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Interrelations between conceptual elements of the Actor-Network Theory (ANT) and food systems

Interrelaciones entre los elementos conceptuales de la Teoría del Actor-Red y los sistemas alimentarios

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Contents

ABSTRACT:

The article is a systematic review of literature; the goal of the study is to identify relationships between the conceptual elements of the Actor-Network Theory (ANT) and food systems. We used the systematic review of indexed documents in scientific databases between 2014 and 2018. Next, successive filters were applied to obtain the final review material. We then used Nvivo software tools in the final review material, in order to analyze this research in depth and determine the contribution of ANT to food systems.

Keywords:

Actor-Network Theory, human and non-human actors, actant, agency

RESUMEN:

El artículo es una revisión sistemática de la literatura; el objetivo del estudio es identificar las relaciones entre los elementos conceptuales de la Teoría del Actor-Red (TAR) y los sistemas alimentarios. Se utilizó la revisión sistemática de documentos indexados en bases de datos científicas entre 2014 y 2018. Luego, se aplicaron filtros sucesivos para obtener el material de revisión final. Posteriormente, se utilizaron herramientas del software Nvivo en el material de revisión final para analizar esta investigación en profundidad y determinar la contribución de ANT a los sistemas alimentarios.

Palabras clave: Teoría del Actor-Red, actores humanos y no-humanos, actante, agencia

1. Introduction

ANT was developed by Latour, Callon and Law in the field of science and technology studies at the end of the 70s and 80s (Carroll, 2018). It perceives the world as being composed of multiple networks of heterogeneous, complex and dynamic actors. Latour (2005a) points out that ANT guides connection evaluations between things, people and ideas in larger units known as networks in order to execute actions. It is conceived as a disparate family of semiotic tools, susceptibilities and analysis methods that treat everything in the natural and social worlds as a continually generated effect of the relationship networks within which they are located (Law, 2007).

ANT talks about hybrid networks that show large networks of connections through which action is achieved. Consequently, there are important implications in the way food is understood. ANT also presents challenges in quality assessment and classification of food (Hopkinson, 2015). Food

systems are conceived as a system of production, marketing, transformation and acquisition of food through agriculture and consumption, as well as resources and institutions involved (Glopan, 2014). The food system has a high level of complexity due to many economic, sociocultural and environmental factors, both internal and external to its limits. Food systems act as complex socio-ecological systems in which there are multiple interactions between human and natural actors (Allen, 2016).

The link between ANT and food systems takes as a background a broader understanding of the relationships between humans and non-humans (actants) in food systems. ANT has been used to facilitate the understanding of the globalization and Canadian production of rapeseed, showing how actant networks are constructed and the redistribution of power. ANT explored how the actants interact in Brazil's soybean production, and highlights the role of the active nature in the food systems (Stuart & Woroosz, 2011).

It should be noted that the world's food systems face the challenge of providing food to the global population, which is expected to reach 9 billion by 2050. The hope is that it will not affect the environment, soil degradation and ecosystem services because they are the basis for global food security, and future food production would be put at risk. It is therefore necessary to reflect on food production and consumption patterns based on quantities, and the types of food consumed and wasted (Jeswani & Azapagic, 2019).

The goal of the study is to identify the relationships between the Actor-Network Theory (ANT) and food systems: actants (human and non-human actors) in food systems. It is considered that the contribution of this study will be reflected in ANT's contributions to food systems, discovering aspects yet to be addressed by ANT in food systems, identifying key literature that shows how ANT relates to certain food system activities. Structurally, the article is organized as follows: i) conceptual framework: contains the literature of ANT's general conceptual elements, and food systems; ii) methods: the methodological process implemented for the study is described; iii) results, iv) discussion: the results are analyzed, and v) conclusion: conclusions and ideas for future research.

1.1. Conceptual framework

Actor-Network Theory (ANT)

The Actor-Network Theory (ANT) originated in the field of science and technology studies (Dwiartama, 2017). It perceives the world as multiple networks of heterogeneous, complex and dynamic actors (Lee, Newell, Wolch, Schneider, & Joassart-Marcelli, 2014); it also describes how the actors interact to form agency networks; affirms that all the actors affect change. In other words, they must be considered mediators instead of intermediaries (Price, 2017). Vitalis, Nor-Khaizura, and Son (2016) mention that ANT can be classified into two categories: human and non-human actors. The human actor represents living entities; the non-human actor represents technologies, institutions and corporations. ANT's primary objective is to explore the construction and maintenance of networks in order to reach a goal (Devi & Kumar, 2017).

Food System

Created through international consensus, the UN-proposed 2030 Agenda for Sustainable Development has shown concern for food systems and health (Pradyumna, Egal, & Utzinger, 2019). Food systems are focused on at least 12 of the 17 Sustainable Development Goals (SDGs) (Chaudhary, Gustafson, & Mathys, 2018). For the United Nations most of the SDGs are related to the performance of global food systems. However, some researchers suggest that food systems are linked to the 17 SDGs (Willett et al., 2019).

Food systems are conceived as a network of actors and activities interacting with each other in an ecological, social, political/cultural and economic environment (Gaitan-Cremaschi et al., 2019), that is, they are socio-ecological systems formed by biophysical and social factors related through feedback mechanisms (Tendall et al., 2015). Food systems comprise all activities in the food supply chain, ranging from production to storage, processing and distribution, retail and marketing, and food preparation and consumption at home (Fanzo, Davis, McLaren, & Choufani, 2018).

