Researching network-like phenomena – the importance of considering three different observation logics

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Abstract

Purpose – The purpose of this paper is to discuss when an observed process requires investigation as a network-like phenomenon. The research question is as follows: How does the way of observing a network-like phenomenon impact on what aspects it is possible to shed light on, and conceptualise?

Design/methodology/approach – The research design is based on the basic characteristics of network-like phenomenon identified in Industrial Network research; non-linearity, connectivity and self-organising. Three types of observation logics are discussed, especially what aspects each can bring forward. A published study is used to illustrate the discussion empirically. Finally, the authors discuss the relation between chosen observation logic, drawing of borders and possibility to conceptualise.

Findings – The findings stress that each research project concerning a network-like phenomenon should rest on a conscious choice of observation logic; an awareness that network-like phenomena always take place on a network level; and finally, a consciousness that each observation logic can provide clear images of certain – but not all – forces involved. This implies that researching network-like phenomena in general should allow a plurality of ways to observe.

Research limitations/implications – See above.

Practical implications – The paper sheds light over the importance of recognising network-like phenomenon; especially how self-organising can be identified and acted on, in processes of significance for businesses, organisations and society at large.

Social implications – See above.

Originality/value – The paper draws attention to the fact that behind the commonly used case study research design radically different observations logics might be hiding, with different ability to catch the content and consequences of interactivity, non-linearity and self-organising.

Keywords Network approach, Non-linearity, Connectivity, Observation logics, Self-organising

Paper type Research paper

1. Introduction

When is it necessary to approach a process occurring in a business and organisational setting as a network-like phenomenon? That is, as a dynamic process, stretching over time and space, caused by interaction concerning exchange of heterogeneous social and material resources, involving actors of different kinds and size, acting on their own approaches, with outcomes that might have far-reaching consequences for others than those direct involved (Håkansson and Waluszewski, 2002; Håkansson *et al.*, 2009). Furthermore, what is required to approach a network-like phenomenon? This is the overall research interest of the paper.

A phenomenon that challenges existing knowledge requires the ability to observe, underlines Von Krogh *et al.* (2012), referring to the famous quote of Niels Bohr: "No phenomenon is a phenomenon until it is an observed phenomenon." A phenomenon has to be observed to develop appropriate ways of investigating it, of documenting and analysing it, and eventually, conceptualising it (Von Krogh *et al.*, 2012). In the words of Von Krogh *et al.* (2012, p. 278), a phenomenon is defined as "regularities that are unexpected, that challenge existing knowledge (including the extant theory) and that are relevant to scientific discourse". This definition can also be depicted as an illustration of how network-like phenomena

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have been observed and conceptualised in the Industrial Network setting (Waluszewski *et al.*, 2017).

Grounded in the empirical observation of economic exchange characterised by interaction with content (Håkansson, 1982), over time, numbers of network-like processes with unexpected regularities have been observed and analysed. The common denominator is that these observations have challenged dominating market inspired business and organisational theories and policy. Put briefly, the first observations of the content and consequences of recurrent interactions triggered a still ongoing research engagement in developing appropriate ways of approaching network-like phenomena (Håkansson, 1982; Håkansson *et al.*, 2009; Håkansson and Snehota, 2024).

But can these processes still be considered as "challenging existing theory," after four decades of systematic research? In parallel with the Industrial Network research community's interest in "thick interaction" (Håkansson and Waluszewski, 2020) and the related experiences made in the related heterodox research field (Fourcade *et al.*, 2015; Marglin, 2008; Lawson, 2005; Mirowski, 2011; Rider *et al.*, 2013), traditionally market thinking has actually increased its stronghold over how to approach exchange in research, higher education and in policy circles (Fourcade *et al.*, 2015; Rider *et al.*, 2013). Exchange characterised by interaction with a content is still an unexpected regularity, in the dominating research and policy approaches.

1.1 Aim and research question

The *aim* of this paper is to discuss when an observed process requires investigationas a network-like phenomenon. The *research question* is as follows:

RQ1. How does the way of observing a network-like phenomenon impact on what aspects it is possible to shed light on, and conceptualise?

The paper is organised as follows. In Section 2, three types of network forces that a network-like phenomenon is part of are presented and discussed. Two short empirical examples are presented, to illustrate the importance of observing network-like phenomena. Thereafter, in Section 3, three basic characteristics of network-like phenomena are presented: non-linearity, connectivity and self-organising; we also discuss how they have been observed. In Section 4, we present the different reasoning behind three types of observations, which we label "observation logics", and what aspects come into the fore with each of them. Thereafter, in Section 5, we use a published case study, to illustrate empirically what forces can be caught through the different types of observations. Finally, in Section 6, we discuss the relation between chosen observation logic, drawing of borders and the possibility to conceptualise.

The discussion of how the way of observing a network-like phenomenon impacts on what aspects are possible to conceptualise rests largely on experiences made in Industrial Network research. This implies that the studies we refer to mainly summarise joint IMP group publications, exemplifying how different ways of observation lead up to new conceptualisations.

