

Dynamic Perspectives in Colombian Swine Supply Chain

Johanna Trujillo-Díaz

Hugo Sarmiento

Department of Industrial Engineering
Escuela Colombiana de Ingeniería Julio Garavito
Bogotá, Colombia

johanna.trujillo@escuelaing.edu.co,

hugo.sarmiento@escuelaing.edu.co

Milton M. Herrera

Economic Sciences Research Centre
Nueva Granada Military University
Bogotá, Colombia

milton.herrera@unimilitar.edu.co

Flor Nancy Díaz-Piraquive

Department of Industrial Engineering
Universidad Católica de Colombia
Bogotá, Colombia

fdiaz@ucatolica.edu.co

Abstract

Pork consumption has increased in Colombia, most dealers are importing it from the other countries, such as the United States and Canada. The swine supply chain (SSC) of Colombia has a low level of competitiveness compared to other countries because of the lack of incentives to foster technological developments that allow sharing information. This paper aims to contribute with a dynamic perspective of the Knowledge Management (KM) to understand the impacts of delays of technological developments on SSC. A closed loop diagram is used to represent the delays of technological developments on the SSC. This diagram could support the design of the technological web platform to knowledge management. Results show that interchange of information using a technological web platform would integrate stakeholders of the SSC.

Keywords

swine supply chain, knowledge management, systems thinking, competitiveness.

1. Introduction

The swine sector is attractive for Colombian economy, because it is capability of generates employment (DNP, 2018). However, it does not have enough technology and knowledge transfer, specialized transportation, or government subsidies. Furthermore, swine smallholders are searching to lower its cost, because pork consumption in Colombia has been growing for the last ten years according to statistics from the Federation of Cattle Ranchers - FEDEGAN (acronym in Spanish), but demand is not enough. In 2017, swine consumption was 7.1 kilograms per inhabitant (FEDEGAN, 2018), however the production cost was between 60% and 70% of the total cost which includes disease and pest prevention, high quality, health and safety, and the lack of livestock policies (FAO, 2018). This situation will could bring challenges and opportunities for the swine sector in terms of technological development.

In Latin-American countries, Brazil has established coordination strategies and governance structures in pork slaughterhouses and processors, including contracts, alliances, cooperatives, and vertical integration to comply with public quality regulation (Menard, 2004; Raynaud et al., 2005; Martins et al., 2017). The livestock sector in Latin America has grown at an annual rate (3.7%), higher than the global average growth rate (2.1%) (FAO, 2018). In 2018, Colombia's agriculture and livestock sectors increased 5.9% higher than in 2017. In addition, Colombian agricultural crops and its related activities have incremented 6.0%, livestock 5.8%, growth of the pig's sector is more than double with 8.8%, while cattle were only 4.2% (DANE, 2018). In Colombia, SSC's production of pork covers only the domestic demand, it is located mainly in Antioquia, Valle del Cauca, Cundinamarca, Meta, and Córdoba. That sector is the second most important in livestock, it represents around 17% of national production. CSSC's products include reproductive male, pregnant sows, lactating, non-lactating, replacement, backyard-pigs, and prime pigs. Its average productive cycle is 296 days, it includes 142 days for raising farms and 154 days for fattening up farms.

In this context, this paper assesses the following questions through a closed loop diagram: What are the effects of delays in the knowledge management (i.e. technological development) that affect the SSC needs for increasing its competitiveness?

Knowledge management is defined as a systematic process to add value supported by the capability of the supply chain for generating new knowledge (Choo, 1996; De Jarnett, 1996). In this sense, a KM model is characterized by: to obtain competitive advantage (Bukowitz and Williams, 2000; Wigg, 1993), a KM model must be accessible (Munoz-Avila et al., 2002), validated (Johnston and Blumentritt, 1998), materialized (Nonaka and Takeuchi, 1996), and improved or updated (Bukowitz, 2000; Meyer and Zack, 1996; Zack, 1999). Some benefits in the use of KM practices into a SC are cooperation (Zhang et al., 2015; Kant and Sigh, 2008; Peng and Yew, 2011; Croom, 2005), integration (Yu et al., 2013; Angeles, 2012; Cheung et al., 2012; Li et al., 2012; Ayoub et al., 2017), dissemination of good practices (Peng and Yew, 2011), and decision-making support. Nevertheless, the main objectives of KM are both social capital and intellectual capital, that is, people knowledge and learning. Thus, KM processes are knowledge creation, knowledge storage, knowledge transfer, and knowledge application.

