APPLICABILITY ANALYSIS OF THE BUSINESS ECOSYSTEM CONCEPT IN DAIRY PRODUCTION BASED ON A SYSTEMATIC LITERATURE REVIEW

Andrei Bonamigo, Helio Aisenberg Ferenhof, Fernando Antônio Forcellini

Abstract: World dairy production has promising growth for the next decades. In order to boost even more, some actions need to be taken regarding to the factors that limit the development of the activity. This study aims to assess the relevance of using the business ecosystem concept in dairy production as a mechanism to mitigate limiting factors and boost the development of this sector. Based on a systematical literature search it was possible to identify its applicability from an analysis of the interactions and / or collaboration between multi-agent milk production. From 1266 retrieved on scientific databases, the resulting bibliographic portfolio analysis presented 14 studies, which support that the business ecosystem concept can be used as an alternative to boost the sector and mitigate potential risks. The works in question, indicate the interaction between the actors in the dairy ecosystem and innovation as a factor to develop this system.

Key-Words: Dairy production, business ecosystem, barriers, milk production, dairy chain, dairy business ecosystem.

1 INTRODUCTION

The world dairy sector shows growth potential. Per capita consumption is currently 83 kg, 3 kg over 77 kg that was consumption for 34 years. All the increase in per capita consumption came from developing countries (ALEXANDRATOS; BRUINSMA, 2012).

However to meet this growing milk demand, the current production system needs improvement, such as better quality milk production, milk production rates, new technologies, among other factors that enable technological innovation in the sector (RODRIGUES; ALBAN, 2013; RYHANEN; SIPILAINEN; YLATALO, 2013; WINCK, 2013; WANG; CHEN; KLEIN, 2015).

Based on the issue exposed, this study analyzes the possible applicability of the business ecosystem concept in the dairy production system as an alternative to enhance this sector.

A business ecosystem can be defined as an economic community supported by a foundation of organizations and individuals, including government, universities / research institutes, industry players and other stakeholders that cooperate together to co-creation of value (MOORE, 2006; RIEMER; KLEIN, 2006; GALATEANU; AVASILCAI, 2013).

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Enhancement in the way that farmers, suppliers, agro-industries, produce became possible through the value co-creation. It sets efficiency and performance improvements standards of the entire chain and meets the growing demands from dairy products (XHOXHI et al., 2014; BONAMIGO; FERENHOF; FORCELLINI, in press).

2   METHODOLOGY

The methodology used for the study comprises two stages. The first was conducted a systematic literature review, to recognize the state of the art on the subject. Then, the content analysis composed by 1) Pre-analysis; 2) Exploration material or coding and; 3) treatment of results, inference and interpretation, as recommended by Bardin (2011) was performed as detailed in the following.

The systematic review followed the approach of Jesson, Matheson and Lacey (2011), that have proposed six principles for systematic reviews, which are as follows:

(1) Mapping the field through a scoping review.

(2) Comprehensive search.

(3) Quality assessment, which comprises the reading and selection of the papers.

(4) Data extraction, which refers to the collection of relevant data and the capturing of the data into a pre-designed extraction sheet.

(5) Synthesis, which comprises the synthesis of the extracted data to show the known and to provide the basis for establishing the unknown.

(6) Write-up.

First the search strategy was developed, composing the research question of interest, the keywords, and a set of inclusion and exclusion criteria. The query for this research was ("milk production" OR "dairy production" OR "dairy industry" OR "dairy farm*" OR "dairy chain") AND (management OR business OR governance OR "business ecosystem") AND (model OR framework). The inclusion criteria were peer-reviewed academic papers in English, Portuguese languages and the databases used were Compendex, Emerald, ISI Web of Science and Scopus. The exclusion criteria were gray literature such as reports, books, and non-academic research, and content in languages other than the presented ones. Furthermore, a spreadsheet was produced consisting of aspects related to the use of the business ecosystem concept to assist daily production.

