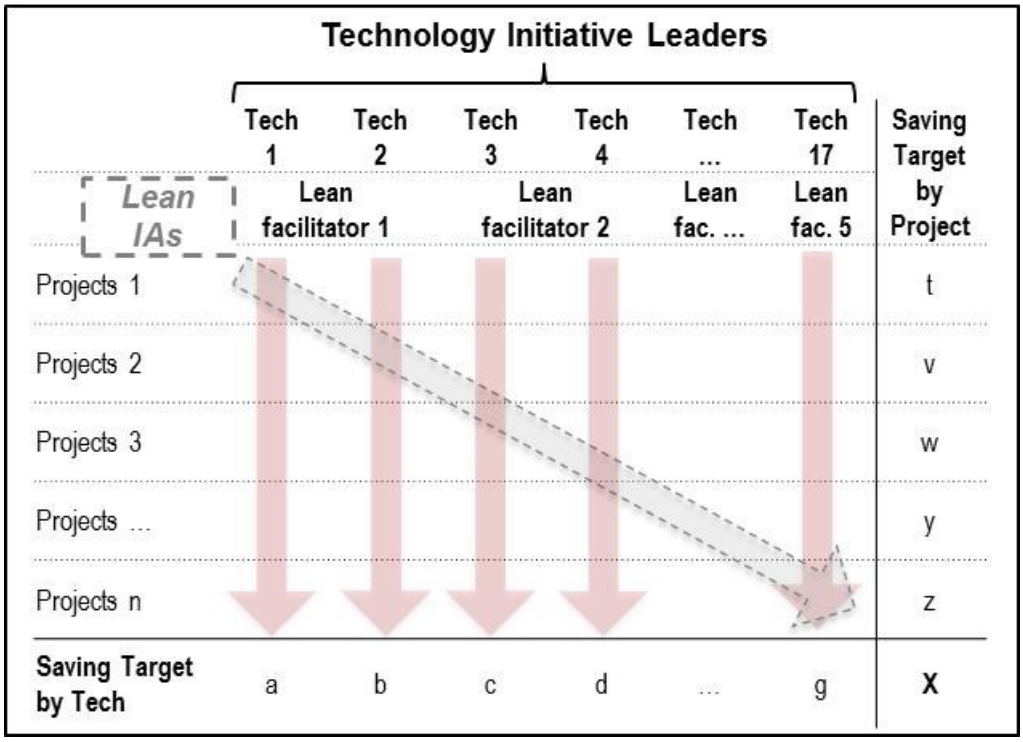
efficiency results – in terms of saving – by putting in place the IAs identified thanks to VSM events and collected into the *Lean & Staffing Catalogue*.

On the one hand, ILs are called to meet a yearly saving target for technology by bringing IAs / efficiency on projects where their technologies are involved; on the other hand, each project team has a saving target to achieve by putting in place the IAs identified within lean methodology.

In order to coordinate and facilitate those two perspective (technology-wise and project-wise), each *Lean team* member has been assigned to follow and support some ILs in bringing efficiency on projects.

Figure 4.4 describes the framework ASTS is adopting for this workstream deployment.

Figure 4.4 Lean implementation framework in Ansaldo STS



Source: elaboration on Ansaldo STS methodology

A periodic monitoring of performance – in terms of IAs implemented and saving achieved – takes regularly place in order to follow the progress of each technology and share results with the company top management.

4.4. KM, CM and lean thinking in Ansaldo STS

After had deeper described how Ansaldo STS has been deploying the *Values to Actions* change program, and how it has been applying lean methodology by heavily investing in knowledge sharing (lean trainings), it appears particularly interesting to highlight the integrated view ASTS has been implicitly adopting on KM, CM and lean approaches.

In order to clearly represent this view, the theoretical framework early presented in paragraph 3.1 – introducing the interactions among KM, CM and lean approaches – could be very useful. Starting from this paradigm (Figure 3.1), hereunder proposed an integrated view of KM, CM and lean adoption within the *Lean* workstream implementation into Ansaldo STS (see Table 4.1).

After had seen how a consolidated change model (Kotter's 8 step change model) has been implicitly adopted for the whole *V2A Program* roll-out, it is interesting to underline how even in the *Lean* workstream implementation, change models could be applied to the different steps of the VSM technique deployment.

The lean methodology aims to bring changes into an organization by leveraging on the new knowledge that it has created (lean principles-based) and this tight

interaction appears clear in Table 4.1 where, following the four VSM steps, a correlation among CM, KM and lean approaches is identified.

Table 4.1 Integrated view of KM, CM and Lean approaches in Ansaldo STS

VSM Steps	Change Management view	Lean view (VSM activities)	Knowledge Management view
Getting started - Processes selection	Need for change	2014: 7 signalling technologies addressed 2015-2016: 5 signalling technologies addressed (Each tecnology involves several company Functions; the main are ENG, DEV, RAMS)	Supported by top management knowledge, the *Lean team* identified the main company processes implemented on projects
Current state map / Mapping the AS IS Process	Understanding the change	Facilitated by the *Lean team* , all VSM events - led by the technology Initiative Leader (IL) - involved 1/2 referent(s) for each Function involved in the technology Working on clearly identifying: - activities flow - interactions and reiterations among activities - reworks (real or possibile) - activities lead time = cycle time + not-value added activities (waste) Draw the AS IS Process	KNOWLEDGE CREATION When the current *modus operandi* is not yet commonly shared, a new knowledge is created among VSM event attendees by aggregating knowledge from each Functional referent KNOWLEDGE STORING Mapping AS IS Process in soft copy. Reserved data repositories created
Future state map / Mapping the TO BE Process	Planning the change	By leveraging on lean principles, identify IAs for increasing value added activities and reducing waste, aiming to make processes more efficient Prioritize IAs based on impact / feasibility Draw the TO BE Process	NEW KNOWLEDGE CREATION By working together, VSM event attendees created a new knowlegde by defining the TO BE Process NEW KNOWLEDGE STORING Mapping TO BE Process in soft copy. Reserved data repositories created
Implementation	Implementing the change	IAs collection in Lean & Staffing Catalogue A first Piloting phase required to validate assumtpions made within the TO BE Process mapping Apply the TO BE Process on current and future projects with a positive impact in terms of efficiency	NEW KNOWLEDGE SHARING Once defined the TO BE Process, the new knowledge is transmitted to all employees thanks to: - opened data repositories - cascading communication NEW KNOWLEDGE APPLICATION By adopting the TO BE Process on projects, the new knowledge is applied

Source: author elaboration

Once the *Need for change* arose for ASTS organization, the *Lean team*, bolstered by top management, launched the VSM activities through the *Getting started* phase. The identification of the key processes (technologies) run across the company was realized by leveraging on the existing organization knowledge. Indeed, top management supported the *Lean team* in prioritizing company areas to address.