A sustainable food system is "a system that guarantees food security and nutrition for all in such a way that economic, social and environmental bases to generate food security and nutrition for future generations are not compromised" (HLPE, 2017). A sustainable food system seeks to transform negative environmental impacts of the main activities of food systems into positive, or

at least neutral, results, as well as promote a shift towards more sustainable practices (Béné et al., 2019). Current global food systems are not sustainable due to their worldwide production, consumption and excessive waste. Additionally, they produce significant environmental degradation and pollution, and cause damage to natural systems (Momo-Cabrera, Ortiz-Andrellucchi, & Serra-Majem, 2018).

From the aforementioned, Ericksen (2008) argues that by broadening the conception of food systems, one can determine: i) interactions between and within biogeophysical and human environments (production to consumption); ii) the results of these activities (contributions to food security, environmental security and social welfare); and iii) other determinants of food security (interactions between food production, processing, distribution, preparation and consumption).

Food Systems Human and Non-Human Actors

The principle of generalized symmetry affirms that there are no a priori differences between human and non-human actors (Latour, 2005a); human actors are treated before analysis as if they had no agency other than a non-human entity. For example, a macro-actor (such as the state, the global economic system or climate change) is not necessarily more important than a microactor, for example, a peasant a rural citizen or a stream (Stone-Jovicich, 2015). In other words, generalized symmetry allows us to explain connections between ontologically different entities comprising a network without the need to address ontological binaries such as matter-spirit and nature-culture (Martínez-Flores, Ruivenkamp, & Jongerden, 2017).

From ANT's perspective, the relational approach of the connections between human and non-human actors in agrifood systems broadens the spectrum of actors considered part of agrifood networks. This promotes identification and description of processes, practices and discourses of the actors linked in R & D, production, distribution, exchange, consumption and availability of food (Herrero, Wickson, & Binimelis, 2015). ANT was introduced into food systems to better understand relationships between humans and non-humans (Stuart & Woroosz, 2011). It also allows studies of agri-food systems to overcome the dividing line between production and consumption, by conceptualizing food systems as heterogeneous networks of human beings, animals, viruses, knowledge, markets, regulations and discourses (Stoddard & Cantor, 2017).

Busch and Juska (1997) present an analysis of the globalization of the Canadian rapeseed industry (Brassica rapa and B. napus) developed through three simultaneous moments: the modification of the relationships between people and plants; extension of rapeseed production networks; and redistribution of power, wealth and status among actors involved in global rapeseed production networks. de Sousa and Busch (1998) argue that the use of agricultural innovations in Brazilian soy production is better understood as the result of the creation of networks of people and things. Goodman (1999) highlights the use of ANT to solve the ontological limitations in case studies related to food shortages, agricultural biotechnologies and proposals to regulate organic agriculture in the United States.

Gouveia and Juska (2002) used ANT to structure an analytical framework related to a case study of the U.S. beef industry. Goodman (1999) reviews ANT's strengths and weaknesses as an alternative of critical commitment to "new" biopolitics of agrifood networks. Whatmore and Lorraine (1997) address fair trade networks; highlight the actions of the material devices in the "hybrid collectives," as well as the extent to which ANT caused the breakdown of the micro versus macro and local versus global dichotomies. In agrifood studies ANT has been a benchmark that allows us to symmetrically capture the determinants and the effects of production and consumption (Lockie & Kitto, 2000). Martínez-Flores et al. (2017) conducted an ethnographic investigation based on ANT and Tim Ingold's relational thinking model to trace the ways in which Lupinus mutabilis Sweet, also known as lupine or tarwi, in a small indigenous community of the Ecuadorian province of Cotopaxi. In this study he analyzes the network of actants (human and nonhuman, organized by horizontal (non-hierarchical) relationships and characterized by their own regeneration (self-sustainability).

Actants

The term actant is used to resist any anthropocentrism and anthropomorphism that can be attributed to the term actor; actant is a more neutral term than actor. ANT reinforces the idea that both humans and non-humans can act (Barter & Bebbington, 2013). Latour (1996) defined the actant as "something that acts or for which others grant activity" (p. 373), that is, within the influence between actants, coexistence is generated (Wang & Selina, 2018). Law (1999) affirmed that "entities achieve their form as a consequence of the relationships in which they are found ... they are realized in, by and through those relationships" (p.4).

Law (1992) states that in a network of actors, humans and non-humans are related, that a farmer is a farmer only in a network with the land, seeds, water, shovel, weather report, soil bacteria, etc. The farmer's actions are not limited to his subjectivity, but go beyond the ontological limits of humanity, nature and technology.

Agency

The concept of agency is used in social sciences to distinguish the capacity of an agent, usually human, to influence broader social relationships or structures or to actively control its own welfare (Brown & Westaway, 2011). In ANT agency is conceived as the ability to cause an effect, or to make a difference in a state of affairs (Callon, 1987); (Latour, 2005b). According to Latour (2005b), agencies are always presented in an explanation that they do something, or that they somehow affect a state of affairs, transforming some A into B through C. Agency only manifests itself in relation to the actors among themselves; material objects exert a humanlike action (Dwiartama & Rosin, 2014).