There are few models found in the literature about KM models for improving efficiency or competitiveness applied to organizations like: supply chains, clusters, industrial groups, etc. Additionally, there are several models found in the literature applied to firms. The systems thinking could supports the processes of knowledge creation.

The paper is organized as follows: Section 2 provides a brief review of the methodology used in this paper. Section 3 discusses the dynamic perspective proposed for the knowledge management in SSC. The last section summarizes the conclusions.

2. Methodology

This paper is an exploratory study about SSC where collected variables for building KM determinants are summarized in a causal structure that represented the dynamics of the KM of SSC. To answer the research question, first, background was collected from primary sources; it summarized the most important issues for the Colombian swine sector that have had an impact on economy. In this part, transversal information from 10 years until the present day was used. Second, the relation between variables was represented through a closed loop diagram to understand the dynamics of the knowledge management. Third, these variables were used for analyzing the interaction between technological innovation system (TIS) and the swine supply chain.

The causal loop diagram links system variables by arrows. These links represent the causality and timing of the swine supply chain. This structure will orient the build of a simulation model which considers the complex dynamic system. The main feature of systems thinking is represented the most types of problem to solve: those involving complex issues and dependent of a great deal dependence on the past (Bala et al., 2017).

3. Dynamic Perspective

In Figure 1, knowledge management processes involve the whole SSC, and are represented by the following questions: i) What should be known; ii) What must be done? iii) What could be done?; and iv) What is known?. Those questions show the creation, storage, transfer, and knowledge application stages; those are jointly generating a continuous improvement cycle. Since the KM model at this stage is a proposal, and the SSC currently has a level of tacit knowledge, the indicators of interest and good practices throughout it are identified through literature that would allow SSC to increase its competitiveness.

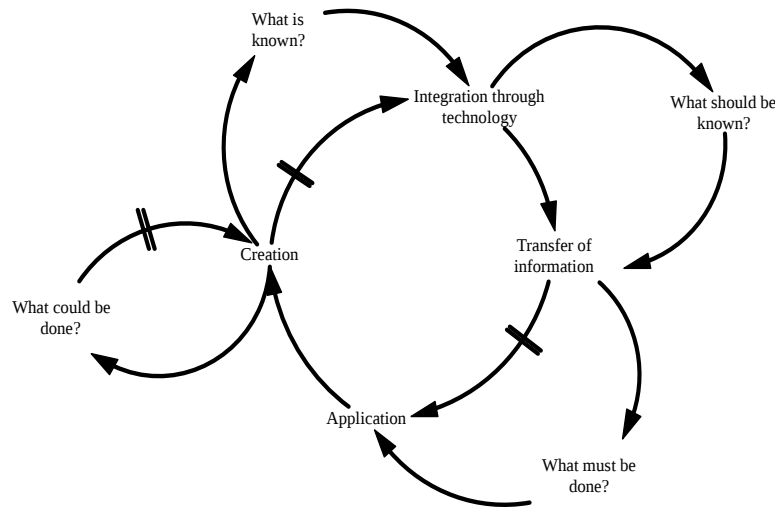


Figure 1. Dynamic perspectives of the Knowledge Management

This paper show how can us identified the connection between technological knowledge, resources mobilization, guidance of the search and swine supply chain, as illustrated in Figure 2. This representation through a closed loop diagram could support for analyzing how technological knowledge diffusion affects guidance of the search (i.e. policies or rules of decision), which generate an impact on the swine supply chain.

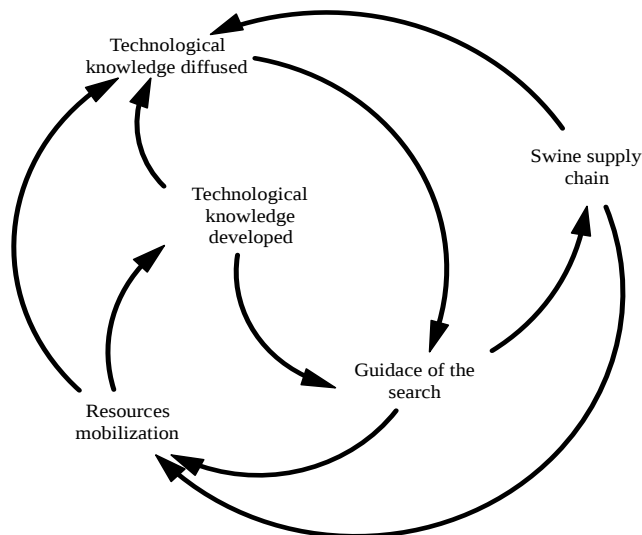


Figure 2. Dynamic perspectives of the Knowledge Management and the swine supply chain