During the *Current state map*, the involved people, getting aware of the complete AS IS Process, started to identify waste areas and room for efficiency, perceiving then opportunity for change (*Understanding the change*). By sharing and aggregating all VSM participants' contribution and knowhow, the current underlying company *modus operandi* is clearly defined, making knowledge moving from tacit to explicit (*Knowledge creation*). A proper soft copy representation of the TO BE Process – uploaded on company data repositories – allows an effective *Knowledge storing*.

In the *Future state map*, the identified change start to be planned (*Planning the change*) for realizing the future desired value stream. By working together and defining the TO BE Process, VSM attendees create an additional knowledge (*Knowledge creation*), again to be adequately stored – on soft copy basis – in reserved company repositories (*Knowledge storing*).

Finally, by implementing the TO BE Process (*Implementation* phase), the change is really applied (*Implementing the change*). Only during the future value stream (piloting first and then) adoption on (current and future) projects, the knowledge created can be: a) shared (*Knowledge sharing*), supported by both opened data repositories and cascading communication, and b) applied (*Knowledge application*) along all the ongoing and upcoming company projects.

4.5. Change program results

During last two-year period (2014-2015) – corresponding to the *V2A Program* deployment – Ansaldo STS performance significantly increased. Taking in consideration the same KPIs investigated at the beginning of this chapter for the previous period (2010-2013), it is possible to notice a significant improvement on results (based on CAGR 2014-2015). Not only on top line where Revenues performed +6.1% vs -1.4% (2010-2013), but even regarding processes effectiveness and efficiency with EBIT +7.7% vs -5.1% (2010-2013); whereas New orders, after a pick in 2014 (+23.0% vs 2013) decreased in 2015 for a CAGR 2014-2015 of -5.1%: performance not positive but still an improvement if compared to the previous one (-9.2%, 2010-2013).

Of course, all those improvements cannot be exclusively linked to the *Values to Actions* deployment but such change program has given a great contribution in concretely change the ASTS way of work with a positive impact also on economic results, as also the CEO stated: "Our Group is successfully reacting to this scenario (*Ed.* strong competition and constant pressure on signalling market margins) both by leveraging its technological leadership…and by constantly pursuing for further areas of efficiency and effectiveness through specific plans, including the latest one launched, V2A – from Values to Actions – which, in respect to our values and our tradition, is ensuring significant results" (ASTS Consolidated and draft financial statements 2014).

Some *V2A* results are separately accounted in the company annual reports whereas others are embedded in the overall company performance. For instance, in the 2014

the company Finance office has clearly allocated to the *New Road* workstream € 40 million as efficiency for the entire life cycle of the macro-category of costs addressed (ASTS Annual Report 2014), whereas all the efficiency results achieved by the *Lean* workstream missed an independent identification in the financial statement. In fact, all the efficiency coming from lean improvement actions are embedded in the overall projects performance, either covering extra-costs (if any, compared to the initial project budget) or increasing projects margin.

4.6. What next: will Hitachi continue in lean deployment across ASTS organization?

Launched in 2014, the *Values to Actions* is a change program planned for a three-year deployment. At the beginning of 2016, ASTS is still energetically investing in such change where the *Lean* workstream represents the main focus of the 2016 plan.

Based on experience and results achieved during the first two-year adoption, the *Lean team* has slightly refined the lean implementation framework (early described in Figure 4.4). The enhanced framework has been presented to both top management and change agents for launching the 2016 lean efficiency initiative.

The overall organization is committed in investing further time and effort in the *Lean* workstream implementation, sure that – following the lean principle of *continuous improvement* – further *room for efficiency* is still to be addressed and over-performance is likely to be achieved again. However, the continuous rumors about the Hitachi future strategy are destabilizing the company environment. On one hand,

day-by-day issues require an incessant adoption of lean principles for enhancing projects performance; on the other hand, an uncertainty regarding what a possible integration with Hitachi could change (compared to current ASTS strategy) arise among personnel.

The question which spontaneously arise is: will Hitachi continue in lean deployment across ASTS organization ?

On one hand, there is a moderate confidence because lean is a Japanese methodology and Hitachi – as Japanese company – should be happy to find such an investment in lean adoption run by a just-acquired company. On the other hand, Hitachi (with Revenues of $ 81.3 billion and more than 330k employees – 2014 data) is a worldwide corporation – operating in several industries (e.g. Healthcare Company, Power Systems Company, Infrastructure Systems Company, Industrial Products Company, Rail Systems Company, Urban Planning and Development Systems Company, Defense Systems Company, Information & Telecommunication Systems Company, Energy Solutions Company) – that may implement, across the numerous companies owned, shared strategies which could differ from the ones ASTS is currently executing.

The uncertainty related to the close integration with Hitachi – and its consequences in terms of following strategies – could seriously undermine ASTS employees' commitment in lean implementation. Therefore, this uncertainty – and the subsequent repercussion on personnel commitment – represents the biggest risk ASTS is currently running for a successful 2016 lean implementation across the whole organization.

More than the 2016 lean implementation plan, the most crucial challenge *Lean team* will face is to properly manage this transition period – by gaining personnel commitment – and effectively run this year efficiency initiative.

Conclusions

Thanks to a literature review of KM and CM, clear interaction links to the lean methodology have been detected. An integrated framework among the three approaches has been proposed – and applied into an international company, as business case – underlying the benefits, in terms of synergy, coming from this integration.