Agency emerges from interconnection, it is distributed through the network that unites things and people, Latour uses the term "actants" to refer to all the actors, human and non-human, that establish the existence of the world that we know (Whiteside, 2013). Agency is not necessarily about people, it is not their attribute, since actions do not occur individually, but are the result of interaction between humans and nonhumans (JÚLIO & POUBEL, 2016)

With regard to non-human agency, Callon (1984) mentions several examples of agency, among them the ability of scallops to direct scientists' attempts to insert themselves as experts in fishing conservation projects. Legun (2015) describes how apples have shaped apple markets; and Dwiartama and Rosin (2014) show the importance of rice in Indonesian culture and politics. Thorsøe, Alrøe, and Noe (2014) mention that in the evaluation of organic agriculture, ANT has been applied so as to understand the agency of the actors and the networks with which the production of organic food is associated. In his ecological rehabilitation project in Cape Town, Ernstson (2013) presented the role that plants had in relation to the memories of oppression and the emergence of an environmental movement.

Translation process

Law and Callon, taken from Powell (2016), mention that translation is a process by which sets of relationships among projects, interests, objectives and entities occurring naturally are proposed and created, objects that could otherwise be separated from each other. Powell says that translation is analogous to the construction of the world because the translator is building a world of interactive and interdefined entities that, by becoming part of a network, obtain agency and identity. Tang, Chen, and Chiu (2018) mentions that all actors in the actor-network must go through translation in order for the role, function and interest of each actor to be redefined, sorted and assigned to different script positions. During translation, each actor must continually translate the problems and interests of other actors into the language of each actor so that each can negotiate and form a consensus with other actors. Attributes and position of each actor are temporary and will change in regard to relationships between actors. This is an iterative process until negotiations are completed and a consensual and stable actor-network model is established.

Translation is comprised of four steps: problematization, interessement, registration and mobilization. According to Callon (1987), problematization is where the creators of a network are configured as an indispensable mandatory crossing point through which all the actors must pass in order to solve problems regarding the project's goal. Interessement is a group of activities through which an entity interposes and imposes the identity of other actors as defined through its problematization. Enrollment refers to the success of the interest. Finally, mobilization is the combination of entities in a world that works naturally and apparently naturally.

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2. Methodology

This article is based on a systematic review of documents indexed in these databases: Web of Science, Taylor & Francis, Science Direct, SpringerLink, Jstor and Proquest, between 2014 and 2018. The goal of this review was to identify the relationships between conceptual elements of the Actor-Network Theory (ANT) and food systems. In each aforementioned database, the exact search criteria were applied through the combination of the words "Actor-Network Theory" & "Food system." In the WOS database the second term was not restricted to exact search criteria, that is to say, the quotation marks were omitted in the term food system due to scarce results. Table 1 details the application of filters and the results obtained in the databases:

Table 1
Filters applied and results
obtained from the databases

Filters					
Databases	**Source Type**	**Publication date**	**Sorted by**	**Aditional filter**	**Results**
Web of science	Article, review and editorial material	from 2014 to 2018	Relevance	Web of Science core collection	8 documents
Taylor&Francis		from 2014 to 2018	Relevance	Subject: Environment and Sustainability: Search anywhere (title, author, keywords)	132 documents
Science Direct	Review articles, research articles, encyclopedia y editorials	from 2014 to 2018	Relevance		31 documents
SpringerLink	Articles	from 2014 to 2018	Relevance		23 documents
JSTOR	Journals and books	from 2014 to 2018	Relevance		11 documents
PROQUEST	Scholarly journals	from 2014 to 2018	Relevance	Full text and peer reviewed	25 documents

Note: Prepared by the author

With the results obtained from the aforementioned databases, we applied the systematic literature review of El Bilali (2018). This methodology creates successive filters to obtain the research documents to be included in the systematic review. The filters applied were: i) removing duplicates, ii) selection of research documents, iii) screening of records based on titles, iv) scrutiny of abstracts for eligibility. The steps of systematic review of literature mentioned can be seen in Table 2. Endnote software was used for this process.

Table 2
Systematic literature review steps

Systematic review steps	Number of selected records	Step description
1) Identification of records:	230	230 records identified through Web of Science, Taylor&Francis, Science Direct, SpringerLink,Jstor, Proquest
Web of Science	8	
Taylor&Francis	132	
Science Direct	31	
SpringerLink	23	

JSTOR	11	
PROQUEST	25	
2) Removing duplicates	**221**	**9 duplicated removed**
		185 records excluded
3) Selection of research documents	**35**	185 revision articles were excluded because the document centers only on ANT's conceptual elements attached to food systems.
		11 records excluded
4) Screening of records based on titles	**24**	We left out 11 registries referring to innovation, power, tourism, climate change, governance, water, sustainability, resilience, ecosystem, etc. related to ANT.
		7 record excluded
5) Scrutiny of abstracts for eligibility	**17**	7 records based on summary scrutiny because they don't relate ANT's conceptual elements in food systems.

Note: After applying systematic review steps,
17 research documents in systematic review were included

3. Results

The use of software in the qualitative data analysis can be a strategy to guarantee methodological rigor (Houghton, Casey, Shaw, & Murphy, 2013). With this in mind, the systematic literature review used the Nvivo software to obtain i) word frequency query, ii) word coding, iii) cluster analysis; and, iv) matrix coding query. The application of these elements can be seen in this section.

One of the most used techniques for qualitative data analysis is content analysis, which can be divided into three approaches: i) lexical (nature and richness of the vocabulary) ii) syntactic (verb tenses times and moods), and, iii) thematic (themes and frequencies). With any approach the volume of work is usually large, since it is a function of the amount of information as well as the maturity of the coding process (Oliveira, Bitencourt, Teixeira, & Santos, 2013).

In the analysis of thematic content related to word frequency query, a text exploration of the 17 documents was carried out to determine a list of the words with greatest occurrence. The parameters used to restrict the workload analysis in word frequency were the following: 100 most frequent words, grouping with synonyms, and a minimum length of 4 letters. Then, a process of eliminating empty words (those that do not contribute to the analysis) was started, for example, also, need, however, within, years (2013, 2010, 2015), used, etc. The result is shown as a word cloud in Figure 1.