4. Conclusions

Competitiveness can be seen as a legislative, political, economic, and social advantage between two different systems, it involves the transformation of granted and produced goods which represent an economic profit and added value in agroindustry. The low technological level in CSSC is the main obstacle in developing competitiveness. Other obstacles are the lack of a) production capacity, b) innovation, research and development (R&D), c) exports, d) product quality, f) strong government policies in terms of price fixing and market protection, and g) tax incentives to specific industries. Thus, the proposed model in KM would be used to encourage industrial cooperation, to share information, knowledge, and raise CSSC competitiveness.

Low technological development and a lack of interest from SC stakeholders seem to be the main barriers in the development of a KM model in CSSC.

Acknowledgements

The article has been written within the framework of the project "Knowledge management model to increase the competitiveness in the swine supply chain". The authors would like to thank at the Escuela Colombiana de Ingenieros Julio Garavito (DII/C008 CIJI2019) and Nueva Granada Military University (INV-ECO-3008) for providing financial support to this research.

References

- Angeles R., "RFID critical success factors and system deployment outcomes as mitigated by IT infrastructure integration and supply chain process integration," *International Journal of Value Chain Management*, vol. 6, pp. 240-281, 2012.
- Ayoub H. F., Abdallah A. B., and Suifan T. S., "The effect of supply chain integration on technical innovation in Jordan: the mediating role of knowledge management," *Benchmarking: An International Journal*, vol. 24, pp. 594-616, 2017.
- Bala, B.K., Arshad, F.M., Noh, K.M., 2017. *System Dynamics: Modelling and Simulation*, Springer. https://doi.org/10.1007/SpringerReference_7284
- Bukowitz W. R. and Williams R. L., *The knowledge management field book*: Financial Times/Prentice Hall, 2000.
- Cheung C.F., Cheung C., and Kwok S., "A knowledge-based customization system for supply chain integration," *Expert Systems with Applications*, vol. 39, pp. 3906-3924, 2012.
- Choo C. W., "The knowing organization: How organizations use information to construct meaning, create knowledge and make decisions," *International journal of information management*, vol. 16, pp. 329-340, 1996
- Croom S.R., "The impact of e-business on supply chain management: An empirical study of key developments," *International Journal of Operations & Production Management*, vol. 25, pp. 55-73, 2005
- DANE. (2018, August 22, 2018). *Boletín técnico - Producto Interno Bruto*. Available: https://www.dane.gov.co/files/investigaciones/boletines/pib/bol_PIB_Iltrim18_produccion_y_gasto.pdf
- De Jarnett L., "Knowledge the latest thing," *Information Strategy, The Executives Journal*, vol. 12, pp. 3-5, 1996.
- DNP. (2018, March 6). *Bases del Plan Nacional de Desarrollo 2018 - 2022*. Available: <https://colaboracion.dnp.gov.co/CDT/Prensa/PND-2018-2022.pdf>
- FAO. (August 24). *Producción pecuaria en América Latina y el Caribe*. Available: <http://www.fao.org/americas/prioridades/produccion-pecuaria/es/>
- FEDEGAN. (2018, August 22). *Estadísticas - Consumos*. Available: <http://www.fedegan.org.co/estadisticas/consumo-0>
- Johnston R. and Blumentritt R., "Knowledge moves to center stage," *Science Communication*, vol. 20, pp. 99-105, 1998.
- Kant R. and Singh M., "An integrative framework of knowledge management enabled supply chain management," in *Industrial Engineering and Engineering Management*, 2008. IEEM 2008. IEEE International Conference on, 2008, pp. 53-57.
- Li Y., Tarafdar M., and Subba Rao S., "Collaborative knowledge management practices: theoretical development and empirical analysis," *International Journal of Operations & Production Management*, vol. 32, pp. 398-422, 2012.