Since such integrated view has not yet been sufficiently studied in literature, the framework here proposed brings an advancement on this research topic, representing the main contribution for scholars.

Interesting appear also the managerial implications for practitioners involved in running a change management program through the lean methodology adoption, with some valuable guidance on KM, CM, cultural change and lean adoption topics.

A company that aims to successfully deploy the lean methodology along its organization has to properly deal with KM and CM topics. Lean adoption brings new knowledge and changes into an organization: KM supports in handling current and new knowledge, while CM manages the transition between current and future scenarios.

An integrated KM, CM and lean framework will definitely boost management in a successful lean culture dissemination within an organization. The proposed business case (Ansaldo STS) validates such theory giving an example of a successful framework adoption within an international company where obstacles are even more challenging.

Nevertheless, the positive application of this integrated framework to only one business case represents the main limit of this research. In order to validate such theory, a future research challenge is to expand such analysis on a wide basket of companies.

Bibliography

Alavi, M.,Leidner, D.E., (2001), "Knowledge management and knowledge management systems: Conceptual foundations and research issues", *MIS Quarterly*, Vol. 25, No. 1, pp.107-136.

Alonderiene, R., Pundziene, A., Krisciunas, K., (2006), "Tacit Knowledge Acquisition and Transfer in the Process of Informal Learning", *Problems and Perspectives in Management*, Vol. 4, No. 3, pp.134-145.

Alpert, S., Whetten, D. A., (1985), "Organizational Identity", *Research in Organizational Behavior*, 7, 263-502.

Amit, R., Schoemaker, P. J., (1993), "Strategic assets and organizational rent", *Strategic Management Journal*, 14(1), 33-46.

Argote, L., Beckmann, S., Epple, D., (1990), "The Persistence and Transfer of Learning in Industrial Settings", *Management Science*, 36(2), 140-154.

Argyis, C., Schoen, D.A., (1978), "Organizational Learning: A Theory of Action Perspective", Addison-Wesley, Reading MA.

Awad E.M., Ghaziri H.M., (2004), *Knowledge Management*, Prentice Hall, New Jearsey

Bahra, N., (2001), *Competitive Knowledge Management*, Palgrave, New York.

Baker, M., Barker, M., Thorne, J., Dutnell, M., (1997), "Leveraging human capital", *Journal of Knowledge Management*, Vol. 1, No. 1, pp.63-74.

Barney, J., (1991), "Firm resources and sustained competitive advantage", *Journal of Management*, 17(1), 99-120.

Bath G., (2000), "Information dynamics; learning and knowledge creation in organizations", *The Learning Organization*, Vol. 7, No. 2, pp. 89-98.

Becerra-Fernandez, I.,Gonzalez, A., Sabherwal, R, (2004), *Knowledge management challenges, solutions, and technologies*, Person Prentice Hall, New Jersey.

Beer, M., Nohria, N., (2000), "Cracking the Code of Change", *Harvard Business Review*, (May-June).

Beijerse, R.P., (2000), "Knowledge management in small and medium – sized companies: knowledge management for entrepreneurs", *Journal of Knowledge Management*, Vol. 4, No. 2, pp.162–179.

Bender, S., Fish, A., (2000)," The transfer of knowledge and the retention of expertise: the continuing need for global assignments". *Journal of Knowledge Management*, 4(2), 125-137.

Bennet, D., Bennet, A., (2008), "Engaging tacit knowledge in support of organizational learning", *The Journal of Information and Knowledge Management Systems*, Vol. 38, No. 1, pp.72-94.

Besterfield, D.H., (1999), *Total Quality Management*, Prentice Hall, Upper Saddle River, New Jersey.

Bierly, P., Kessler, E., Christensen, E., (2000), "Organizational learning, knowledge and wisdom", *Journal of Organizational Change Management*, Vol. 13, No. 6, pp.595-618.

Black, J. A., Boal, K. B., (1994), "Strategic resources: Traits, configurations and paths to sustainable competitive advantage", *Strategic Management Journal*, 15(S2), 131-148.

Blauner, R., (1964), *Alienation and Freedom*, University of Chicago Press, Chicago.

Blumentritt, R., Johnston, R., (1999), "Towards a strategy for knowledge management", *Technology Analysis and Strategic Management*, Vol. 11, No. 3, pp.287-300.

Bollinger, AS, Smith, RD, (2001), "Managing organizational knowledge as a strategic asset", *Journal of Knowledge Management*, vol. 5, no. 1, p. 8-18.

Botkin, J. W., (1999), *Smart business: How knowledge communities can revolutionize your company*. The Free Press, New York.

Brauner, E., Becker, A., (2006), "Beyond Knowledge Sharing: The Management of Transactive Knowledge Systems", *Knowledge and Process Management*, 13(1), 62-71.

Brown, J.S., Duguid, P., (1991), "Organizational learning and communities-of- practice: Toward a unified view of working, learning, and innovation". *Organizational Science*, 2(1), 40-57.

Brumagin, A.L., (1994), A hierarchy of corporate resources. In P. Shrivastava, A.S. Huff, and J.Dutton, eds., *Advances in Strategic Management: A Resource-Based View of the Firm*, CT: JAI Press, Greenwich.

Burnes, B., (2004), "Kurt Lewin and the planned approach to change: a re-appraisal", *Journal of Management Studies*, 41(6), 977-1002.

Caldwell, B., (1994), "Missteps, Miscues", *InformationWeek*, June 20.

Cameron, K. S., (1998), "Strategic Organizational Downsizing: An Extreme Case", *Research in Organizational Behavior*, 20, 185-229.

Cameron, K. S., "Downsizing, Quality, and Performance", In Cole, R. E., (1995), *The death and life of the American quality movement*, Oxford University Press, USA.

Cameron, K. S., "Ethics, Virtuousness, and Constant Change." In Tichy, N. M., McGill, A. (2003), *The ethical challenge: How to lead with unyielding integrity*, John Wiley & Sons, New Jersey.