Figure 1
Word frequency query cloud.

Prepared by the author

From the word cloud, an automatic coding of words considered relevant for the study was carried out. Likewise, nodes were structured, that is, a collection of references on a specific topic, case or relationship (Qsrinternational, 2018). For this case, the actor network theory (ANT) and the food system have been taken as reference elements. The ANT grouped 10 nodes: actors, agency, bodies, human, hybrid, material, network, relations, systems and technology. The food system merged 23 nodes: agriculture, consumer, development, ecology, economic, environmental, farmers, food, industry, knowledge, local, market, nature, organic, plant, practices, process, production, quality, rural, science, structures and sustainability.

With these elements, we applied a relationship search through cluster analysis. The parameters for the analysis were coding similarity and Jaccard's coefficient. Table 3 shows some similarities between the nodes of the documents.

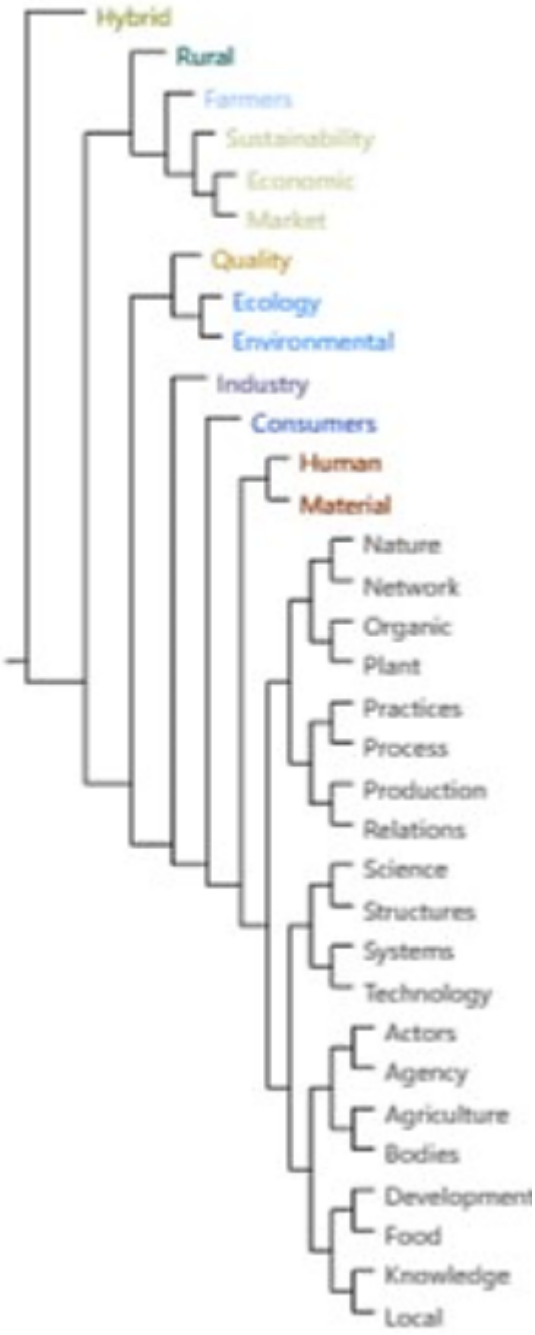
Table 3
Cluster analysis by coding similarity
and Jaccard's coefficient

Node A	Node B	Jaccard's coefficient
Nodes\\Actor-Network Theory\Agency	Nodes\\Actor-Network Theory\Actors	1
Nodes\\Food System\Agriculture	Nodes\\Actor-Network Theory\Actors	1
Nodes\\Food System\Agriculture	Nodes\\Actor-Network Theory\Actors	1
Nodes\\Food System\Agriculture	Nodes\\Actor-Network Theory\Agency	1
Nodes\\Actor-Network Theory\Bodies	Nodes\\Actor-Network Theory\Actors	1
Nodes\\Actor-Network Theory\Bodies	Nodes\\Actor-Network Theory\Agency	1
Nodes\\Actor-Network Theory\Bodies	Nodes\\Food System\Agriculture	1

Note. The whole table contains 195 similarities equal to 1; 100 similarities equal to 0.941176, 15 similarities equal to 0.9375; 4 similarities equal to 0.933333; etc

In figure 2 the similarities presented between the nodes of the documents submitted to the analysis are shown as a dendrogram.

Figure 2
Dendrogram of conglomerate
nodes by coding similarity



Prepared by the author

By using the dendrogram of conglomerate nodes by coding similarity, the Actor, Agency, Human, Food and Systems nodes were selected to create an encoding matrix showing how many times such terms or synonyms appear in the 17 articles that underwent the analysis. This matrix is shown in table 4.

Table 4
Actors, Agency, Human, Food
and System matrix coding query

	Actors	**Agency**	**Food**	**Human**	**Systems**
Levelly	27	92	81	22	84
Hausknost	54	85	3	70	235
Tang	144	27	162	13	118
Vitalis	53	11	123	60	33

Powell	91	24	17	56	19
Dwiartama (2015)	31	40	329	24	70
Thorsoe	38	32	130	18	190
Hetherington	18	34	19	31	29
Sarmiento	41	30	165	151	87
Dwiartama (2014)	32	101	22	86	106
Herrero	20	42	154	26	124
De hoop	7	35	175	34	56
Kristensen	7	21	61	17	35
Watts	5	22	161	23	45
Killion	1	2	14	1	18
Carolan	4	35	91	48	21
Derbez	1	2	1	0	5

Note: Prepared by the author

4. Discussions

The Word frequency query cloud in Figure 1 indicates that the word with the most representativeness is Food. Also featured are systems, actors, network, agency, local, studies, agriculture, development, and relations, among others.