Second, one of the authors accessed the four databases and searched using query resulted by the combinations of the keywords set. Seeking for combinations of these

keywords in the title, keywords and abstract. Is highlighted that the search on the databases where made on May 19, 2016. And returned 1266 documents that 67 where duplicated, resulting into 1199 documents as can be seen on Table 1.

Table 1 - General documents distribution by Database

Data base	Frequency
ISI Web of Science	1049
Scopus	122
Compendex	54
Emerald	41
Total	**1266**
Duplicated	67
Final Total	**1199**

Source: Authors

Third, to filter the documents, each of the researchers physically examined the title, abstracts and keywords of all documents to make sure that they actually fell within the research scope. This reduced the number of documents to 230, which fulfilled the criteria and were then analyzed.

Fourth, the 230 documents were full read by each of the authors. By doing the reading the authors found that 221 documents weren't aligned with the research. Reducing to 9 documents. Additionally, the authors checked the references of those 9 documents and found other 5 works referenced that was aligned with the theme and was included into the final bibliographic portfolio. Later then, the 14 documents were coded and analyzed according to the content analysis criteria as specified by (Bardin, 2011).

Fifth, in the sequence, the individual data were synthesized into one single spread sheet. Later, each instigator independently worked across the merged sheet to check for consistency regarding the coding of the context unit and record unit. Our different understandings were shared and discussed during our discussion cycles.

Sixth, the final stage of our review process was devoted to the write-up of the findings.

3 RESULTS AND DISCUSSION

Based on the systematic literature review, the resulting bibliographic portfolio shows fourteen documents, as can be seen on Table 2, which forms the base to analysis.

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Table 2 – Bibliographic Portfolio

ID	Author	Year	Title	Journal
1	Dolinska, A. and d'Aquino, P.	2016	Farmers as agents in innovation systems. Empowering farmers for innovation through communities of practice	Agricultural Systems
2	Schneider, S. and Gazolla, M.	2015	Seeds and Sprouts of Rural Development: Innovations and Nested Markets in Small Scale On-Farm Processing by Family Farmers in South Brazil	Constructing a New Framework for Rural Development
3	Wang, J., Chen, M. and Klein, P. G.	2015	China's Dairy United: A New Model for Milk Production	American Journal of Agricultural Economics
4	Lamprinopoulou, C., Renwick, A., Klerkx, L., Hermans, F. and Roep, D.	2014	Application of an integrated systemic framework for analysing agricultural innovation systems and informing innovation policies: Comparing the Dutch and Scottish agrifood sectors	Agricultural Systems
5	Bošková, I.	2013	Collaboration in the Czech dairy chain	Agris On-line Papers in Economics and Informatics
6	Ryhanen, M., Sipilainen, T. and Ylatalo, M.	2013	Cooperation in business activities on dairy farms in south Ostrobothnia, Finland	Economic Science for Rural Development: Production and Cooperation in Agriculture / Finance and Taxes
7	Kilelu, C. W., Klerkx, L. Leeuwis, C.	2013	Unravelling the role of innovation platforms in supporting co-evolution of innovation: Contributions and tensions in a smallholder dairy development programme	Agricultural Systems
8	Eastwood, C. R., Chapman, D. F. and Paine, M. S.	2012	Networks of practice for co-construction of agricultural decision support systems: Case studies of precision dairy farms in Australia	Agricultural Systems
9	Colurcio, M., Wolf, P., Kocher, P. Y. and Spena, T. R.	2012	Asymmetric relationships in networked food innovation processes	British Food Journal
10	Bachev, H.	2008	Integration of dairy farms in the supply chain in Bulgaria	Society and Economy
11	Hansson, H.	2007	Strategy factors as drivers and restraints on dairy farm performance: Evidence from Sweden	Agricultural Systems
12	Valeeva, N. I., Huirne, R. B. M., Meuwissen, M. P. M. and Oude Lansink, A. G. J. M.	2007	Modeling farm-level strategies for improving food safety in the dairy chain	Agricultural Systems
13	Parrott, L., Lacroix, R. and Wade, K. M.	2003	Design considerations for the implementation of multi-agent systems in the dairy industry	Computers and Electronics in Agriculture
14	Somda, J., Kamuanga, M. and Tollens, E.	2005	Characteristics and economic viability of milk production in the smallholder farming systems in The Gambia	Agricultural Systems

Source: Authors.