Cameron, K. S., "Techniques for Making Organizations Effective: Some Popular Approaches." In Druckman, D., Singer, J. E., Van Cott, H., (1997), *Enhancing organizational performance*, National Academies Press, Washington.

Cameron, K. S., Bright, D., Caza, A., (2004), "Exploring the Relationships Between Organizational Virtuousness and Performance", *American Behavioral Scientist*, 47, 766-790.

Cameron, K. S., Ettington, D. R., "The Conceptual Foundations of Organizational Culture", in Paulsen, M. B., Smart, J. C., (1988), *Higher education: Handbook of theory and research*, Springer .John C. Smart (ed.), Norwell, Mass. Kluwer.

Cameron, K. S., Freeman, S. J., Mishra, A. K., (1991), "Best Practices in White-Collar Downsizing: Managing Contradictions", *Academy of Management Executive*, 5, 57-73.

Cameron, K. S., Quinn, R. E., (2005), *Diagnosing and changing organizational culture: based on the competing values framework*, John Wiley & Sons, New Jersey.

Carlucci, D., Marr, B., Schiuma, G., (2004), "The knowledge value chain: how intellectual capital impacts on business performance", *International Journal of Technology Management*, Vol. 27, Nos. 6/7, pp.575-590.

Coch, L., French, J.R.P. Jr., (1948), "Overcoming resistance to change", *Human Relations*, 1(4), 512-532.

Cohen, W.M., Levinthal, D.A., (1990), "Absorptive capacity: A new perspective on learning and innovation", *Administrative Science Quarterly*, 35(1), 128-152.

Collins, H., (1993), "The Structure of Knowledge", *Social Research*, Vol. 60, pp.95-116.

Collison, S., Gregson, G., (2003), "Knowledge networks for new technology-based firms: An international comparison of local entrepreneurship promotion", *R&D Management*, 33(2), 189-208.

Conner, K. R., Prahalad, C. K., (1996), "A resource-based theory of the firm: Knowledge versus opportunism", *Organization science*, 7(5), 477-501.

Cox, T., (1991), "The Multicultural Organization", *Academy of Management Executive*, 5, 34-47.

Cross, R., Laseter, T., Parker, A., Velasquez, G., (2006), "Using Social Network Analysis to Improve Communities of Practice", *California Management Review*, 49(1), 32-60.

Cross, R., Sproull, L., (2004), "More Than an Answer: Information Relationships for Actionable Knowledge", *Organization Science*, 15(4), 446-462.

Crossan, M. M., Lane, H. W., White, R. E., (1999), "An organizational learning framework: From intuition to institution", *Academy of Management Review*, 24(3), 522-537.

CSC Index, (1994), *State of Reengineering Report (North America and Europe)*, CSC Index, Cambridge, Mass.

Cuel, R., Bouquet, P, Bonifacio, M., (2006), "Distributed Knowledge Management". In: Schwartz, D.G., *Encyclopedia of Knowledge Management*, Idea Group Reference, Hershey PA.

Cusumano, M. A., Studies, H. U. C. o. E. A., (1985), *The Japanese automobile industry: Technology and management at Nissan and Toyota*, Harvard University Press Cambridge, MA.

Dale, B. G., Van Der Wiele, T., Van Iwaarden, J., (2007). *Managing quality*, John Wiley & Sons, New Jersey.

Darr, E.D., Argote, L., Epple, D., (1995), "The Acquisition, Transfer and Depreciation of Knowledge in Service Organizations: Productivity in Franchises", *Management Science*, 41(11), 1750-1783.

Darroch, J., McNaughton, R., (2002), "Examining the link between knowledge management practices and types of innovation", *Journal of Intellectual Capital*, vol. 3, no. 3, pp. 210-22.

Davenport, T. H., Prusak, L., (1998), *Working Knowledge: How Organizations Manage What They Know*, Harvard Business School Press, Boston.

Davenport, T.H., De Long, D.W., Beers, M.C., (1998), "Successful knowledge management projects", *Sloan Management Review*, Vol. 39, No. 2, pp.43-57.

Davidson, C, Voss, P., (2002), "Getting practical about knowledge management", *NZ Business*, vol. 16, no. 3, p. 10-1.

Dawson, P., (1994), *Organizational Change: A Processual Approach*,Paul Chapman Publishing, London.

De Jager, P., (2001), "Resistance to change: a new view of an old problem", *The Futurist*, May – June, 24-27.

Deal, T. E., Kennedy, A. A., (1982), *Corporate Cultures: The Rights and Rituals of Corporate Life*, Addison-Wesley, Boston.

Debowski, S., (2006), *Knowledge Management*, John Wiley & Sons, Milton, Queensland, Australia.

DeLong, G., (1997), *Building the knowledge-based organization: how culture drives knowledge behaviours*. Working paper, Boston: Ernst & Young's Center for Business Innovation.

Deming, W. E., (1952), *Elementary principles of the statistical control of quality: a series of lectures*. Nippon Kagaku Gijutsu Remmei.

Denison, D. R., (1990), *Corporate Culture and Organizational Effectiveness*, Wiley, Hoboken, New Jersey.

Dixon, N.M., (2000), *Common Knowledge: How Companies Thrive by Sharing What They Know*, Harvard Business School Press, Boston.

Drucker, P.F., (1994), "The age of social transformation", *The Atlantic Monthly*, November, 274(5), 53-80.

Elrod II, P. D., Tippett, D. D., (2002), "The "death valley" of change", *Journal of Organizational Change Management*, 273-291

Flower, O. D., (1962), *Overcoming resistance to change*, Roundtable Productions, Beverly Hills, CA.

Flynn, B. B., Schroeder, R. G., Sakakibara, S., (1994), "A Framework for Quality Management Research and an Associated Measurement Instrument", *Journal of Operations Management*, 11(4), pp. 339-366.

Ford, H., (1927), *Today and Tomorrow*, New York.

Forza, C., (1996), "Work organization in lean production and traditional plants: what are the differences?", *International Journal of Operations & Production Management*, *16*(2), 42-62.