Applying Jaccard’s coefficient, the cluster analysis identifies the closest relationships between the Food System and Actor-Network Theory nodes. This exercise shows the existence of relationships with Jaccard's coefficient = 1, between sub-nodes of food systems and sub-nodes of Actor-Network Theory, such as: Agriculture and Actors; Development and actors; Development and Agency; Food and Agency; Knowledge and Actors; and Nature and Agency, among others.

As for the matrix coding query, when searching for links between Actors, Agency, Human, Food and systems that contain final review material, the author who includes the word Actors most frequently is Tang et al. (2018) with 144, followed by Powell (2016) with 91 and Hausknost et al. (2016) with 54. Tang et al. (2018) Powell (2016) Hausknost et al. (2016).

Tang et al. (2018) and Powell (2016) concurrently use the ANT translation process. Tang analyzes agricultural food systems on the peripheral island of Penghu, focusing on the establishment of market networks, which include agricultural production, consumption and interrelation between society, economy, ecological sustainability and agricultural food system. The study maps the network of social relations between the actors of the local agricultural food system. The network map identifies key factors that could impact the local brand value of Penghu. Initially, six actors, ten obstacle problems and twelve goals are identified. Secondly, the calculation of the associative connection frequencies in the analyzed data is applied and a hierarchical perceptual map of the local agricultural food systems is drawn. According to ANT, an actor-network perceptual map of the structured local brand value with five main actors (government agency, producer association, producer, school and consumer); five main obstacle problems (government policy, the high degree of homogeneity of agricultural products, the product produced, population departure, lack of marketing and promotion); and five main objectives (community development, industry transformation, brand development, food and agriculture education and experiential marketing).

Powell (2016) conducts his study in northwestern Portugal and uses translation as a framework for conceptual organization to explore a particular type of white corn, known as Pigarro, which is improved through an experimental type of participatory plant breeding. Powell says Pigarro can be conceived as the name given to a certain variety of white corn; however, the difference lies in the wide range of human and non-human actors who are enrolled in the project. The analysis of the effort needed to make a Pigarro actor-network stands out, i.e. the work necessary to move from illustrative plant breeding ideas to a variety of corn grown by farmers and, finally, to a processed grain such as flour and baked in a traditional Portuguese cornbread called broa. The author thus shows crop varieties as fluid and dynamic, things that never form but are constantly transforming. Despite addressing the Agency and social ecology, Hausknost et al. (2016) do not make an important contribution, since the issue does not develop around ANT.

Dwiartama and Rosin (2014) mentions the word Agency 101 times, Le Velly and Dufeu (2016) 81 times and Hausknost et al. (2016) 85 times. Both, Dwiartama and Rosin (2014) and Le Velly and Dufeu (2016) research are based on alternative food networks. The first study takes place in Dunedin, a small city on New Zealand's South Island, and whose interest is based on detecting the main actors of the food system and understanding relational activities between them. The objective of Dunedin's population is to achieve food security through a local food strategy. The researchers use the thought of assembly of Deleuze and Guattari in order to articulate continuous appearance of processes and structures. Likewise, the term Agency is not explicitly mentioned; however, it has been included in the context of the term Agency due to its similarity to or as a synonym of Agency.

It is important to highlight that, although the study does not contribute directly to the goal of this study, it mentions interesting aspects of food safety, such as alternative food networks through the assembly of various actors. It emphasizes that assembly, mechanics and statements are incorporated into the study's development. The first consists of the materiality of humans (students, farmers, social workers and migrants), as well as non-humans (climate, geography and food). The second includes the fulfillment of goals and objectives. On the other hand, in Le Velly and Dufeu (2016) study, carried out around Nantes, France, market devices, market mediation and market agreements are used in the local food system. Considering a food system as a "market agent," it is able to act within the market and allows the detection the hybridities from which alternative food networks are composed, i.e., human beings, materials and naturalness, local and global scale, production and consumption, alternative and conventional actors and devices. Hausknost et al. (2016) does not contribute because the issue does not develop around ANT.

The word Food is mentioned 329 times in Dwiartama and Rosin (2014) and 175 times in Evelien De Hoop and Jehlička (2017). Both authors address alternative food networks (AFN), spaces of action that transform food systems due to reconnection between production, consumption that are integrated into localized social relationships. However, the difference with Dwiartama is that he mentions an AFN variant called food self-sufficiency (FSP). It is considered a more radical form of AFN due to the deeper reconnection and social integration of food production and consumption (E. de Hoop & Jehlicka, 2017).

As previously noted, Dwiartama and Rosin (2014) looks at the local food system using the assembly thinking of Deleuze and Guattari to identify the main actors and understand the relationships that arise between them. Evelien De Hoop and Jehlička (2017) bases his research on a case study in the Czech Republic, the purpose of which is to understand the relationships between environmental NGO activists and food self-supply practices (FSP). He mentions that it takes some sensitivities from ANT, particularly about the importance of non-humans and the distributed agency. They are used to study how discourse and material reality come together through concerted actions among humans (activists, gardeners, etc.) and non-humans (gardens, crops, etc.) to document how alternative food activists relate to the FSP through discourse and practice, so that they can understand how relations are created.