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In a first analysis of the documents, can be seen that in the last five years there is a greater concentration of published papers related to the theme, as shown in Figure 1. This seems to indicate a greater interest of the scientific community on the subject.

Figure 1: Publications vs Year
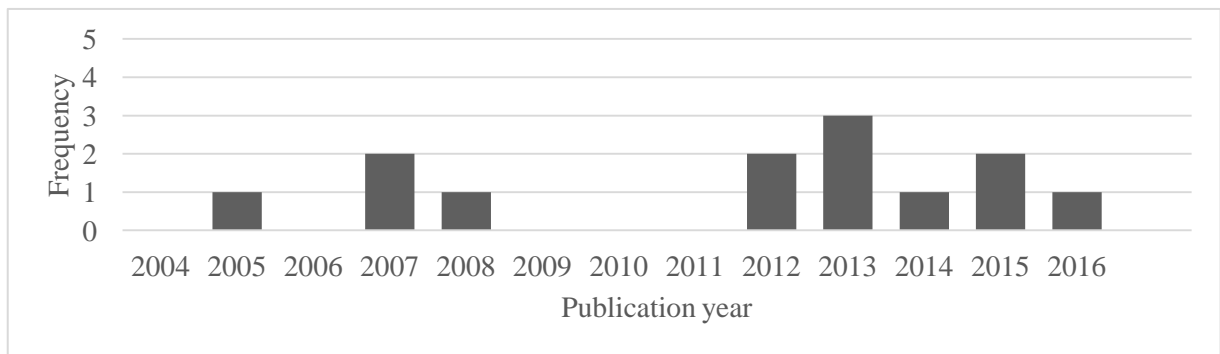
Source: Authors

Following the content analysis, two unit's records were generated, and classified the context units, totaling fifteen context units. as can be seen on Table 3.

Table 3: Analysis units

Record Unit	Context Unit	Author	Frequency
Cooperation between actors	Dairy farmers working in a cooperative way gets advantages and competitiveness.	Bošková (2013)	11
	Interventions based on multi-agent settings, should make space for farmers to collectively build their participation in the platform activities.	Dolinska e D'aquino (2016)	
	Cooperation brings innovation and differentiation resulting in added value to food.	Schneider e Gazolla (2015)	
	Dairy farmers need resources, and alone these are limited, cooperation is an alternative to solve this challenge.	Ryhanen; Sipilainen e Ylatalo (2013)	
	Farmers learn through interaction with a contacts network, inside and outside the farm.	Eastwood; Chapman e Paine (2012)	
	The farmers' integration has been associated with the need of progressive changes in the race of animals, production technology, work organization, and these led to elevate income, production quality, stability, sell and prices, animal care and environment. Also provide the possibility of modernization and adaptation to the formal requirements that demand activity.	Bachev (2008)	
	The performance of a link in the chain dairy can being limited to another actor downstream or upstream.	Hansson (2007)	
	The multi-agent approach is highly suitable for the creation of a decision support system for dairy production, being important the system flexibility and extension are important	Parrott; Lacroix e Wade (2003)	

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	The dairy cattle integration system in China has overcome problems related to quality. The model is transforming small production units, in high production potential.	Wang; Chen e Klein (2015)	
	The government can influence in the chain, by creating incentives and policy for food security, among other measures.	Valeeva *et al.* (2007)	
	Results suggest that the active cooperation with customers, especially in innovation networks supports to create opportunities for small and medium size food producers.	Colurcio *et al.* (2012)	
Innovation	Innovation in farming systems focuses primarily on interactions and learning between farmers and other actors	Kilelu; Klerkx e Leeuwis (2013)	4
	Systemic failures in terms of interactions and skills of the actors, as well as market structures and incentives for innovation were revealed in the agro-industrial system.	Lamprinopoulou *et al.* (2014)	
	The innovation co-evolution is a highly dynamic process with multiple interaction strains and unexpected effects, being the distributed nature of intermediation between multiple actors important to address some of these emergency tensions on different actors interfaces	Dolinska e D'aquino (2016)	
	Constraints to increased productivity include lack of technology improvement at the farm level and weak institutional support.	Somda; Kamuanga e Tollens (2005)	