George, J. M., Jones, G. R., (2002), *Understanding and Managing Organizational Behavior*, 3rd ed., Prentice Hall, New Jersey

Goh, S.C., (2002), "Managing effective knowledge transfer: an integrative framework and some practice implications", *Journal of Knowledge Management*, 6(1), 23-30.

Gold, A.H., Malholtra, A., Segars, A.H., (2001), "Knowledge management: an organizational capabilities perspective", *Journal of Management Information Systems*, 18(1), 185-214.

Gordon, G. W., (1991), "Industry Determinants of Organizational Culture", *Academy of Management Review*, 16, 396-415.

Gore, C., Gore, E., (1999), "Knowledge management: the way forward", *Total Quality Management*, Vol. 10, No. 4&5, pp.554-560.

Grant, R.M., (1996), "Toward a Knowledge-based Theory of the Firm", *Strategic Management Journal*, Winter Special Issue 17, 109-122.

Grant, R.M., (2005), *Contemporary strategic analysis*, 5th edition, Blackwell, Oxford.

Greif, M., (1991), *The Visual Factory: Building Participation through Shared Information*, Productivity Press, Portland.

Gross, T., Pascale, R., Athos, A., (1993), "The Reinvention Roller Coaster: Risking the Present for a Powerful Future", *Harvard Business Review*, November-December, pp. 97-107.

Gulati, R., Gargiulo, M., (1999), "Where Do Interorganizational Networks Come From?", *The American Journal of Sociology*, 104(5), 1439-1492.

Gupta, B., Iyer, L., Aronson, J., (2000), "Knowledge management: practices and challenges", *Industrial Management & Data Systems*, Vol. 100, No. 1, pp.17-21.

Hall, R., (1992), "The strategic analysis of intangible resources", *Strategic Management Journal*, 13(2), 135-144.

Hamel, G., Prahalad, C. K., (1991), "Corporate imagination and expeditionary marketing", *Harvard Business Review*, 69(4), 81-92.

Hammer, M., Champy, J., (1993), *Reengineering the Corporation: A manifesto for business Revolution*, Harper Business, New York.

Hansen, M.T., Nohria, N., Tierney, T., (1999), "What's your strategy for managing knowledge?", *Harvard Business Review*, 77(2), 106-116.

Hargadon, A., (2003), *How breakthroughs happen: The surprising truth about how companies innovate*, Harvard Business School Press, Boston.

Haveman, H. A., Russo, M. V., Meyer, A. D., (2001), "Organizational environments in Flux: the impact for regulatory punctuations on organizational domains, CEO succession, and performance", *Organization Science*, 12, 253-273.

Helleloid, D., Simonin, B., (1994), *Organizational learning and a firm's core competence*. In: Hamel, G., Heene, A., (Eds.), *Competence-based competition. Chichester*: John Wiley & Sons.

Hofstede, G. H., Hofstede, G., (2001), *Culture's consequences: Comparing values, behaviors, institutions and organizations across nations*, Sage, Thousand Oaks, California.

Holweg, M., (2007), "The genealogy of lean production", *Journal of Operations Management,* 25(2), 420-437.

Hultman, K., (1979), *The Path of Least Resistance*, Learning Concepts, Denton, TX.

Imai, M., (1997), *Gemba Kaizen: A Commonsense, Low-Cost Approach to Management*, McGraw-Hill, London.

Inkpen, A.C., Dinur, A., (1998), "Knowledge management processes and international joint venture", *Organization Science*, Vol. 9, No. 4, pp.454-68.

James, P., (2005), "Knowledge Asset Management: The Strategic Management and Knowledge Management Nexus", *DBA thesis*, Southern Cross University.

Jashapara, A., (2004), *Knowledge Management: An Integrated Approach*, Prentice Hall, London.

Jennex, M.E., Olfman, L., (2006), "A model of knowledge management success", *International Journal of Knowledge Management*, vol. 2, no. 3, pp. 51-68.

Jerimier, J. M., Slocum, J. W., Fry, .L. W., Gaines, J., (1991), "Organizational Subcultures in a Soft Bureaucracy: Resistance Behind the Myth and Facade of an Official Culture", *Organization Science*, 2, 170-195.

Jones, D. T., Womack, J. P., (2002), *Seeing the whole–mapping the extended value stream*, The Lean Enterprise Institute, Brookline, MA.

Jones, G. R., (2004), *Organization Theory, Design, and Change*, Addison-Wesley Publishing Company, New York

Karlsson, C., Ahlstrom, P., (1996), "Assessing changes towards lean production", *International Journal of Operations & Production Management*,*16*(2), 24-41.

Katzenbach, J. R., Steffen I., Kronley C., (2012), "Cultural Change That Sticks. Start with what's already working", Harvard Business Review, (July-August), pp. 111-117.

Kegan, R., Lahey, L., (2001), "The real reason people won't change", *Harvard Business Review*, November, 85-92.

Kelleher, D., Levene, S., (2001), *Knowledge Management: A Guide to Good Practice*, British Standards Institution, London.

Kim, W.C., Mauborgne, R., (2003), "Fair Process: Managing in the Knowledge Economy", *Harvard Business Review*, January, pp. 127-136.

Klein, G. (2003), *Intuition at Work: Why Developing Your Gut Instincts Will Make You Better at What You Do*, Doubleday, New York.

Kogut, B., Zander, U., (1992), "Knowledge of the firm, combinative capabilities, and the replication of technology", *Organization science*, 3(3), 383-397.

Kotter, J. P., (1995), "Leading change: Why transformation efforts fail", *Harvard business review*, 73(2), 59-67.

Kotter, J. P., (2008), *A sense of urgency*, Harvard Business Press, Boston.

Kotter, J. P., Heskett, J. L., (1992), *Corporate Culture and Performance*, Free Press, New York.

Kotter, J., (1996), *Leading Change,* Harvard Business Review Press, Boston.

Kraaijenbrink, J., Wijnhoven, F., (2006), "External Knowledge Integration", In: Schwartz, D.G., *Encyclopedia of Knowledge Management*, Idea Group Reference, Hershey PA.

Krafcik, J.F., (1988), "Triumph of the lean production system", *Sloan Management Review* 30 (1), 41–52.

