

## FINDING PARALLELS BETWEEN KNOWLEDGE CREATION AND INVENTORY MANAGEMENT

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**Abstract:** According to studies, the total costs related to inventories usually raise to 30-60% of all company's operational costs, therefore it is necessary to manage inventory meaningfully. Inventory management deals with complexity and many coordination problems, because inventory is managed by many different people. This fact usually causes of many problems in company and in supply chain. How is it possible to deal with these complex problems? Company need to improve the learning processes to foster knowledge creation. Studying knowledge management and utilization of these ideas in specific problematic of inventory management can bring competitive advantage for company and whole supply chain. This article contains the Fundamental model of inventory management in knowledge-based company that tries to outline the possible way.

**Keywords:** knowledge creation, inventory management, supply chain, system approach, coordination problem, complexity, entropy

### 1 Introduction

We see enormous grow of complexity and interconnectedness. We live in interrelated and networked world. Necessary conditions for any meaningful managing are: better understanding of characteristics of complex systems, grasp their behavior in the past and ability to predict behavior in the future. We need to see the whole picture.

Typical case of these ideas is the issue of inventory management. Inventory management cannot be grasped by single person because of high level of complexity. So it is necessary to coordinate the decisions of many employees (from different department across whole organization) and take other stakeholders of supply chain into consideration. The concept of collective intelligence is highlighted in this context. I'm suggested, that the better coordination between each inventory management agents, that is based on better exchange of data, information and also on fostering the knowledge creation can be the only way for company to be successful in competing on global market. For keeping and building the competitive advantage it is necessary to deliver the right product, in the right volume and the quality to the right place in right time. And this is big challenge of logistics. We must try to identify the possible utilization of knowledge creation theory in this specific issue.

### 2 Knowledge creation theory and coordination ability

The meaning of the expression "knowledge creation" is often ambiguous. It is possible to find different definitions, what knowledge and knowledge creation is. Philosophers view knowledge in broad context. They usually connect term knowledge to wisdom and to understanding universal metaphysical principles.

Other example is case of theoretical informatics experts. They view knowledge creation as finding higher level information (some kind of meta-information) in information or data. It is usually achieved by utilization of some data mining technologies, neural networks and probabilistic proof systems and artificial intelligence. For example, very common is zero-knowledge proofs, which are of great theoretical and practical interest especially in cryptography. Many of these practical problems belong to NP-complete or NP-hard and efficient computation is associated with deterministic polynomial-time algorithms.

From managerial point of view is knowledge created and utilized by mind of knowers. So it is important the human dimension of problematic, not the technology as in theoretical informatics. But what can be utilized in daily dealing with practical problems of

company? Many economist and thinkers note, that knowledge is the most important resource of each company.

Nowadays there are many universal models in knowledge management, which should be useful for praxis. But they are often more theoretical and abstract than ready for application in concrete case. The situation is not even in utilization in inventory management. It can be found many universal models of knowledge creation in contemporary literature. For example:

- DIKW model (Data-information-knowledge-wisdom pyramid model),
- Senge's Learning organization,
- Nonaka's SECI model, 'Ba' concept and Process model of the knowledge-based firm,
- Motycka's Theory of regress ARME spiral,
- Rona's and Haslet's Feedback model of knowledge-creation for organizational learning,
- Schwartz's Layer model of knowledge management,
- Monyx's Core theory of success,
- etc.

Each model can be modified and then can be utilized the ideas of knowledge management theories in solving real problems. For purpose of this article, it is utilized DIKW model, ideas of Nonaka and Zeleny. All these models adopt the *system discipline* paradigm and the understanding requires a *holistic approach*.

DIKW pyramid model tries to create distinctions between concepts: data, information, knowledge and wisdom. This model interconnects these concepts, draws connections and highlights the qualitative difference between these concepts.

Senge describes in his book "The art and practice of the learning organization" [7] the main ideas about Learning organization concept and its elements. These ideas are very useful in knowledge creation theory and praxis. Many managers and academics are influenced by his ideas. Senge describes the importance of system thinking and ability to perceive the system dynamics. His learning organization concept has five main characteristics (or areas): (i) systems thinking, (ii) personal mastery, (iii) mental models, (iv) shared vision, and (v) team learning.