2. The organisational forces of network-like phenomena

Since the first observations of economic exchange characterised by recurrent interactions and connected consequences were made in the Industrial Network setting, what kind of processes have been identified as necessary to approach as network-like? Furthermore, what observation requirements have they addressed? When the main research observations were summarised (Håkansson *et al.*, 2009; Håkansson and Snehota, 2017, 2024), the following features were outlined.

A basic characteristic of a network-like phenomenon is that it is part of a context that is multidimensional whether it is mainly related to the use of certain resources, the production of certain resources and/or the development of resources (Håkansson and Waluszewski, 2007, pp. 152–156). An interesting peculiarity is that a network-like phenomenon always includes contradictions, due to the interaction processes it emerges from and is continuously shaped by. It is affected by relationships, by individual actors, and by indirectly related actors and their organising engagement (Håkansson and Waluszewski, 2002). *The fundamental observation is that a network phenomenon is part of at least three different types of forces.* That is, if a phenomenon is part of the three types of forces presented below, it is fruitful to approach it as a network-like phenomenon. Otherwise, other approaches might be more suitable:

1 The observed phenomenon is affected by the interactions taking place among extensive *relationships* between pairs of companies and/or organisations. Relationship is an indicator of the existence of cooperation. It is a mechanism to relate actions over time. Actors can search for benefit through joint investments and coordinated development, concerning how to combine and activate resources, but can never know beforehand exactly what actions the counterpart sees as beneficial. Furthermore, the relationship does not exist in a vacuum, but is connected to other relationships. Therefore, it both creates, and is influenced by, significant non-linear effects. *This takes relationship non-linearity to a first type of network force.* To understand a relationship, its content and consequences, it has to be observed from both sides.
2 The observed phenomenon is affected by how *individual business and/or organisational actors* engage in combining and activating resources. Even this type of network force is connected to specific counterparts, which implies that acting on its own strategies will be restrained, or supported, depending on the reactions from those directly and indirectly affected. Actors can be engaged in several relationships, and they can also try to connect these relationships to each other. An important consequence is that the boundary of the resource combinations and activities an individual actor wants to influence have fuzzy borders, and might to a lesser or larger extent be designed and controlled by others across time and space. The awareness and use of connectivity is a central task of individual actors, influenced by significant non-linear effects of others acting. *This takes individual actors' use of connectivity to a second type of network force.* To understand how individual actors use connectivity, observations have to be made from the individual actor's point of view.

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3 The observed phenomenon is affected by contextual self-organising processes concerning how resources are combined and activated. The combining and activating of directly and indirectly related resources, within and across organisational borders, creates larger network-like patterns. Relationship non-linearity and actor connectivity make these patterns dynamic. *Self-organising, based on significant patterns of how resources are combined and activated, is a third type of network force.* In contrast to established business relationships and significant individual actors, this force is much more difficult to observe since it is based on interdependencies that might be distantly related. It requires multiple observations from different points of view.

To illustrate the importance of observing network-like phenomena and the forces they are exposed to, we present two short empirical examples. The focal content and outcome of the chosen examples are radically different. However, the common denominator is that these observations were rather the result of tough empirical forces than any previously existing awareness of network-like phenomena and the different types of organising forces they are part of.

2.1 A network-like phenomenon with dark consequences

An intriguing network-like phenomenon, with severe dark economic and social consequences for millions of people, became visible in 2008. A particular way of securing financial risk was leading up to the bankruptcy of the American investment bank Lehman Brothers which, through direct and indirect connections, resulted in a global financial crisis.

It was a radical change in the Lehman Brothers bank's traditional way of securing risks that created the intricate connections that eventually distributed the consequences of the crash. The bank's established tradition of securing risk, through the development of long-term relationships with specific reliable partners, was phased out during the last decades of the 20th century. Instead, deal-based actions were favoured, which became even more attractive through deregulation. The aggressive investments in real-estate-related assets, where the risks were concealed in complex, "opaque" products, that furthermore were embedded across legal and spatial borders, became toxic when the bank could no longer finance itself. Through its border crossing connections, the bankruptcy caused a global financial crisis, and revealed intricate network interdependencies that had been bypassed in thousands of financial analytical and policy reports (Wiggins *et al.*, 2019).

The network-like phenomenon related to the Lehman Brothers' bankruptcy includes all the different forces presented above. Firstly, the opaque real-estate assets designed by Lehman Brothers were rather rapidly embedded into other financial businesses, a network force based on business and organisational *relationship non-linearity*. Secondly, the design of the real-estate assets with a concealed content allowed Lehman Brothers to organise through its use of *connectivity* to the deregulation. Thirdly, the real-estate assets were widely distributed by *self-organising* through indirectly related financial businesses and end-consumers, facilitated by the lack of comprehension of the created resources and activity patterns. The neglection of these three network forces, and the related actors; governmental bodies including, understanding of each actor as independent, paved the way for a domino effect with devastating economic consequences.