Kreitner R., (2004), 7th ed., *Management*, Houghton Mifflin, Boston.

Kubler, R. E., (1969), *On death and dying*, Macmillan, New York.

Lawrence, P. R., (1954), "How to deal with resistance to change", *Harvard Business Review*, 32(3), 49-57.

Lee, C.C., Yang, J., (2000), "Knowledge value chain", *Journal of Management Development*, Vol. 19, No. 9, pp.783–793.

Leonard, D., (1995), *Wellsprings of Knowledge: Building and Sustaining the Source of Innovation*, Harvard Business School Press, Boston, MA.

Leonard-Barton, D., (1992), "Core capabilities and core rigidities: a paradox in managing new product development", *Strategic Management Journal*, *13*(S1), 111-125.

Lesser, E.L., Slusher, J., Fontaine, M., (2000), *Knowledge and communities*, Butterworth-Heinemann, Boston, MA.

Lesser, E.L., Storck, J., (2001), "Communities of practice and organizational performance", *IBM Systems Journal*, 40(4), 831-841.

Lewin, K., (1947), "Frontiers in group dynamics II. Channels of group life; social planning and action research", *Human relations*, 1(2), 143-153.

Lewis, A. M., (2000), "Lean production and sustainable competitive advantage", *International Journal of Operations & Production Management*, 20(8), 959-978.

Li, M., Gao, F., (2003), "Why Nonaka highlights tacit knowledge: a critical review", *Journal of Knowledge Management*, Vol. 7, No. 4, pp.6-14.

Logan, R. K., Stokes, L. W., (2004), *Collaborate to compete: Driving profitability in the knowledge economy*. John Wiley & Sons Inc, New Jersey.

Loshin, P., (2001), "Knowledge management", *Computerworld*, vol. 35, no. 43, p. 56.

Lundvall, B.A., (1996), "The Social Dimension of the Learning Economy", *Department of Business Studies*, Aalborg University, Denmark.

Machlup, F., (1980), *Knowledge: Its Creation, Distribution and Economic Significance*, Princeton University Press, Princeton.

Mann, D., (2005), *Creating a Lean Culture: Tools to Sustain Lean Conversion*, Productivity Press, New York.

Martin, J., (1990), "Deconstructing Organizational Taboos: The Suppression of Gender Conflict in Organizations", *Organizational Science*, 339-359.

Massa, S., Testa, S., (2009), "A knowledge management approach to organizational competitive advantage: Evidence from the food sector", *European Management Journal*, vol. 27, no. 2, pp. 129-41.

McElroy, M.W., (2003), *The New Knowledge Management: Complexity, Learning, and Sustainable Innovation*, Butterworth-Heinemann, USA.

McInerney, C., (2002), "Knowledge management and the dynamic nature of knowledge", *Journal of the American Society for Information Science and Technology*, Vol. 53, No. 12, pp.1009–1018.

McManus, H.L., (2005), *Product Development Value Stream Mapping (PDVSM) Manual*, The Lean Aerospace Initiative, Cambridge.

Melton, T., (2005), "The Benefits of Lean Manufacturing: What Lean Thinking has to Offer the Process Industries", *Chemical Engineering Research and Design*, 83(6A), 662-673.

Morgan, J.M., (2002), *High Performance Product Development: A Systems Approach to a Lean Product Development Process*, Ann Arbor: The University of Michigan.

Mueller-Prothmann, T., (2006), “Knowledge Communities, Communities of Practice, and Knowledge Networks”, In: Coakes, E., Clarke, S., *Encyclopedia of Communities of Practice in Information and Knowledge Management*, Idea Group Reference, Hershey PA.

Murman, E. M., (2002), *Lean enterprise value: insights from MIT’s Lean Aerospace Initiative*. Palgrave Macmillan, New York.

Musgrave, A., (1993), *Common Sense, Science and Scepticism*, Cambridge University Press, Cambridge.

Nelson, R., (1991), “Why do firms differ, and how does it matter ?”, *Strategic Management Journal*, 12: 61-74.

Newman, B., Conrad, K., (1999), “A Framework for Characterizing Knowledge Management Methods, Practices, and Technologies”, West Richland, WA, *The Knowledge Management Forum*, in support of The Introduction to Knowledge Management, George Washington University Course EMGT 298.T1, Spring 1999

Nickerson, J., Zenger, T., (2004), “A Knowledge-Based Theory of the Firm: The Problem-Solving Perspective”, *Organization Science*, 15(6), 617-632.

Nickols F., (2000), “The Knowledge in Knowledge Management”, *The Knowledge Management Yearbook 2000-2001*, ed. J.W. Cortada and J.A. Woods, Butterworth Heinemann, 12-21.

Nohria, N., Eccles, R.G., (1992), “Face-to-face: Making network organizations work”, In: Nohria, N., Eccles, R.G. (Eds.), *Network and organizations*, Boston, MA: Harvard Business School Press.

Nonaka, I., (1991), “The knowledge-creating company”, *Harvard Business Review*, 69(6), 96-104.

Nonaka, I., (1994), “A dynamic theory of organizational knowledge creation”, *Organization Science*, 5(1), 14-37.

Nonaka, I., (2007), “The Knowledge- Creating Company”, *Harvard Business Review*, Vol. 85, No. 7&8, pp.162-171.

Nonaka, I., Konno, N., (1998), “The concept of 'Ba': building a foundation for knowledge creation”, *California Management Review*, 40(3), 40-54.

Nonaka, I., Takeuchi, H., (1995), *The Knowledge- Creating Company: How Japanese Companies Create the Dynamics of Innovation*, Oxford University Press, Oxford.

Nonaka, I., Teece, D.J., (2001), *Managing industrial knowledge: Creation, transfer and utilisation*. Sage, London.

Nonaka, I., Toyama, R., Nagata, A., (2000), "A firm as a knowledge-creating entity: a new perspective on the theory of the firm", *Industrial and Corporate Change*, 9(1), 1-20.

Nonaka, I., Von Krogh, G., Voelpel, S., (2006), "Organizational knowledge creation theory: Evolutionary paths and future advances", *Organization Studies*, 27(8), 1179-1208.