Nonaka define knowledge creation as "social process of validating truth" [6]. This idea refers to effort to finding more relevant explanation of reality and the need of improving dialogue ability of participants. From this point of view, knowledge creation can be characterized as communication problematic. Without improvement of the ability to exchange relevant data, information and knowledge, the performance of knowledge creating process will be minimal.

Zeleny [8] defines knowledge in following way: "knowledge is an embodied complex of action enabling structures, externalized through a purposeful coordination of requisite activities". He adds that "*knowledge is purposeful coordination of action*".

These definitions refer not only to action itself, but also to potential action. The need of coordination is apparent in his ideas.

*Coordination* function can be considered as *one of key functions of management*, because of "business and/or organizational models are based on two core concepts: specialization and coordination" [3]. Kraus and Streeter characterize coordination as "integration or linking together of different parts of an organization to accomplish a collective set of tasks" [10]. He says that coordination tries to achieve common and explicitly recognized goals of company by integration of different parts of company. It is possible to add to this definition also the term 'supply chain'. These ideas can be fully utilized in field of inventory management.

Someone can say that the coordination can be fostered only by better utilization of contemporary technologies and investment in infrastructure. It is not so true, because all managers may pay attention to focus on knowledge creation and improving skills of employees. These activities are investment to (not so far) future and have potential to bring enormous value to company. *The ability to create new knowledge and developing the own company culture is the main competitive advantage of each company.*

### 3 Inventory management and need for coordination

What is inventory? Kral says, that "Inventory is any idle resource held for future use." [4] The term 'inventory' contains usually raw materials, work-in-progress goods and finished goods; and they are maintained for many purposes. Johnsons [2] enumerates following possible purposes: (i) resale to others, (ii) use in a further manufacturing or assembling process, (iii) investment, (iv) or for the operation or maintenance of existing equipment.

Inventory is current assets and "because the turnover of inventory represents one of the primary sources of revenue generation and subsequent earnings for the company's shareholders/owners" [12].

Effective inventory management is crucial for fulfilment of customer's needs. According to Kral [4] each manufacturing and production company deal with inventory planning and control. So each company must have some type of inventory management. Inventory is one of the main sources of cost, so the effectiveness of inventory management is of crucial importance to company performance.

Inventory management is a part of logistics. According to Council of Logistics Management can be the logistics [9] characterized as: "Logistics is that part of the supply chain process that plans, implements, and controls the efficient, effective flow and storage of goods, services, and related information from the point of origin to the point of consumption in order to meet customers' requirements." This definition contains term a 'supply chain', that indicates the need for taking these problematic in wider consideration. This task is very complex, because it requires managing flows of goods, services and related information. Many employees participate on solving these tasks and all these *logistics operations must be coordinated.*

Company must usually deals with hundred thousand of stock keeping units (SKUs) and they are located on tens or hundreds of places. Inventories are purchased from hundreds of suppliers. Continuously there are take place transactions (operations), which are closely related to inventories. These *transactions* are held in space and time, and they are a source of most important data and information for inventory management (both decision-making and problem-solving).

Managing of inventory (not only on operational level) belongs to NP-complete or NP-hard problems. The classical optimization methods (Operations research, Queuing theory etc.) have low utilization in practice. It is usually caused by:

- the high level of complexity of reality and the models are not able to factor all significant variables (the character of more of them is qualitative);
- it is impossible to take in to consideration the broader consequences of the decision to organization and supply chain;
- the agents utilize also the tacit knowledge.

For these reasons, many companies try to use simplify the processes. Visualization, standardization, implementation of kaizen principles come to consideration in improvement the inventory management. This way is usually not considered as 'scientific', but the results of many companies are astonishing (Toyota, Honda, Motorola).

### 4 Fundamental model of inventory management in knowledge-based company

The model is based on the structure of DIKM pyramid model; and is influenced by Nonaka's ideas, Senge's concept of Learning organization and PDCA cycle (in this model a cycle means a spiral). Fundamental character of the model allows to articulating the qualitative distinction between its elements. Model shows also the degree of concreteness/abstractness.

Fundamental model of inventory management in knowledge-based company can be seen in the figure 1. The hierarchy of the model represents the influence of higher level to the lower. In other words it means, that each level determine all stages below it. Each change of content must trigger the cascade of changes on lower levels.