2.2 A network-like phenomenon with benefits for society at large

Another network-phenomenon, recognised for its extensive benefits for global human health and economy, was the connected efforts that lead up to the rapid development and launch of the COVID-19 vaccines. Before the COVID-19 vaccine era, a typical vaccine development time line was estimated to about 5–10 years. It was based on individual organisations' engagement in a step-wide process, including clinical trials, regularity approval processes and, if these were successful, establishment of manufacturing and distribution [1]. However, after the publication of the genetic code of the corona virus in January 2020, a new way of organising the development work was applied, and the time-line was dramatically shortened.

Governments, international health organisations, pharmaceutical companies, and university research units, started to search for ways to utilise interdependencies, in combinatory efforts stretching across political, legal and spatial borders. Clinical trial phases were organised in news ways; in cooperations among traditionally competing university and company research labs. Regularity approval rules were adapted and manufacturing capacity was scaled up in relation to clinical trials, already before approval. All to speed up the process [2].

Less than one year after the genetic code was published, in December 2020, UK became first country to approve use of the Pfizer-BioNtech vaccine, to be followed by approval by FDA and several EU member-states. One and a half year after the code was presented and the new development regime took off, hundreds of vaccine candidates were in clinical development, and 18 vaccines were approved for emergency use. The rapid development and launch of COVID-19 vaccines, which is estimated to have saved millions of lives, became possible thanks to the systematic identification and use of interdependencies. Previous and recent research advances made in public and private labs, along with testing, regulatory, manufacturing and logistic resources, were used in new types of combinatory efforts, across organisational, legal and political borders (Ndwandwe and Wiysonge, 2021; Le *et al.*, 2020).

The COVID-19 vaccine case is, in several aspects, something of an opposite to the Lehman Brothers case. The global health threat and the need for a rapid development of a vaccine more or less forced the related actors, especially governmental bodies, to search for the *dynamic relationships, actor connectivity and new patterns of combining and activating resources* that could be connected to speed up the process. *Relationships* were identified and financially supported, by *significant actors* responsible for regulation and financing, searching for connectivity and how to use it, and furthermore, how to use *emerging patterns of new ways of combining and activating resources*. The more or less conscious use of the three types of network forces, and especially, the governmental bodies' understanding of direct and indirect related actors' interdependency, paved the way for a network-phenomenon with extensive global health benefits.

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3. The intriguing observation requirements

The short empirical examples presented above underlines the importance of recognising network-like phenomenon and the involved forces, for researchers, policy and for the direct and indirect involved companies and organisations themselves. For policy the ability to identify such processes is of greatest importance, to be able to support the bright sides and to combat the dark sides.

How to approach network-like phenomena has challenged researchers in the Industrial Network research setting since the first observations of recurrent interactions among businesses and organisations were made, triggering the establishment of the joint Industrial Marketing and Purchasing (IMP) study (Håkansson, 1982). These early findings, pointing to the central role of interactivity were, in the wording of Von Krogh *et al.* (2012), "side-effects" of empirical investigations based on presuppositions of significant different regularities. The existence and importance of continuous interactions and their consequences were simply absent in conventional market theories. "We challenge" became the epitome for the observed phenomena, which was assumed away in dominating economic thinking (Håkansson, 1982; Waluszewski *et al.*, 2017).

Approaching a neglected phenomenon with unexpected regularities; in this case a research object that involves resources activated across several organisational and spatial borders, by actors with different agendas (Håkansson *et al.*, 2009), implies that *a priori* hypothesising based on existing theory has to be handled with care (Håkansson, 1982; Eisenhardt, 1989). There is always a risk falling into the trap of searching for a "simple fit" between observations and a more or less consciously applied theory (Burke, 1992). As von Krogh *et al.*, 2012, p. 278) put it:

> Because the researcher has no way of knowing what puzzling issues may emerge from observations, a priori hypothesising regarding specific relationships among the variables may prevent the proper identification of the problem.

This is close to what Galison (1997, p. 19) refers to as image-based studies; that is, extensive empirical observations of phenomena appearing in their original form; in "all their fullness and complexity" which are not "translated" to fit into established theories. "These images are presented and defended, as mimetic – they purport to preserve the form of things as they occur in the world" (Galison, 1997, p. 19).

If we apply the similar claims made by Von Krogh *et al.* (2012), Galison (1997) and Burke (1992), that is, on observations that, to as large an extent as possible, are free from presuppositions stemming from established theory, what does it imply for observing network-like phenomena?