O'Dell, C., Grayson, C. J., (1998), "If only we knew what we know", *California management review*, 40(3), 154-174.

O'Dell, C., Wiig, K., Odem, P., (1999), "Benchmarking unveils emerging knowledge management strategies", *Benchmarking*, 6(3), 202-206.

O'Reilly, C., Chatman, J., Caldwell, D., (1991), "People and Organizational Culture: A Profile Comparison Approach to Assessing Person-Organization Fit.", *Academy of Management Journal*, 34, 487-516.

Ohno, T., (1988), *Toyota Production System: Beyond Large Scale Production*, Productivity Press, Cambridge, MA.

Oppenheim, B., (2004), "Lean product development flow", *Systems Engineering*, 7 (4), pp. 352-376.

Ouchi, W. G., (1981), *Theory Z: How American Business Can Meet the Japanese Challenge*, Addison-Wesley, Boston.

Pascale, R., Athos, A., (1981), *The Art of Japanese Management*, Simon & Schuster, New York.

Patton, J. R., (2007), "Metrics for knowledge-based project organizations", *SAM Advanced Management Journal*, 72(1), 33.

Pemberton, J.D., Stonehouse, G.H., (2000), "Organisational learning and knowledge assets – an essential partnership", *The Learning Organization*, vol. 7, no. 4, p. 184-93.

Peter, T., Waterman, R., (1982), *In search of excellence. Lessons from Americans Best Running Companies*, Harper & Row, New York.

Petersson, P., Johansson, O., Broman, M., Blucher, D., Alsterman, H., (2010), *Lean-Turn deviations into success! Bromma*, Part Media, Gronviksvagen, Sweden.

Pettigrew, A. M., Ferlie, E., McKee, L., (1992), *Shaping Strategic Change*, Sage, London

Polanyi, M., (1966), *The Tacit Dimension*. Anchor Day Books, New York.

Polanyi, M., (1997), "Tacit Knowledge", Chapter 7 in *Knowledge in Organizations*, Laurence Prusak, Editor. Butterworth-Heinemann: Boston.

Porter, M., 1985, *Competitive Advantage: Creating and Sustaining Superior Performance*, Free Press: New York.

Powell, W.W., (1998), "Learning from collaboration: Knowledge and networks in the biotechnology and pharmaceutical industries", *California Management Review*, 40(3), 228-240.

Probst, G., Raub, S., Romhardt, K., (2000), *Managing knowledge: Building blocks for success*, John Wiley and Sons Ltd, West Sussex, England.

Quinn, R. E., (2000), *Change the World*, Jossey-Bass, San Francisco.

Quintas, P., Lefrere, P., Jones, G., (1997), "Knowledge management: a strategic agenda", *Long Range Planning*, Vol. 30, No. 3, pp.385–391.

Rastogi, P.N., (2000), "Knowledge management and intellectual capital – the new virtuous reality of competitiveness", *Human Systems Management*, vol. 19, no. 1, pp. 39-49.

Robbins, S, Bergman, R, Stagg, I and Coulter, M., (2000), *Management*, Prentice Hall, New Jersey.

Rother, M., Shook, J., (1998), *Learning to See: Value Stream Mapping to Add Value and Eliminate Muda*, The Lean Enterprise Institute, Brookline, MA.

Ruggles, R., (1998), "The State of the Notion: Knowledge Management in Practice", *California Management Review*, 40(3), 80-89.

Sabherwal, R., Becerra-Fernandez, I., (2003), "An empirical study of the effect of knowledge management processes at individual, group, and organizational levels", *Decision Sciences*, 34(2), 225-260.

Sanchez, A. M., Perez, M. P., (2001), "Lean indicators and manufacturing strategies", *International Journal of Operations & Production Management*, Vol. 21 No. 11, pp. 1433-51.

Sanchez, R., Mahoney, J. T., (1996), "Modularity, flexibility, and knowledge management in product and organization design", *Strategic Management Journal*, 17(S2), 63-76.

Schein, E. H., (1985), *Organizational Culture and Leadership*, Jossey-Bass, San Francisco.

Schein, E. H., (1996), "Kurt Lewin's change theory in the field and in the classroom: Notes toward a model of managed learning", *Systems practice*, 9(1), 27-47.

Schonberger, R. J., (1992), "Total Quality Management Cuts a Broad Swath - through Manufacturing and Beyond", *Organizational Dynamics*, 20(4), pp. 16-28.

Seufert, A., Von Krogh, G., Bach, A., (1999), "Towards knowledge networking", *Journal of Knowledge Management*, 3(3), 180-190.

Shah, R., Ward, P. T., (2003), "Lean manufacturing: context, practice bundles, and performance", *Journal of Operations Management*, 21(2), 129-149.

Shah, R., Ward, P. T., (2007), "Defining and developing measures of lean production", *Journal of Operations Management*, 25(4), 785-805.

Shankar, R, Singh, M.D., Gupta, A., Narain, R., (2003), "Strategic planning for knowledge management implementation in engineering firms", *Work Study*, vol. 52, no. 4, pp. 190-200.

Shewhart, W. A., Deming, W. E., (1939), *Statistical method from the viewpoint of quality control*. Courier Corporation.

Simon, H.A., (1991), "Bounded rationality and organizational learning", *Organization Science*, 2(1), 125-134.

Sirkin, H. L., Keenan, P., Jackson, A., (2005), "The Hard Side of Change Management", *Harvard Business Review*, (October).

Skyrme, D., Amidon, D., (1998), "New measures of success", *Journal of Business Strategy*, 19(1),20-24.

Slack, N., Chambers, S., Johnston, R., (2007), *Operations Management*, Edinburgh Gate, Harlow, Essex: Pearson Education Limited.

Slack, R.A., (1998), *The application of Lean Principles to the Military Aerospace Product Development Process*, Massachusetts Institute of Technology, Cambridge.

Sohal, A. S., Egglestone, A., (1994), "Lean production: experience among Australian organizations", *International Journal of Operations & Production Management*, *14*(11), 35-51.