- Martins F.M., Trienekens J., and Omta O., "Differences in quality governance: the case of the Brazilian pork chain," *British Food Journal*, vol. 119, pp. 2837-2850, 2017.
- Menard C., "The economics of hybrid organizations," *Journal of Institutional and Theoretical Economics JITE*, vol. 160, pp. 345-376, 2004.
- Meyer M. and Zack M., "The design and implementation of information products," *Sloan Management Review*, vol. 37, pp. 43-59, 1996.
- Munoz-Avila H., Gupta K., Aha D., and Nau D., "Knowledge Management and Organizational Memories," ed: Kluwer Academic Publishers. chapter Knowledge Based Project Planning, 2002.
- Nikabadi M.S., "A multidimensional structure for describing the influence of supply chain strategies, business strategies, and knowledge management strategies on knowledge sharing in supply chain," *International Journal of Knowledge Management (IJKM)*, vol. 8, pp. 50-70, 2012.
- Nonaka I. and Takeuchi H., "The knowledge-creating company: How Japanese companies create the dynamics of innovation," *Long range planning*, vol. 4, p. 592, 1996.
- Peng Wong W. and Yew Wong K., "Supply chain management, knowledge management capability, and their linkages towards firm performance," *Business Process Management Journal*, vol. 17, pp. 940-964, 2011.
- Raynaud E., Sauvee L., and Valceschini E., "Alignment between quality enforcement devices and governance structures in the agro-food vertical chains," *Journal of Management & Governance*, vol. 9, pp. 47-77, 2005.
- Wigg K., "Knowledge management foundations," *Knowledge management foundations*, 1993.
- Yu W., Jacobs M.A., Salisbury W. D., and Enns H., "The effects of supply chain integration on customer satisfaction and financial performance: An organizational learning perspective," *International Journal of Production Economics*, vol. 146, pp. 346-358, 2013.
- Zack M. H., "Managing codified knowledge," *Sloan management review*, vol. 40, pp. 45-58, 1999.
- Zhang M., Zhao X., Lyles M. A., and Guo H., "Absorptive capacity and mass customization capability," *International Journal of Operations & Production Management*, vol. 35, pp. 1275-1294, 2015.

Biographies

Johanna Trujillo-Díaz is an Assistant Professor at Escuela Colombiana de Ingeniería Julio Garavito of Department of Industrial Engineering. She holds BSc degree in Industrial Engineering and MSc degree in Industrial Engineering from Pontificia Universidad Javeriana. She is currently a PhD student in Strategic Planning and Technological Management from Universidad Popular Autónoma del Estado de Puebla (UPAEP). She has published journal and conference papers. Her research interests include knowledge management and the supply chains.

Hugo Sarmiento is an Associate Professor at Escuela Colombiana de Ingeniería Julio Garavito. He is Industrial Engineer from Pontificia Universidad Javeriana. MBA specialized in Quality, Environmental and Safety at Viña del Mar University (Chile). He has worked in different companies in Colombia, in project management and manufacturing costs. He is a professor and Director of the Production Studies Center at Escuela Colombiana de Ingeniería Julio Garavito. His research interests include innovation, competitiveness, production costs and Lean Six Sigma methodologies.

Milton M. Herrera is an Assistant Professor of Production and Logistics at the Nueva Granada Military University of the Economic Sciences Research Centre. He holds BSc degree in Production Engineering and MSc degree in Industrial Engineering from Universidad Distrital Francisco José de Caldas. He is currently a PhD candidate in Model-based public, policy design and management at the Universidad Jorge Tadeo Lozano and Università Degli Studi di Palermo. He has published journal and conference papers. His research interests are system dynamics, performance management, energy transitions and dynamics of supply chains.

Flor Nancy Diaz-Piraquive Economist at the Catholic University of Colombia, Specialist in Preparation and Development Project and Project Management of Information Systems of the University of Rosario, Doctor of Information Technology: Information and Knowledge Management, Author of Project Management books and, Author of numerous articles published in internationally indexed journals with high qualification impact indexes. She is an Associate Researcher for COLCIENCIAS. She is currently the Director of the Research Group on Business Management & Innovation Management and the Leader of the Research Seedbed Knowledge Management in Organizations Management - KMOM. She is a consultant for the Evaluation of Knowledge and Business Management Models, of companies that provide services that involve the use and appropriation of Information and Communication Technologies - ICT. She leads projects with other universities and companies of the Health Sector as a principal researcher, as a cooperation strategy for a better positioning of the Research Group.