As for the word Human, Sarmiento (2015) mentions it 151 times, Hausknost et al. (2016), 70 times and Vitalis et al. (2016), 60 times. Sarmiento (2015) bases his work on a field investigation in the Oklahoma food cooperative and is based on the writings of the ethologist Uexküll. This reasoning is based on two examples of critical research on food: one related to feminism about food and personification, and the other, having relevance for this literature review, is the post-humanist approach. This approach expresses the importance of the roles of non-human actors in food systems; it emphasizes the need to include non-human actors so they are considered allies in the struggle to create more just, human and sustainable food. Vitalis et al. (2016) addresses certain ANT-related studies to assess and analyze food safety problems, so that human and non-

human actors are identified. This paper cites several studies that address the aforementioned problem; however, the food safety mentioned in this research refers to issues of food safety, food quality, food supply chain.

The inclusion of ANT in food safety, focused from the aforementioned vision, provides a broader understanding of the relationship between the human and non-human actors, as it helps to identify them more clearly. For example, when analyzing contaminated food, ANT makes it easier to detect the source of contamination, the responsible agent, factors involved and how to control its spread. Hausknost et al. (2016), does not develop around ANT so he does not contribute to this analysis.

Finally, Hausknost et al. (2016) mentions Systems 235 times, Thorsøe et al. (2014) 190 times and Tang et al. (2018), 118 times. Thorsøe et al. (2014) incorporates ANT as one research perspective that helps him to determine the role of values in evaluations of organic food systems. He mentions as an antecedent that ANT has been applied to understand the agency of the actors and networks related to the production of organic food. The guide of this paper from research perspectives is related to three central questions: 1) How was value fundamentally understood? 2) How was the value measured? and 3) How was the term "organic" understood? Two cases were selected to illustrate and identify the central concepts and the reasons for each question. Tang et al. (2018) research, focused from the term Systems, emphasizes that he applies ANT to the analysis of agricultural food systems with a focus on the establishment of market networks, such as agricultural production, consumption and interrelation between society , economy, ecological sustainability and the agri-food system. Hausknost et al. (2016) is not considered due to the reasons stated above.

ANT has a series of theoretical and methodological tools that have paved the way for various topics to be covered with the ANT umbrella. Several food systems topics have been addressed here. The underlying elements of the topics mentioned previously have been considered, as they are composed of networks of human and non-human actors, or rather actants, that interact with each other to make sense of the systems. Actants can cover everything that is around an object of study.

Food systems are complex and quite heterogeneous and a scalar level approach is very important since there are food systems that are within other systems, i.e they are subsystems. It is therefore important to identify which actors (human and non-human) are immersed in a specific food system in the perspective of building systems capable of finding solutions to food security and nutrition problems without compromising social and environmental economic resources of future generations: systems capable of generating sustainability. For example, Dwiartama and Rosin (2014) study addresses the main actors in the food system of Dunedin's population and determines the understanding of the relationships of said population to achieve food security through a local food strategy.

Tensions existing between the actors of a given food system may be a result of certain variables, such as distribution channels. In these circumstances, through translation of ANT as an analytical tool to systematically interpret and analyze the components in the network of actors (Tang et al., 2018), common objectives of each actor meeting his needs can be achieved. Tang et al. (2018) study illustrates the conception of an actor-network perceptual map in which relationships between actors, the problems and the goals they set out to achieve as a food system network were identified.

Under these circumstances, upon conceiving different aspects that can be integrated from the perspective of food systems and analyzed through a lens of a set of relational networks, different contributions to ANT can be shown from aspects such as plant breeding, resilience, analysis of socio-ecological systems, alternative food networks, food security, and evaluations of organic food systems, among others.

Due to the multidimensionality of food systems, which include many actors and socio-economic, environmental, and political aspects, it is considered that there remains a wide field of research opportunities in food systems that can integrate the ANT approach that include approaches to the different activities of the food system: production, transformation, distribution and consumption. For example, in this literature analysis we did not find ANT related to the consumption phase of the food systems, specifically with food waste.

5. Conclusions

This paper has sought to identify through a systematic literature analysis the relationships between the conceptual elements of the Actor-Network Theory and food systems: Actants (human and non-human actors) in food systems. ANT determines that the actants are all the elements that interact in a network, that is, they meet, interact and affect each other. When perceiving food systems as networks, actants can be articulated with the food system--all the elements interacting in the food system can be linked. However, a food system is very complex and would be composed of countless actants. Given these circumstances, it is necessary to determine a temporal and spatial scale of the food system to associate it with the ANT approach. The ANT approach follows actant networks to understand a variety of research that not only includes the food system but also related aspects such as environmental conservation. It is considered that the contribution of this study is identifying key literature that shows how ANT relates to certain activities of the food systems, such as sustainability, plant breeding, resilience, food security, organic food systems, etc. In this sense, the articulation of other ANT elements, such as "translation," with elements and activities of food systems, is considered convenient in future investigations, since it is the process by which an actant integrates into a network.

Bibliographic references

Allen, M. (2016). Transformational Organizational Change, Reinforcing Structures, and Formal Communication. In *Strategic Communication for Sustainable Organizations* (pp. 139-188).

Barter, N., & Bebbington, J. (2013). Actor-network theory: a briefing note and possibilities for social and environmental accounting research. *Social and Environmental Accountability Journal, 33*(1), 33-50.

Béné, C., Oosterveer, P., Lamotte, L., Brouwer, I. D., de Haan, S., Prager, S. D., . . . Khoury, C. K. (2019). When food systems meet sustainability–Current narratives and implications for actions. *World Development, 113*, 116-130.