Spender, J.-C., Grant, R.M., (1996), "Knowledge and the firm: Overview", *Strategic Management Journal*, 12(5),5-10.

STA-Singapore Technologies Automobile, (1996), *Business Improvement Handbook*, 5th ed., Singapore Technologies, Singapore.

Stein, E.W., Zwass, V., (1995), "Actualizing Organizational Memory with Information Systems", *Information Systems Research*, 6(2), 85-117.

Strebel, P., (1996), "Why do employees resist change?", *Harvard Business Review*, May- Jun, *86-92*.

Summers, D, C. S., (2000), *Quality*, 2ed., Prentice-Hall, Inc, New Jersey.

Suzaki, K., (1993), *The New Shop Floor Management: Empowering People for Continuous Improvement*, The Free Press, New York.

Syed-Ikhsan, S.O.S., Rowland, F., (2004), "Knowledge management in a public organization: a study on the relationship between organizational elements and the performance of knowledge transfer", *Journal of Knowledge Management*, 8(2), 95-111.

Szulanski, G., (1996), "Exploring internal stickiness: Impediments to the transfer of best practice within the firm", *Strategic Management Journal*, Winter Special Issue 17, 27-43.

Tampoe, M., (1993), "Motivating Knowledge Workers – The Challenge for the 1990s", *Long Range Planning*, Vol. 26. No. 3. pp. 49-55.

Tan, S.S., Teo, H.H., Tan, B.C., Wei, K.K., (1998), "Developing a Preliminary Framework for Knowledge Management in Organizations", In: E. Hoadley and I. Benbasat, Proceedings of the Fourth Americas Conference on Information Systems, 629-631.

Teece, D.. (1998), “Capturing value from knowledge assets: the new economy, markets for know-how and intangible assets”, *California Management Review*, 40(3), 55-79.

Teece, D.J., (2000), “Strategies for managing knowledge assets: the role of firm structure and industrial context”, *Long Range Planning*, Vol. 33, pp.35–54.

Tiwana, A. (2002), *The Knowledge Management Toolkit*, Prentice Hall PTR, NJ, USA.

Tiwana, A., (1999), *The Knowledge Management Toolkit: Practical Techniques for Building a Knowledge Management System*, Prentice Hall, New Jersey.

Trice, H., Beyer, J., (1993), *The Cultures of Work Organizations*, Prentice Hall, Upper Saddle River, New Jersey.

Trompenaars, F., Hampden-Turner, C., (1998), *Riding the waves of culture: Understanding diversity in global business*, Mc Graw Hill, New York.

Tywoniak, S.A., (2007), “Knowledge in Four Deformation Dimensions”, *Organization*, 14(1), 53-76.

Van de Ven, A. H., Poole, M. S., (1995), “Explaining development and change in organizations”, *Academy of Management Review*, 20, 510-540.

Van Maanen, J., (1975), “Police Socialization: A Longitudinal Examination of Job Attitudes in an Urban Police Department”, *Administrative Science Quarterly*, 20, 207-228.

Van Maanen, J., Barley, S., (1984), “Occupational Communities: Culture and Control in Organizations”, *Research in Organizational Behavior*, 6, 287–365.

Van Maanen, J., Barley, S., (1985), “Cultural Organization: Fragments of a Theory.” In Frost, P. J., Moore, L. F., Louis, M. R. E., Lundberg, C. C., Martin, J. E., (1985), *Organizational culture*, Sage, Thousand Oaks, California.

Waddell D, Sohal A.S., (1998*),* “Resistance: a constructive tool for change management”, *Management Decision*, Vol. 38, Issue.8, pp. 543-548

Walters, D., Halliday, M., Glaser, S., (2002), “Creating value in the “New economy””. *Management Decision*, *40*(8), 775-781.

Waterman, R. H., Peters, T. J., Phillips, J. R., (1980), “Structure is not organization”, *Business Horizons*, 23(3), 14-26.

Wenger, E.C., (1999), *Communities of practice: Learning, meaning, and identity. Cambridge*, Cambridge University Press, Cambridge.

Wernerfelt, B., (1984), "A resource-based view of the firm", *Strategic Management Journal* 5.2, 171-180.

Wernerfelt, B., (1995), "The resource-based view of the firm: Ten years after", *Strategic Management Journal*, 16 (3), 171-174.

Wickramasinghe, N., (2006), "Knowledge Creation". In: D.G. Schwartz, *Encyclopedia of Knowledge Management*, Idea Group Reference, Hershey PA.

Wickramasinghe, N., von Lubitz, D., (2007), *Knowledge-Based Enterprise: Theories and Fundamentals*, Idea Group Reference, Hershey, PA.

Wiig, K.M., (1997), "Integrating intellectual capital and knowledge management", *Long Range Planning*, June, Vol. 30, pp.399–405.

Wilson, D. C., (1992), *A Strategy of Change*, Routledge, London.

Womack, J.P., Jones, D.T., (1996), *Lean Thinking: Banish Waste and Create Wealth in Your Corporation*, Simon & Schuster: New York.

Womack, J.P., Jones, D.T., Roos, D., (1990), *The Machine that Changed the World*, Harper Perennial, New York.

Wu, J., (2000), "Business Intelligence: The Transition of Data into Wisdom", *DM Review*, November

Yang, K., (2007), *Voice of the customer: Capture and analysis: Capture and analysis*, McGraw Hill Professional, New York.

Zander, A. F., (1950), "Resistance to change - Its analysis and prevention", Advanced Management, 4(5), 9-11. Bessant, J., Francis, D., (1999), "Developing Strategic Continuous Improvement Capability", *International Journal of Operations and Production Management*, 19(11), pp. 1106-1119.

Zikmund, W.G., (2000), *Business Research Methods*, Dryden, Fort Worth. Aiken, M., Bacharach, S. B., French, J. L., (1980), "Organizational structure, work process, and proposal making in administrative bureaucracies", *Academy of Management Journal*, 23(4), 631-652.

Websites

http://www.ansaldo-sts.com/en/index

https://www.linkedin.com/company/ansaldo-sts

http://www.hitachi.com/corporate/about/