3.1 To observe network-like phenomena

Based on the triggering observation of thick interaction, clashing with the dominating presupposition of atomistic exchange, further observations, made over time in the Industrial Network research setting, have outlined the three basic characteristics of network-like phenomena presented above; non-linearity, connectivity and self-organising (Håkansson and Waluszewski, 2002; Håkansson et al, 2009; Håkansson and Snehota, 2024). What this implies is discussed in detail below:

1. *Non-linearity: to observe network forces based on relationships:* Non-linearity characterises the first force presented above, based on cooperative business and organisational relationships. Within and across these relationships, significant combinations of heterogeneous social and material resources are organised, creating non-linear consequences (Håkansson, 1987, 1989; Håkansson and Waluszewski, 2002; Håkansson *et al.*, 2009). Both within and across relationships different kinds of chain-like effects can occur. Relationships can be more or less balanced, the involved organisational bodies can be more or less active, and these variations affect the outcome. The engagement within and across relationships can give rise to bigger or smaller non-linear consequences, both in expected and unexpected dimensions.

   Hence, observations of non-linearity are vital to capture how changes made within and across cooperative relationships are reacted on. For example, a change of a resource combination initiated in a specific relationship, which from the initiating actors' perspective might appear as simple and restricted, can due to interdependencies give rise to domino effects with complex and multifaceted consequences. Observations of non-linearity can also reveal how this is understood by the involved businesses and organisations. Furthermore, it can show the degree of homogeneity/heterogeneity, that is, how elaborated the business and organisational relationships are and how stable or dynamic they are.
2. *Connectivity – to observe network forces based on significant individual actors.* The way individual actors combine heterogeneous resources and design activities is largely influenced by how they, through their relationships, are connected to others. The connections between relationships are made by actors, which makes them important connecting nodes. Actors can create connectivity in a more or less aware, advanced and elaborated way. Actors can also restrict connectivity, for example through treating all counterparts in a standardised way, and through considering each counterpart in isolation, neglecting its other relationships. The individual actor's ability to act can be both restrained and supported by how it and related counterparts are aware of and using connectivity (Håkansson and Snehota, 1995; Håkansson and Snehota, 2024).

   Hence, investigating network-like phenomena requires observations of connectivity, and especially of different actors' approaches and acting on it to take advantage of how resources can be combined and activated. Observations of connectivity can catch, for example, how an actor is engaged in combining social and material resources in a new way and how it engages in involved connected relationships in this change: furthermore, if and how connectivity is identified by an individual actor and related to over time. Observations of connectivity is necessary to get detailed pictures of the ability of an individual actor to organise combinations of resources and activities in a certain way, due to how it recognises and can use connections to others, based on what approaches, what knowledge and agenda.

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3. *Self-organising – to observe network forces stemming from multiple actors and the resources they activate.* The self-organising processes are formed around the combining and activating of resources across organisational borders, to which the related actors have different roles (Håkansson and Waluszewski, 2002, 2020; Håkansson et al, 2009). This combining and activating creates significant network-like structures that all directly and indirectly related actors and relationships affect and are affected by, regardless how well they are recognised. Furthermore, they are also influenced by governmental bodies and legal arrangements.

   Hence, networks are multidimensionally self-organised by private and public actors and how they are related to the combining and activating of resources over time.

   The direction of the self-organising is influenced by whether or not it takes place in relation to the using, producing or developing setting of certain resource combinations (Håkansson and Waluszewski, 2007). In a using context, self-organising is influenced by systems of products that are already in use, which implies that other features of a product than those intended by the producer, might be taken advantage of. In a producing context, self-organising is influenced by the investments made to economise on across production units, implying that adaptations that take advantage of existing combinations of scale and specialisation are favoured. In the developing setting, self-organising is influenced by certain knowledge paths, which implies that knowledge advancement can be valuable whether it confirms or challenges established ways of using and producing a certain resource.

   Hence, observations of self-organising are necessary to capture the emergent nature of network-like phenomenon. Self-organising is composed by reactions from related business and organisational relationships and individual actors, which in turn are based on different interpretations of the content and consequences of a certain phenomenon. Observations of multiple reactions, including how these are affected by directly and indirectly related conditions can, for example, show if and how distantly related actors are involved in a network-like phenomenon, in entangled bottom-up like processes (Waluszewski *et al.*, 2024; Håkansson and Waluszewski, 2002). Furthermore, observations of self-organising processes do not follow some simple organisational chart, but have to include influencing actors, regardless of formal and informal roles, across organisational borders.

To summarise: Observing network-like phenomenon requires the ability to catch non-linearity, connectivity and self-organising. To approach and observe in detail all these aspects, in all their complexity, might be an unrealistic goal. Still, all have to be recognised and reflected, whether in the perspective of the actors involved in a specific relationship, of an individual actor, or in perspective of multiple actors. This implies that observing network-like phenomena presents the researcher with the challenge of catching processes where the involved human and material resources are acted on by directly and indirectly related actors with their own approaches, interpretations, and agendas. Below we take a closer look at the different reasoning behind three types of observations, which we label "observation logics", and what aspects that comes to the fore with each of them.