Brown, K., & Westaway, E. (2011). Agency, capacity, and resilience to environmental change: lessons from human development, well-being, and disasters. *Annual review of environment and resources, 36*, 321-342.

Busch , L., & Juska, A. (1997). Beyond Political Economy: Actor Networks and the Globalization of Agriculture. *Review of International Political Economy, 4*(4), 688-708.

Callon, M. (1984). Some elements of a sociology of translation: domestication of the scallops and the fishermen of St Brieuc Bay. *The sociological review, 32*(1_suppl), 196-233.

Callon, M. (1987). Society in the making: the study of technology as a tool for sociological analysis. *The social construction of technological systems: New directions in the sociology and history of technology*, 83-103.

Carroll. (2018). Understanding Curriculum: An Actor Network Theory Approach. *Studies in Self-Access Learning Journal, 9*(2), 247-261.

Chaudhary, A., Gustafson, D., & Mathys, A. (2018). Multi-indicator sustainability assessment of global food systems. *Nat Commun, 9*(1), 848. doi:10.1038/s41467-018-03308-7

de Hoop, E., & Jehlicka, P. (2017). Reluctant pioneers in the European periphery? Environmental activism, food consumption and "growing your own". *Local Environment, 22*(7), 809-824. doi:10.1080/13549839.2017.1289160

De Hoop, E., & Jehlička, P. (2017). Reluctant pioneers in the European periphery? Environmental activism, food consumption and “growing your own”. *Local Environment, 22*(7), 809-824.

de Sousa, I. S. F., & Busch, L. (1998). Networks and agricultural development: The case of soybean production and consumption in Brazil. *Rural Sociology, 63*(3), 349-371.

Devi, W. P., & Kumar, H. (2017). Frugal Innovations and Actor–Network Theory: A Case of Bamboo Shoots Processing in Manipur, India. *The European Journal of Development Research, 30*(1), 66-83. doi:10.1057/s41287-017-0116-1

Dwiartama, A. (2017). Resilience and transformation of the New Zealand kiwifruit industry in the face of Psa-V disease. *Journal of rural studies, 52*, 118-126. doi:10.1016/j.jrurstud.2017.03.002

Dwiartama, A., & Rosin, C. (2014). Exploring agency beyond humans: the compatibility of Actor-Network Theory (ANT) and resilience thinking. *Ecology and Society, 19*(3).

El Bilali, H. (2018). Transition heuristic frameworks in research on agro-food sustainability transitions. *Environment, Development and Sustainability*. doi:10.1007/s10668-018-0290-0

Ericksen, P. J. (2008). Conceptualizing food systems for global environmental change research. *Global Environmental Change, 18*(1), 234-245. doi:10.1016/j.gloenvcha.2007.09.002

Ernstson, H. (2013). The social production of ecosystem services: A framework for studying environmental justice and ecological complexity in urbanized landscapes. *Landscape and Urban Planning, 109*(1), 7-17.

Fanzo, J., Davis, C., McLaren, R., & Choufani, J. (2018). The effect of climate change across food systems: Implications for nutrition outcomes. *Global Food Security, 18*, 12-19. doi:10.1016/j.gfs.2018.06.001

Gaitan-Cremaschi, D., Klerkx, L., Duncan, J., Trienekens, J. H., Huenchuleo, C., Dogliotti, S., . . . Rossing, W. A. H. (2019). Characterizing diversity of food systems in view of sustainability transitions. A review. *Agron Sustain Dev, 39*(1), 1. doi:10.1007/s13593-018-0550-2

Glopan. (2014). How Can Agriculture and Food System Policies Improve Nutrition.

Goodman, D. (1999). Agro-food studies in the 'age of ecology': Nature, corporeality, bio-politics. (39), 17-37.

Gouveia, L., & Juska, A. (2002). Taming nature, taming workers: Constructing the separation between meat consumption and meat production in the U.S. *Sociologia Ruralis, 42*(4), 370-390.

Hausknost, D., Gaube, V., Haas, W., Smetschka, B., Lutz, J., Singh, S. J., & Schmid, M. (2016). 'Society Can't Move So Much As a Chair!'—Systems, Structures and Actors in Social Ecology. In *Social ecology* (pp. 125-147): Springer.

Herrero, A., Wickson, F., & Binimelis, R. (2015). Seeing GMOs from a Systems Perspective: The Need for Comparative Cartographies of Agri/Cultures for Sustainability Assessment. *Sustainability, 7*(8), 11321-11344. doi:10.3390/su70811321

HLPE. (2017). Report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security. *Committee on World Food Security*.

Hopkinson, G. C. (2015). Network graffiti: Interaction as sensemaking. *Industrial Marketing Management, 48*, 79-88. doi:https://doi.org/10.1016/j.indmarman.2015.03.004

Houghton, C., Casey, D., Shaw, D., & Murphy, K. (2013). Rigour in qualitative case-study research. *Nurse researcher, 20*(4).

Jeswani, H. K., & Azapagic, A. (2019). Environmental Sustainability Issues in Food Systems. In *Reference Module in Food Science*.

JÚLIO, A. C., & POUBEL, L. (2016). TA Materialidades das Práticas Sociais. *Revista ESPACIOS| Vol. 37 (Nº 28) Año 2016*.

Latour, B. (1996). On actor-network theory: A few clarifications. *Soziale welt*, 369-381.

Latour, B. (2005a). Reassembling the Social-An Introduction to Actor-Network-Theory. *Reassembling the Social-An Introduction to Actor-Network-Theory, by Bruno Latour, pp. 316. Foreword by Bruno Latour. Oxford University Press, Sep 2005. ISBN-10: 0199256047. ISBN-13: 9780199256044*, 316.

