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# Info-knowledge for supply chains: its links with management, human capital, supply chain operations and innovation

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## El infoconocimiento para las cadenas de suministro: su vínculo con la gestión, el capital humano, las operaciones de la cadena y la innovación

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## Abstract

When analyzing processes of information and knowledge management and their application to the business practice, the links between both processes' approaches and categories become apparent, evidencing a tight relationship in their conception and function in business, though they are usually seen as isolated categories.

Info-knowledge integrates the flows of information and knowledge between agents, as well as their experiences, learning and skills, having a spiraling, growing and synergic thought model as its process approach that adds value and sets the business foundation and product innovation. The proposed design breaks with the traditional information and knowledge structure, generating a single cycle that offers the possibility of integration in supply chain processes that is grounded in the application of information technology.

Relevant results are the contributions to the global planning of the supply chain, the possibility to make adequate decisions; cooperation, permanent communication and institutionalization, increase in value in the supply chain, and the preparation of actions of continuous improvement and innovation.

**Key words:** *information management, knowledge management, continuous improvement, information technology.*

**JEL:** M40, M42



## Resumen

En el análisis de los procesos de gestión de información, gestión del conocimiento y su aplicación en la práctica empresarial, se evidencian los vínculos existentes entre los enfoques y categorías de ambos procesos, reconociéndose una relación estrecha desde su concepción y función en la organización pero abordadas, tendentemente, como categorías no integradas.

El infoconocimiento integra los flujos de información y conocimiento entre los actores, sus experiencias, el aprendizaje y las competencias, a partir del desarrollo de un pensamiento en espiral como enfoque de proceso, creciente y sinérgico, que agrega valor y crea las bases para la innovación organizacional y de productos. El diseño que se presenta rompe con la estructura tradicional de información y conocimiento, generando un solo ciclo, que ofrece la posibilidad de integración a los procesos de las cadenas de suministro soportado en la aplicación de las tecnologías de información.

Como resultados resultan relevantes, la contribución a la planificación global de la cadena, la posibilidad de la toma de decisiones oportunas, la colaboración, la comunicación y socialización permanente, el incremento del valor en la cadena y la generación de acciones de mejora continua e innovación.

**Palabras clave:** *gestión de información, gestión del conocimiento, mejora continua y tecnologías de información.*

## 1. INTRODUCTION

What used to be regarded as most valuable in organizations was that which could generate monetary profit from the perspective of tangible assets in the accounting system. Outside this tangible measure, nothing else was recorded in the organization's accounting system. This situation has changed drastically in our day: organizations have shown a growing interest in studying intangible assets. Knowledge is one of the most important of those intangible assets. Organizations have realized that knowledge is a fundamental resource to create sustainable competitive advantages, and there is now a big interest in this topic. Knowledge reveals not only what an organization does, but also what it says and where it is regarding the activities it is engaged on.

The development of economics shows that the time when knowledge started to become the main asset was during the Third Industrial Revolution, with the first revolution occurring in the industrial era that began in 18<sup>th</sup> century Europe, and the second one in the 20<sup>th</sup> century with the rise of economies fueled by oil, electricity, assembly-lines and mass production (Lage, 2013). The evolution of economics shows a general tendency to rely more on information and knowledge. Knowledge management has become a catalyzer of economic growth and productivity enhancement. Information and technology are seeds that contributed to making knowledge a factor of production.

Currently, organizations are going through a phase of rapid changes produced by the fast development of information technology, which is increasingly becoming fundamental in the expression of information societies. However, information technology is nothing but a means of transmitting contents, and efficiently organizing and managing data, information and knowledge (Dájer, 2006).

Knowledge creation is promoted through information technology. Computational infrastructures, information technology and their related skills become of special importance. Hence, knowledge management looks very technology-oriented. Information technology has come to be another pillar of knowledge-based economies: this can be seen in the extensive use of internet and in the development and fast growth of e-commerce.

In this new scenario, the permanent search for business solutions is oriented toward the creation of value and competitiveness. Thus, the proper management of processes that incentivize the creation, usage and spread of knowledge becomes a crucial task for decision makers.