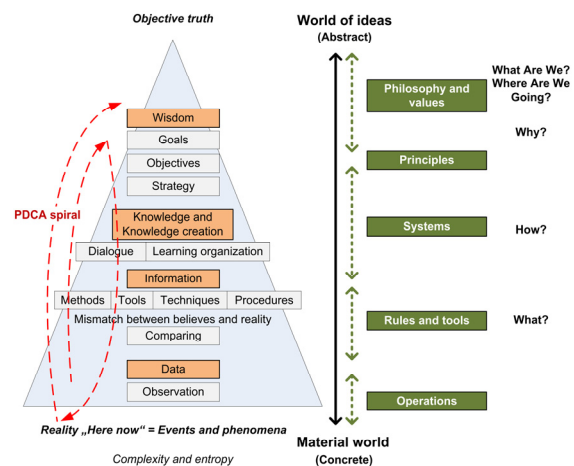


Figure 1 Fundamental model of inventory management in knowledge-based company

The cornerstone of this model is the idea that each *company should tries to become wise.* Only then is company fully capable to define mission, key values and orientation on it, manage itself, drive one's continuous adaptation processes (like in the nature) and *improving own business, process architecture and organizational culture.* Only unique and meaningful business process architecture and culture, those are based on real wisdom of a company, can be the main source of long-term competitive advantage. Because it is very hard to copy or transfer to other company.

Many companies are trying to follow some paradigm in management. For example: Toyota production system, Production system Bata etc. They implement unthinkingly many elements of different production systems without understanding of the philosophical background and wider relationships. It brings only minimal benefit or its ends usually with restoring processes to its previous state. Each implementation of a foreign concept may case in encroachment of inner companies climate.

I am convinced that it is possible to build the own business process architecture and company culture, that is based on its specifics and abilities of a company to bring higher value to customers.

#### 4.1 Top level of the model – Wisdom

In earlier 80's and 90's there was information age. Today we live (or we believe that we live) in 'knowledge society'. Companies try to follow the world class companies and managers use terms like knowledge and knowledge creation processes more frequently<sup>1</sup>. But it must be highlights the top of the DIKM pyramid – the wisdom. It is wisdom of a company not only of a few isolated individuals. According to Zeleny [8], "as companies are becoming more informing more informed and

<sup>1</sup> But they usually do not know what it really means.

more knowledgeable, they – the best ones – are searching to become wise”.

Generally speaking, wisdom deals with aesthetic question – about purpose of existence. These questions are not cliché, but the finding answers influence the fundamental orientation of company.

Wisdom is strongly *related to ethics and values hierarchy* (of individuals, company and society). Zeleny [8] deals with problematic of wisdom of company and he highlights fact that this character of wisdom will bring additional dimension to business. The importance will be attaches not only to efficiency but also to moral (or virtuous) dimension of business. He adds that “wisdom is socially accepted or experience-validated *explication of purpose*.”

Wisdom is not some philosophical, academic or fictitious construct. It is real concept and also may have positive pragmatic consequences for company. Wisdom tries to grasp the objective truth and it is the higher level of knowing and human thinking. The finding of truth is the ideal and its may implies the proper way for company.

Only the wise person is capable to identify and define the company goals. Goals imply the objectives, which must be specific, measurable, attainable, realistic and time-targeted. Company must establish a proper strategy to achieve these objectives. Nonaka [6] writes similar idea: “When one relentlessly *pursues excellence<sup>2</sup> as way of life, one’s knowledge becomes wisdom*”.

What can be concluded from these ideas to inventory management? It is possible to find some implications. It can be seen on following table.

Tab. 1 *The upper stages of the Fundamental model of inventory management in knowledge-based company*

Category	Description
Wisdom	must be based on providing common good to society; it is related to specifics of business;
Goals	is to achieve the deal; is to fulfill customer needs, because primary function of inventory is to serve the customer;
Objectives	is to deliver the right product, in right volume and quality to the right place in right time; (all activities must considers the phenomenon of volatility between supply and demand of internal or external customer)
Strategy (or Operations strategy)	is on essence about orientation to <i>low costs</i> , or <i>high sales</i> .

Each of these two ways of choosing the suitable operations strategy offers additional possibilities, which can be seen in the following table. The decision making must always take existence of *principles* into consideration. Character of principles is more long-term than rules.

Tab. 2 *Operational strategy dilemma of company [1]*

1 <sup>st</sup> step	2 <sup>nd</sup> step	3 <sup>rd</sup> step	result
Way of low costs	Low units costs	High throughput	Less variability
		High utilization	
Way of high sales	Product quality	Low inventory	Short cycle time
		-	
	High customer service	Fast response	Low utilization
			High

<sup>2</sup> It is possible to find many implications (not only in world of business). It is related to value, quality (TQM) etc.