Latour, B. (2005b). Reassembling the Social. An Introduction to Actor-Network-Theory. New York: Oxford University Press.

Law, J. (1992). Notes on the theory of the actor-network: Ordering, strategy, and heterogeneity. *Systems practice, 5*(4), 379-393.

Law, J. (1999). Actor network theory and after.

Law, J. (2007). Actor network theory and material semiotics, version of 25th April 2007. *disponibile online all'indirizzo http://www. heterogeneities. net/publications/Law-ANTandMaterialSemiotics. pdf,(scaricato il 18 maggio 2007)*.

Le Velly, R., & Dufeu, I. (2016). Alternative food networks as "market agencements": Exploring their multiple hybridities. *Journal of rural studies, 43*, 173-182.

Lee, K. C. L., Newell, J. P., Wolch, J., Schneider, N., & Joassart-Marcelli, P. (2014). "Story-Networks" of Livestock and Climate Change: Actors, Their Artifacts, and the Shaping of Urban Print Media. *Society & Natural Resources, 27*(9), 948-963. doi:10.1080/08941920.2014.918227

Legun, K. (2015). Tiny trees for trendy produce: dwarfing technologies as assemblage actors in orchard economies. *Geoforum, 65*, 314-322.

Lockie, S., & Kitto, S. (2000). Beyond the farm gate: production-consumption networks and agri-food research. *Sociologia Ruralis, 40*(1), 3-19.

Martínez-Flores, A., Ruivenkamp, G., & Jongerden, J. (2017). The Journey of an Ancestral Seed: The Case of the Lupino Paisano

Food Network in Cotopaxi, Ecuador. *Culture, Agriculture, Food and Environment, 39*(1), 4-14. doi:10.1111/cuag.12083

Momo-Cabrera, P., Ortiz-Andrellucchi, A., & Serra-Majem, L. (2018). Food Systems.

Oliveira, M., Bitencourt, C., Teixeira, E., & Santos, A. C. (2013). *Thematic content analysis: Is there a difference between the support provided by the MAXQDA® and NVivo® software packages.* Paper presented at the Proceedings of the 12th European Conference on Research Methods for Business and Management Studies.

Powell, J. B. (2016). White Maize to Pigarro: An Actor-Network Analysis of an Improved Crop Variety in Northwest Portugal. *Journal of ethnobiology, 36*(1), 45-65.

Pradyumna, A., Egal, F., & Utzinger, J. (2019). Sustainable food systems, health and infectious diseases: Concerns and opportunities. *Acta Trop, 191*, 172-177. doi:10.1016/j.actatropica.2018.12.042

Price, H. (2017). A hive of activity: realigning the figure of the bee in the mead-making network of Exeter Book Riddle 27. *postmedieval, 8*(4), 444-462. doi:10.1057/pmed.2015.1

Qsrinternational. (2018). Nvivo 11 for Windows Help. Retrieved from http://help-nv11.qsrinternational.com/desktop/welcome/welcome.htm

Sarmiento, E. (2015). Umwelt, food, and the limits of control. *Emotion, Space and Society, 14*, 74-83.

Stoddard, E. A., & Cantor, A. (2017). A Relational Network Vulnerability Assessment of the North Carolina Hog Industry. *Annals of the American Association of Geographers, 107*(3), 682-699. doi:10.1080/24694452.2016.1261679

Stone-Jovicich, S. (2015). Probing the interfaces between the social sciences and social-ecological resilience: insights from integrative and hybrid perspectives in the social sciences. *Ecology and Society, 20*(2). doi:10.5751/es-07347-200225

Stuart, D., & Woroosz, M. R. (2011). The Myth of Efficiency: Technology and Ethics in Industrial Food Production. *Journal of Agricultural and Environmental Ethics, 26*(1), 231-256. doi:10.1007/s10806-011-9357-8

Tang, J.-W., Chen, M.-L., & Chiu, T.-H. (2018). An Exploratory Study on Local Brand Value Development for Outlying Island Agriculture: Local Food System and Actor–Network Theory Perspectives. *Sustainability, 10*(11), 4186.

Tendall, D. M., Joerin, J., Kopainsky, B., Edwards, P., Shreck, A., Le, Q. B., . . . Six, J. (2015). Food system resilience: Defining the concept. *Global Food Security, 6*, 17-23. doi:10.1016/j.gfs.2015.08.001

Thorsøe, M. H., Alrøe, H. F., & Noe, E. (2014). Observing the observers: uncovering the role of values in research assessments of organic food systems. *Ecology and Society, 19*(2).

Vitalis, R. E., Nor-Khaizura, M. A. R., & Son, R. (2016). Actor network theory in food safety. *International Food Research Journal, 23*(6).

Wang, J. J., & Selina, Y. (2018). Case studies on transport infrastructure projects in belt and road initiative: An actor network theory perspective. *Journal of Transport Geography, 71*, 213-223.

Whatmore, S., & Lorraine, T. (1997). Nourishing networks: alternative geographies of food. *Reading Economic Geography*(235).

Whiteside, K. H. (2013). A representative politics of nature? Bruno Latour on collectives and constitutions. *Contemporary Political Theory, 12*(3), 185-205.

Willett, W., Rockström, J., Loken, B., Springmann, M., Lang, T., Vermeulen, S., . . . Wood, A. (2019). Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems. *The Lancet, 393*(10170), 447-492.

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[Index]

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