Moreover, contributions can reach other spheres such as human capital, innovation and management. Just like information constitutes the foundation for knowledge, knowledge and its management constitute an essential element for innovation that translates into the renewal and expansion of products and services, processes, changes within organizations, management and the qualification of professionals. Innovation as a process lets us adopt a set of inputs and outputs that feed on a set of intermediate activities that are interrelated.

A conceptual review of the literature on innovation led us to highlight the following authors: Pavón & Goodman (1976); Hamel (2000); Fernández (2000); and Ramírez; our present analysis leads us to conclude that:

- Innovation demands the coordinated efforts of many different participants. Organizational creation is fundamental in the innovation process.
- Innovation focuses on the introduction of an asset, process, service or product together with its novel ideas and the ability to create.
- We also identified the need to create a new production method that allows for the successful application of results; that is to say, the application of a novel idea that in the context of organizations would be an innovation, ensuring that it leads to contributions and social benefits.
- We found that innovation requires a set of organized steps that articulate new techniques in the areas through which an organization's products circulate, and it is necessary to be open to a market that offers possibilities of supply and demand, positioning and launching of new products and services.
- The current concept of innovative action sees businesses as integrated wholes, where success often depends on the integration between units, the close relationship between production, com-

mercialization, R&D + i and finance, which requires a fusion of the technical, the economic and the social items, instead of being an exclusive matter of technological impulse or market attraction.

On the other hand, the globalization of economies, the high competitiveness of the market, the development of information technology and scientific and technical advances, have created a dynamic in companies that changed the traditional ways of doing business. In this context, the supply chain emerges as a business necessity, as an initial step in the evolution towards the networks of networks and as a way to offer products of high added value to clients.

The application of a chain-oriented approach is based on what the market demands and can absorb, it is constituted in a way that can integrate different agents and institutions, it responds to a strategy that stems from collective and consensual needs (as a chain) and not from the specific needs of the agents that integrate it. It also looks for equity and sustainability (Vinci et. al, 2014).

In supply chains, goods circulate between companies, and these add value to them until there is a finished product that satisfies the client's requirements. To make this possible, it is necessary to have adequate information flows that, once integrated to the flows of knowledge, allow for the coordination of activities among companies. When analyzing supply chains, we can generally find that the sources of raw materials, factories and points of sales are not located in the same place, and the flow of materials between companies comes with a flow of information and knowledge that needs to be managed.

Our study reflects the need to promote new mechanisms (both managerial and technological) of information and communication among those who participate in supply chains. The aim is not to incorporate a combination of approaches and tools that generally become redundant, but to harmonically integrate the chain's components in light of the contemporary management approaches, wherein contributions can be made to the management itself, the operating human capital and the developed processes.

## 2. THE MODEL OF INFO-KNOWLEDGE MANAGEMENT FOR SUPPLY CHAINS

We now introduce the model of info-knowledge management for supply chains (IKMSC) (Alba & Herrera, 2015), which identifies the elements that need to be managed in the information and knowledge management, according to the models and projections published by the following authors regarding this topic: Marland (1981); Kogut & Zander (1992); Wiig (1993); Kim (1993); Hedlund (1994); Nonaka & Takeuchi (1995); Gopal & Gagnon (1995); Stanat, 1992 quoted in Villardefrancos (2005); Doyle (1992); Choo (1995); Grant (1996); Muñoz & Riverola (1997); Sveiby (1997); Bueno (1998); Tejedor & Aguirre (1998); Arthur (1999); Kerschberg (2000); Cornella (2002); Ortoll (2003); Pérez (2004); Ponjuán (2000); (2004); Villardefrancos (2005); Soto (2005); Dájer (2006); Artiles (2008); Machado (2008); Carrillo (2009); García (2010); Gil-Montelongo, López-Orozco et. al (2011); Franch & Herrera, (2011); Monagas (2012); Alba & Herrera (2013); Ruso & Borrás (2013).