		Many products	inventory
			More variability

It is not possible to provide more detailed description of these alternatives, because of length and the focus of this article.

### 4.2 Knowledge and knowledge creation

Objectives, operational strategy and knowledge creation can be classified as *systems*. Each company should have its own unique system that is based on specific potential and culture of the company. System can be defined as *know-how*.

Operation strategy drives knowledge creation processes. It delimits the *modus operandi* and creates demand of knowledge. One of key condition for successful knowledge creation is that the knowledge must be demanded by managers of company.

Dialogue and concept of learning organization can be considered as the pillars of successful knowledge creation. Both allow to better understand the broader implications of information. Each company needs to foster its learning processes.

### 4.3 Information

Required knowledge determines the quantitative and qualitative characteristics of information. Zeleny [8] says: “information a symbolic description of action”. In presented model is this level related to question “What to do”. From managerial point of view, it must be defined following information for each process:

- what to do (who, how, when etc.),
- what information is necessary (why!, where, who and when need it etc.),
- who (where and how) creates required information (and also transferred, sorted, processed).

Information deals with methods, tools, techniques and procedures of a company. They can be classified as *rules* and *tools*. Foundation of all these elements must be based on ideas emerged from higher levels of the model. The main idea is to be able to compare observed ‘facts’ with plan. All identified significant deviations must be utilized by control function by real-time feedback.

### 4.4 Data

Information arises from data. Data describes simple objective facts in natural or social word (events and phenomena). It mediates connection between humans and reality. Source of data are operations of company. The main feature of reality can be described using two concepts: complexity and entropy.

We can find many of approaches to characterise *complexity*. Generally speaking, complexity is reflection of “a condition of numerous elements in a system and numerous forms of relationships among the elements”. Warren Weaver [11] postulates, that “complexity of a particular system is the degree of difficulty in predicting the properties of the system if the properties of the system’s parts are given”. Ability to understand the essence of object and its behaviour is necessary condition for prediction the future behaviour. System thinking based on system dynamics concept enables to better deal with the complexity of reality (especially of complex live systems - like companies, society, etc.).



Figure 2 *Consequences of complexity [10]*

*Entropy* is the second significant concept that deals with the issue of cognition the reality. Generally speaking, entropy expresses the disorder or randomness of the constituents of a system. Each manager of company must fight against grow of complexity. Grow of complexity is heading for death of all live systems. It is interesting that live systems in the nature are complex adaptive and they are able to keep entropy on low level. We do not know how to do and we must learn it from the nature.

#### 4.5 PDCA cycle

It is important to understand that movement through stages of the model proceeds in a spiral, not a circle. According to Nonaka [6], "knowledge creation is a future-creating activity". The future is always open. Heraclitus (ancient Greek philosopher) says "Ta panta rhei" - everything flows or all is in flux. Everything around us must be seen as a process, because nothing is stable. Similar ideas present Japanese philosophers and they present the idea that human beings also keep changing or becoming.

PDCA (plan-do-check-act, or PDSA: plan-do-study-act) is a famous model that was invented by Deming. This model describes iterative four-step problem-solving process and it implied process of knowing. Necessary condition for process of knowing is the existence of continuous (or never ending) rotation through PDCA model.

PDCA cycle introduce to this model the dynamics and provide better connection between constituent elements; and allow to foster adaptation and continuous improvement process of company.

#### 5 Conclusion

Each company deals with complex coordination problems. All those problems cause in grow of costs and also influence the value added to customer. One of the most complex issue is inventory management. Each company need to improve all processes. But, how to do? Knowledge management is one of the fastest growing disciplines of contemporary management. We must find how to adopt the universal models and approaches into specific problematic of inventory management. Inventory management and knowledge creation has many clues (system character, holistic approach to company, low-structured and complex problems etc.) that makes possible to create theory based on conclusions of these problematic.

This article contains the Fundamental model of inventory management in knowledge-based company model that tries to outline the possible way. Model is based on many partial concepts and models, and shows the conceptualistic or integrated view on target problematic. The main idea is that the ability to create new knowledge and developing the own company culture is the main competitive advantage of each company. It is possible only by improving/fostering the learning and knowledge creating processes of company.

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**Primary Paper Section: A**

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