Source: Authors

In order to identifying possible contributions that the business ecosystem may present to the dairy production system, each of the two records units were discussed.

3.1   Possible contributions from the business ecosystem concept in dairy production

From the content analysis it was possible to identify the possible contributions of the business ecosystem concept from the perspective of two context units: the interaction between the actors and innovation.

The interaction between producers in a cooperative form presents as value co-creation way between dairy farmers, enabling the knowledge exchange between the actors (BOŠKOVÁ, 2013). In some countries such as Brazil, cooperation between small dairy producers led to the formation of agro-industrial cooperatives, such as the Cooperative Production and Consumption Concordia (COPÉRDIA) and Aurora cooperative; which allow producers bargain best input prices and better commercializing milk pricing, originated from these small production units.

Interactions between producers and even among multiple-agents such as universities, research centers, consumers, customers and agribusiness enables the value co-creation in the dairy system (MOORE, 2006; KILELU; KLERKX; LEEUWIS, 2013; DOLINSKA; D'AQUINO, 2016). That means, work in network, allows the actors in the dairy system to

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have access to resources, which alone are limited (RYHANEN; SIPILAINEN; YLATALO, 2013).

The resources and / or knowledge sharing among the actors of the dairy business ecosystem, i.e. interactions between the various actors in this environment, configures a business platform. This platform permits to minimize deficiencies related to the dairy industry, such as: lack of quality need for genetic improvement limited production technologies, and low productivity (MOORE, 2006; MAZZAROL; LIMNIOS; REBOUD, 2013; DOLINSKA; D'AQUINO, 2016).

Regarding innovation, the business ecosystem concept offers advantages by promoting the interaction between the actors of the dairy business environment. In the business ecosystem, the actors can interact to innovate, through the exchange of knowledge, experiences and resources, which acting individually, they are limited (KILELU; KLERKX; LEEUWIS, 2013).

The lack of a holistic look at the dairy ecosystem, has highlighted systemic failures in terms of interactions and responsibilities between the actors, also to the market structure and incentives for innovation (LAMPRINOPOULOU; RENWICK et al., 2014).

Innovation in dairy ecosystem, drives the improvement of new products, processes and services in dairy production making it more competitive (KILELU; KLERKX; LEEUWIS, 2013; DOLINSKA; D'AQUINO, 2016). For SOMDA; KAMUANGA e TOLLENS (2005) lack of innovation is seen as the main limiter of increase for the sector's productivity.

5. FINAL THOUGHTS

This study aimed to analyze the applicability of the business ecosystem concept in the dairy production system as an alternative to improve this system. Through a systematic literature review, supported by content analysis were proposed two units records to evaluate the dairy ecosystem, being: the interaction between the actors in the business environment and innovation.

Through this study it was possible to identify potential contributions of the business ecosystem concept in the dairy production system, so that the obstacles related to lack of cooperation between the actors for the value co-creation are mitigated. This cooperation between the actors comprises multiple players such as universities, research institutes, agro-industries, consumers, producers, manufacturing industries, cooperatives, among others.

The holistic approach that the business concept ecosystem introduces, boosts the knowledge and / or resources exchange, which an actor acting individually would be restricted to themselves and should work harder to compensate for their limitations in order to develop the dairy production.

As an opportunity for future studies, it is proposed to make a literature review in order to identify the main barriers of the dairy sector from the business ecosystem concept and beyond, propose a framework to overcome those barriers.

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