From a critical analysis of the aforementioned authors by Alba & Herrera (2014, 25-34); (2014, 199), info-knowledge<sup>1</sup> was defined as a matrix that absorbs the information and knowledge flows between agents, as well as their experiences and learning and skills, starting with the development of a spiraling, growing and synergic thought model as its process approach, one that adds value and sets the foundations for business and product innovation. The info-knowledge spiral lets us pinpoint and organize the relevant information through filtering processes, content availability, storage of sources, and the incorporation of value judgements on key stages of the supply chain—which emerge from the participation of experts and the involved personnel, who in turn intervene creatively in acquisitions, communications and decision-making.

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<sup>1</sup> Info-knowledge: a term with few records in academic literature, it is especially used in the context of online education. In our proposal, info-knowledge presents a managerial approach with an integrative perspective, and it makes part of an *evolutionary* process from the conception (data, information, knowledge) until info-knowledge is attained.

The application, institutionalization and registration of the decisions that are made feed the spiral, allowing activities and processes to create value and promote continuous improvement and innovation, which comes as a result of the ongoing cycles of the spiral.

The results of these processes are shared as a means to promote cooperation, with the aid of computational platforms and mechanisms that give access to the results and enable collaboration to generate transformations with added value via transfer processes, whose results are stored in repositories that facilitate their location and feedback —aspects that are monitored and managed.

The integrality of these categories is conceived from a process approach which begins with the entry of the category into a spiraling curve, it is processed in the spiral and then its output is expressed in indicators of management, operations and personnel, which feed back on the supply chain and lead to the following curve of the spiral.

This management and the resulting success of the spiral (info-knowledge) are based on the incorporation of these elements in a technological framework identified through a portal of info-knowledge management for the supply chain (IKMSC portal) that defines a set of requirements and incorporates computational tools, which in turn interact cyclically in a single support system (IKMSC portal) with multiple outputs, wherein each of them adds value to the next one. The spinning movement of the model's toolkit responds to the demands made by the users in any phase of the info-knowledge spiral.

From the tools that respond to the demands of the info-knowledge spiral, we can identify the following: those that are process-oriented, such as data mining; those that are used for management, such as learning management tools, technological surveillance, strategic intelligence and monitoring; those that promote diffusion such as technological observatories, networks of experts, virtual communities, notifications blocks, newsletters, chats, discussion forums, RSS and tools that transversally influence all the actions that are executed in the IKMSC portal, content management and repositories. The functioning of the tools within the



disc-shaped model follows a process structure that starts with the processing of inputs, and the tools that are used in this phase are located near the center of the disc (the area whence the storage process propagates), the middle part of the disc (where the inputs have been processed) and the final outermost area where that which has been subjected to management can now be shared.

### **3. THE IMPACT OF INFO-KNOWLEDGE ON SUPPLY CHAINS**

Info-knowledge has an impact on four fundamental areas: management, human capital, the chain's key operations, and innovation. The main impact on these areas is visible in how relevant management turns out to be in terms of contributing to the global planning of the supply chain, and the possibility to deconstruct the various links that constitute it (supplies – production – distribution), since the inputs of the directive data are monitored and shared by every agent in the chain according to his functions, giving the process more objectivity in the strategic, real and foreseeable aspects.

Within the sphere of management, the model also enhances (through the IKMSC portal) the possibility to make adequate decisions by giving, in an updated and systematic manner, the necessary and precise information that reinforces the articulation between each one of the supply chain's links and processes. Combined with the resources and decision-making processes, the model promotes the development of cooperation with an anticipative spirit, which is meant to offer solutions to possible problems in order to minimize their magnitude.

Another area where results are visible is the development of human capital because the model and its computational framework influence the improvement of skills, learning, communication, cooperation and permanent sharing, allowing for the detection and acknowledgement of experts, the capacitation and training of managers, specialists and employees, and the development of necessary skills, as well as the creation and proliferation of spaces where knowledge and experiences can be shared.