4. Three different observation logics

It goes without saying that there is no simple "plug-and-play" research approach that can provide a detailed insight into the content and consequences of the connectivity, non-linearity and self-organising of network-like phenomena. Instead, how to make observations of these "no-business-is-an-island" like network features (Håkansson and Snehota, 1989, 2024) is a never-ending challenge. It requires considerations of how to catch and highlight what organisational forces, without assuming away others, that might impact on the understanding of the focal phenomenon.

Three main types of observation logics have been used Industrial Network research, and due to what images of the organisational forces of a network-like phenomenon they can provide, they can be labelled "one-sided", "double-sided" or "multiple" (Waluszewski *et al.*, 2017). Each highlights certain network forces and leaves others in the background. That is, each observation logic has a significant impact on what forces of the focal network-like phenomenon can be portraited in detail, what remains in the background, and consequently, on what aspects can be conceptualised. Hence, the three observation logics concern processes taking place on a network level. Regardless of what choice of these are made, it has to be based on awareness connectivity, non-linearity and self-organising of network-like phenomena; including what forces can be portrayed in detail and only touched upon indirectly.

Below we discuss what forces of a network-like phenomenon can be portraited through a one-sided, double-sided or multiple observation logic, and how the different observation logics impact on the drawing of research borders and on what aspects that can be conceptualised.

4.1 One-sided observation logic

A first, and rather common way of observing network-like phenomena, is to focus on a single actor; a company or organisation. As it is concentrated to a focal actor's perspective, it can be labelled one-sided observation logic. Most often the observations are concerned with how a focal actor interprets a certain phenomenon, how it acts internally and in relation to related counterparts (Håkansson, 1982).

One-sided observations are necessary to get detailed images of how an individual actor connects to related actors and relationships. It is through the individual actor's perspective that connectedness can be investigated in detail. This kind of observation makes it possible to identify how a focal company or organisation connects to relationships identified as important for a certain phenomenon. It is possible to gain an understanding of which functional units within the focal company/organisation have significant roles in this connecting. Furthermore, of how the connecting is manifested, informally of more or less formal, in strategy and/or policy.

An illustrating example of how detailed one-sided observations of a focal company can give clear images of how connectivity is recognised and used, is given in Håkansson and Lind (2004). The study shows how a focal actor, through the development of a new, multidimensional accounting system, manages to coordinate the use of internal resources in relation to a single relationship. Another example, based on the same type of observation, is given in Moll and Harrigan (2018), and

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gives a clear picture of what a company risks when connectivity is neglected. It shows how a focal company's engagement in the development of an airplane, where a number of sub-systems are outsourced to suppliers without being connected to each other, leads up to massive technological problems, eventually forcing the company to insourcing several of them.

To summarise, detailed one-sided observations can give clear images of connectivity, but can only give the individual actor's partial and indirect view of non-linearity and self-organising. *Hence, one-sided observations come with a significant restriction: it is the individual actor's perspective of a network-like phenomenon that is caught.*

4.2 Double-sided observation logic

A second, also rather common way of observing network-like phenomena, is to focus on the dyad; on relationships between companies, between companies and organisations, and between organisations. Double-sided observations are necessary to capture the interplay between the parties involved in the relationship. For example, how each part of the dyad identifies and approaches a certain phenomenon, and how each part acts in relation to the other. Furthermore, how each part considers the relationship, the resources combined and activated and what can be achieved. This kind of observation can give clear images of the interplay between the parties involved and the dynamic it creates. Furthermore, it can portrait the non-linearity stemming from the involved parties' comprehension and acting, from concordant over to conflicting (Håkansson and Snehota, 1995). It is possible to get an understanding of how the involved parties in a relationship act in relation to a network-like phenomenon, especially when it includes development and innovation efforts.

An illustrating example of how double-sided observation can capture non-linearity is given in Bocconcelli and Håkansson (2008). The study shows the importance of observing not only a focal producer-supplier relationship, but also the suppliers' relationships, to understand how a motor bike producing company, Ducati, through the ability of the suppliers and sub-suppliers managed to go from close to bankruptcy to a dynamic and economically successful development path. Another example is Baraldi (2003) where the detailed observations of IKEA's development engagement in relation to suppliers and sub-suppliers reveals the company's ability to keep the price of a specific furniture constant over a period of 30 years.

To summarise, detailed double-sided observations can give clear images of the non-linearity stemming from the interplay in relation to a certain network-like phenomenon. The images of connectivity will be restricted to the investigated relationship, while only indirect and fragmented images of self-organising can be achieved. *Hence, also a double-sided observation logic comes with a significant restriction: it is the perspective of the relationship, and the parties involved, that can be caught.*

4.3 Multiple observation logic

A third way of investigating network-like phenomena is to make multiple, contextual based observations of the direct and indirect interactions it is a part of. This implies that numbers of directly and indirectly related companies and organisations have to be identified and investigated. Multiple observations can start out from how a central resource is combined, activated and acted on, across several business, organisational and legal borders. The content and consequences of a network-like phenomenon is observed from both directly and indirectly related business and organisation perspectives (Håkansson and Waluszewski, 2002). Through these observations, it is possible to outline the self-organising of a network-like phenomenon, and also, to gain limited images of connectivity and interactivity. This type of observation can catch forces creating and affecting extensive network-like phenomena, involving sets of companies and organisations, across time and space.