The model is linked with the supply chain operations. And through the IKMSC portal, it ensures a greater connectivity between agents and processes, achieving simultaneity in tasks and a reduction in disconnections among processes and activities, given that its design assumes the operations flow approach in which, from different scenarios, it will be possible to enter (capture), process and display information, execute actions and get feedback from the decisions that are made. This constitutes a control device for the chain and the framework itself, since by standardizing information inputs and registries, as well as its storage and circulation, we increase reliability and decrease user errors and fraud.

As part of the operations, the model integrates information and knowledge in a single cycle that can create alerts —based on monitoring, experiences and discussions— regarding foreseeable situations or possible courses of action. The model is supported by a block of notifications whose purpose is to monitor and share the chain's main indicators, as well as its key processes and activities, with the connected users. Thus, the IKMSC aims for real-time management, while it permanently puts at its participants' disposal the knowledge and know-how of its members.

In the application of the IKMSC model, we should expect to find an increase in the supply chain's value emerging from the info-knowledge spiral's elements and the synergy that the spiral creates; those elements also contribute to the materialization and generation of actions of continuous improvement and innovation. In this model, innovation constitutes one of the key elements that are aimed for, and its management is meant to help achieve greater competitive advantages. Innovation management has become a relevant factor and it is especially important in organizations that are involved in the knowledge economy.

This theoretical modeling establishes two types of feedback: one for the chain's maintenance and another one for the portal's maintenance. The first one lies in the review of the obtained results in order to perfect the input and functioning conditions of the chain's elements; the second one makes it possible to update the portal, which means that the portal's outputs contribute to the functioning, pertinence and development of the info-knowledge spiral, generating value within the chain, because when a new

registry entry is added using the toolkit, the information and knowledge assets grow and keep moving in the spiral, thus increasing the adequacy and effectiveness for future enquiries and management operations.

The universal value of this study lies in the conception of info-knowledge, which stemmed from studies conducted by the author that encompass the national and international contexts from 1985 to date. This conception does not contradict previous approaches; instead it constitutes an evolutionary process from data, information and knowledge, until info-knowledge is attained. And it respects the tenets of various approaches: systemic, synergic, technologic, interdisciplinary, among others, and it shows that organizations can no longer find their information and knowledge systems in isolation, but they assume info-knowledge instead: a model wherein all the flows that appear in organizations can be found (structural, monetary/financial, material and informational; communication flows, work-group flows and decision-making flows). These flows are not only assumed in independent organizations, but they transcend to their environment or to other organizations (supply chains). The model is based on the features of Cuba's social and economic policies, thus demonstrating its generalizability for every type of Cuban organization; hence its universal value.

The IKMSC model highlights the setting of foundations so that organizations can be linked together, and it integrates info-knowledge into the supply chain for the first time, thus achieving effective management in this type of structure, based on the simultaneity of tasks, cooperation, anticipation and digitalization in any scenario.

A remarkable feature that makes this model different from others is that it has a computational framework that articulates its entire cycle, which is not based on a knowledge repository, but it has an anticipative spirit instead; it can make predictions benefiting from a network of experts, a system of alerts and notifications, monitoring and surveillance tools, news and RSS, and this enables it to meet all the IKMSC demands from a computational perspective, while allowing for decision-making, problem solving, communication and cooperation based on real-time management.

#### 4. CONCLUSIONS

1. The management of intangible assets (information, knowledge) is crucially important and requires an integral perspective that links together all of an organization's members and phases that make part of the flow. This ensures that relevant indicators are shared in a matrix of material, monetary/financial, informative and knowledge flows, which contribute with valuable and innovative actions in the organizational articulation.
2. The IKMSC model integrates information and knowledge management processes into the info-knowledge flow, which facilitates the management of material, monetary/financial and human flows in the supply chain, fostering in turn the identification of knowledge, its availability and its relationship with other processes.
3. The impact of the IKMSC model on management enhances actions of planning, budgeting and decision-making in the practice of the businesses that make part of the supply chain, while in terms of human capital it enhances the sharing of experiences and cooperation, thus improving training activities. In the supply chain operations, real-time responses are enhanced, which decreases errors ensuring a higher efficiency and efficacy in the developed processes; and the creation of knowledge, seen from an innovation-oriented perspective, adds value to the chain processes and guarantees competitive management.

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