An example of how multiple observations can provide images of self-organising in a science-based innovation process is presented in Perna *et al.* (2015). The main resources involved in the use, production and development of thin film solar cells were observed, along with the connected monetary flow, to outline the ability for investors to reap the benefit of an innovation project. Eventually, this took place in a Chinese setting instead of the expected Swedish setting. Another example is Waluszewski (2004) where multiple observations gave a radically different picture of a dynamic biomedical setting, compared to the explanation given by a policy actor. Instead of being the rapid result of the restructuring of a big pharmaceutical company, the multiple observations pointed to the self-organising taking place over at least seven decades, in numbers of interaction processes, across public and private borders involving several types of industrial areas.

To summarise, multiple observations are less common in Industrial Network research, probably due to the required extensive research involved. This type of observation is necessary to achieve clear images of the self-organising of network-like phenomena, especially when they are extensive and involve different using, producing and developing settings. However, the images of connectivity and non-linearity will be indirect. *Hence, also multiple observations come with a restriction. It requires far-reaching empirical research, where the borders; both in time and space, are more or less impossible to design in advance.*

In the next section, we use a published case study to discuss in detail the different aspects that can be outlined through the observation logics.

5. Case illustration

In the research question, we asked how the way of observing a network-like phenomenon impacts on what aspects are possible to shed light on, and eventually, to conceptualise. So far, we have discussed the research question and illustrated it with some short empirical examples. To get a somewhat deeper empirical illustration, we use short summaries of a published case study (Waluszewski *et al.*, 2024). The network phenomenon in focus of the chosen study is the (more or less successful) reduced use of antibiotics in animal-based food production in the EU setting (Waluszewski *et al.*, 2024). The choice of this case was based on the ability to show the different aspects of a network-like phenomenon that can be brought forward through different observation logics. The part of the study that is used in this paper concerns the EU and the Swedish setting. Three short empirical illustrations based on the study are presented and discussed further.

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5.1 If a one-sided observation logic had been used

If the forces behind the minimised use of antibiotics in the animal-based food production had been investigated through a one-sided observation logic, that is through the rather common way of focusing on the perspective of focal actor, for example the EU policy, the following aspects could have been outlined:

> From the perspective of the EU Commission, the EU was quick to act against overuse of antibiotics and antibiotic resistance, to force its member states and their animal-based food businesses to take action. EU started to ban one type of antibiotics, avoparcin, as an ingredient in animal feed in 1998, aiming that all animal-based food producers of the member states should adopt the new regulation. The antibiotic that was banned was aimed to be reserved for human health. In 1999, four other types of antibiotics for growth and nutrition were banned. Other types of antibiotics were still allowed to be used as "feed-additives" for nutrition and growth, given daily in animal feed. In 2006, a new step was taken when all routine use of antibiotics for animals, given for nutrition and growth promotion, was finally banned. However, the consumption figures revealed that despite the fact that the total use within the EU decreased somewhat, in the main part of the member states the use was still high and varied, with the Nordic countries as the exception. The consumption figures indicated that routine use motivated by "precautionary" reason was practised in several animal-based food production settings. In 2016 the EU adopted the "One Health" approach to antibiotic resistance, launched by the tripartite alliance of the World Health Organisation (WHO)' Food and Agriculture Organisation (FAO) and the World Organisation for Animal Health (OIE), with the ambition to increase the awareness of the interconnections between human and animal health and environmental needs. In January 2022, a general principle was introduced stating that antibiotics cannot be used preventatively as compensation for investments in precautionary animal health, hygiene and welfare. This meant that the EU expected all animal-based food businesses in each member state to invest to adopt of the new regulation (Waluszewski *et al.*, 2024).

Although the first presented empirical example is very short, it shows an important aspect of one-sided observations: It is a focal actor view of a certain phenomenon and how it expects related counterparts to act in relation to it, that is presented. The example shows that one-sided observations can give important information of a focal actor's understanding of a certain phenomenon, or and/or how it wants others to view its role in it. We saw that the focal actor, the EU Commission, was lifting forwards its early actions in relation to antibiotic resistance, especially the ban of certain types of antibiotics as ingredients in animal feed, expecting the animal-based food producers of the member states to adopt it. Although the empirical example is short, it indicates that instead of taking advantage of connectivity in relation to the member states, they were treated in a standardised way.

A study that applies a one-sided observation logic can provide detailed images of if and how a focal actor understands connectivity, and furthermore, how it is used in relation to a network-like phenomenon. However, it can only give indirect and partial images of non-linearity and self-organising.

5.2 If double-sided observations had been used

If the forces behind the minimised use of antibiotics in the animal-based food production had been investigated through a double-sided observation logic, focusing on the dyad, for example on the interactions between EU policy and Swedish policy, the following aspects could have been outlined:

> Swedish policy on antibiotic resistance resulted in that Sweden already in 1986 got the world's first law banning the use of antibiotics for nutrition and growth promotion in force. A year later another law of importance for the effects of the ban came into force, stipulating that animals shall be protected not only from suffering but also from disease through animal-based food producers' investments in precautionary health. That is, the Swedish policy engagement in minimised use of antibiotics for food animals took off already two decades before the EU ban on use of antibiotics for nutrition and growth promotion. However, the EU did not applaud the Swedish policy measures. In relation to Sweden's EU membership in 1995 the message from the EU Commission was that Sweden had to adapt to the community regulation. This implied that Sweden should be forced to allow its animal-based food producers to give their animals an everyday dose of antibiotics for nutrition and growth, mixed into feed and/or water. Swedish policy strongly opposed to the EU decision. After negotiations, Sweden managed to get a redemption until December 31, 1998. After that, the antibiotics allowed to be used as additives in feed in the EU had to be permitted also for Swedish animal-based food producers. The Swedish opposition continued, and the new strategy was to develop scientific argument for keeping the ban. The Swedish Minister of Agriculture commissioned an inquiry aimed to serve as a suggestion for the EU to not only accept but also adopt the Swedish antibiotic strategy. The outcome of the conflict was that Sweden got permission to keep its legal ban on routine use of antibiotics, and that the EU, in 1998 banned the use of one type of antibiotics as an ingredient in animal feed, avoparcin, due to its importance for human health (Waluszewski *et al.*, 2024).

The second short empirical example illustrates the dynamics and non-linearity that is possible to outline with double-sided observations. What could be brought forward through one-sided observations, in this case that the EU argued that it was "quick to act against overuse of antibiotics", appeared rather differently through double-sided observations. In the presented case, the acting of the EU Commission came out as a severe hindrance for the Swedish ban of routine use of antibiotics for food animals, rather than being an early driving force.

As soon as a double-sided observation logic is applied; that is when two parties related to a specific network-like phenomenon are investigated, the dynamics and tensions between them are brought forward, and non-linearity is outlined. This type of observation can shed light on how each side understands and acts in relation to network-like process. For example, double-sided observations can reflect how each side views what types of resource are involved, how they are affected and adapted, on whose initiative, to what outcome. However, the connectivity is mainly reflected in relation to a specific relationship, and the self-organising is only indirect and partial reflected.

5.3 Using a multiple observation logic

The forces behind the minimised use of antibiotics in the animal-based food production was in the original case study (Waluszewski *et al.*, 2024) investigated through a multiple observation logic, including both direct and indirect interactions. Through this logic the following aspects related to the EU and Swedish setting were caught:

> It was not Swedish policy but a number of pioneering farmers and concerned managers at the Swedish Farmers' Association, that triggered the Swedish engagement in getting rid of everyday use of antibiotics. The pioneering pig farmers were influenced by an intense, decade long environmental debate in the media, making them concerned about the long-term environmental effects of using drugs and chemicals. The representatives of the Swedish Farmers' Association, also influenced by the environmental debate, were afraid of losing consumers' trust. Among both farmers themselves and the general public, there were doubts as to whether the industrialisation of animal-based food production and the use of antibiotics had been driven too far. In 1981, the Swedish Farmers Association presented a first policy document, suggesting a voluntary exclusion of antibiotics. However, the most engaged farmers were convinced that a "one for all" solution was necessary to achieve a significant change, and that the Swedish Farmers' Association had to take a stand and mount for a legal ban of antibiotics for growth promotion. In 1984 the Swedish Farmers' Association got the annual meeting's support to approach the government with suggestions of a legal ban on routine use of antibiotics for nutrition and growth promotion, and in 1986 the new law came into force. When Sweden became an EU member in 1995, and the EU Commission reacted negatively to the ban, the Swedish strict attitude towards antibiotics in animal feed was supported by few other EU member states; Finland, Denmark and the Netherlands. Several governmental and

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non-governmental organisations in these settings engaged in delivering argument for a total ban, while heavy protests were expressed by representatives from the pharmaceutical industry and also from the EU's Scientific Committee on Animal Nutrition. Eventually, the engagement by Swedish (and supporting member states) policy bodies, animal-based producers, and non-governmental organisations convinced the EU – Sweden was allowed to keep its ban. Furthermore, it was followed up by a series of EU bans of different kinds of antibiotics, and finally, in a total ban of routine use of antibiotics in animal feed.

The third empirical example illustrates that a multiple observation logic can portrait forces beyond the acting taking place within relationships and by individual actors. For example, that the Swedish engagement in banning all use of antibiotics for animals which could not be strictly medically motivated had been influenced by several directly and indirectly related forces. Among others, by an extensive Swedish media and societal debate, by individual farmers environmental engagement, and by the engagement of the Swedish Farmers Association. The multiple observations revealed that these processes took off decades before Sweden became an EU member. Furthermore, that when the Swedish ban was questioned by the EU Commission, different advocates for it; both governmental and non-governmental, engaged in delivering argument for not only allowing Sweden to keep its regulation but also for adopting it within EU.

Hence, through a multiple observation logic it is possible to outline the self-organising forces created by both direct and indirect actions in relation to a network-like phenomenon. It is possible to identify how both close and distantly related actors, with different formal or informal roles, can have a significant impact on the direction of the process. However, individual actors' way of using connectivity, and the dynamic taking place within relationships, are reflected only if they have a significant impact on main forces of the investigated network-like phenomenon.

How do these different types of observation logics impact on the choice of research design and the ability to conceptualise? In the next section we will discuss these aspects.

6. Discussion: observation logics and conceptualisation

Although an impressive number of network-like phenomenon have been investigated over the last decades; encompassing among others innovation, efficiency, logistics, environmental and climate change, involving private companies, public organisations and NGOs, there is a great variety in terms of what aspects have been caught – due to the choice of observation logics. Behind the façade of the commonly used research design; an Industrial Network approach based on the notion of interactivity, applied on a "case study", all the above presented observation logics might be hiding. The outcome is that the images achieved varies significantly, from individual actor's views based on one-sided observations, over to wide, process-oriented network maps, based on multiple observations. Most importantly, this variation has significant implications for what understanding of connectivity, non-linearity and self-organising can be achieved – and for what other aspects of network-like phenomena that can be caught. Hence, the type of observation logic applied have consequences for both the drawing of research borders, and for what aspects can be conceptualised.

6.1 One-sided observation logic and conceptualisation

When a one-sided observation logic is chosen to shed light over connectivity and related aspects of investigated network-like phenomena, the border questions concern what actors should be included in the study. The observations, and the conceptualisation, rely on the focal actors' views.

When one-sided observations were used in the second joint IMP study (Håkansson and Snehota, 1995) it was to investigate in detail a finding that was indicated in the first joint IMP study (Håkansson, 1982). While the aim of the first study was to investigate the role of each counterpart interacting in purchasing and marketing processes, the observations indicated that it was not only the counterpart in itself but also how they were connected, that were of importance. This observation triggered the systematic study, focusing on the content and consequence of relationships, and especially of how actors worked to achieve benefits through connecting them (Håkansson and Snehota, 1995). Based on the empirical images, the conceptualisations of connectedness were expressed among others in terms of actor bonds, resource ties and activity links and their role in network-like phenomena (Håkansson and Snehota, 1995).

6.2 Double-sided observation logic and conceptualisation

When a double-sided logic is chosen to shed light of non-linearity and related aspects of network-like phenomenon, the drawing of borders has to be dynamic. Exactly what counterpart that is of significant importance cannot be identified beforehand. When it was observed in early IMP studies that purchasing and marketing seemed to include so much of development, pointing to the dynamics of these processes, a number of related studies based on double-sided observations was designed (Håkansson, 1989; Waluszewski, 1990; Laage-Hellman, 1989; Lundgren, 1991). To observe in detail what was absent in the dominating literature, the product development, technological renewal and innovation taking place within and across business relationships, double-sided observations became necessary. Detailed images of development interactions were obtained, especially of the dynamics of attempts to change established or create new combinations of social and material resources across organisational boundaries. The conceptualisations concerning non-linearity were expressed among others in term of the consequences of resource heterogeneity (Håkansson, 1989).

6.3 Multiple observation logic and conceptualisation

When multiple observations are chosen to investigate self-organising and related aspects of network-like phenomenon, the border question also has to be dynamic. The border question, which cannot be designed beforehand, includes continuous selection of observations, due to what types of directly and indirectly related actors, activating what resources, that are of importance for the self-organising and therefore should be included in the study. Multiple observations became necessary to investigate in detail where findings indicated in studies of technological development and innovation; that indirectly related forces had a significant impact in the content and direction of network-like phenomena (Håkansson and Waluszewski, 2002). This type of observation allowed the

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investigation of how actors that might appear as distantly related to a certain phenomenon; both in time and space, were involved in the creation of patterns of how significant resources were activated in a using setting, in how they are produced, and how they are developed.

Multiple observations have been necessary in investigations of encompassing network-like phenomena, for example, concerning environmental and industrial change (Håkansson and Waluszewski, 2002), the relationship between scientific and industrial development (Waluszewski, 2004; Håkansson and Waluszewski, 2007), the relationship between societal movements and industrial change (Waluszewski, 2023). Multiple observations have contributed with an understanding of the characteristics of the self-organising forces of network-like phenomenon, the patterns of how resources are combined and activated they give rise to, and the challenges that individual actors face in attempts to change these. The conceptualisation especially concerned how ideas and activated structures interact in relation to four types of resources; two types of social and two types of material resources involved in network-like phenomena, and how the patterns of these differ in contexts characterised by using, producing and developing processes (Håkansson and Waluszewski, 2002, 2007).

7. Conclusions

The ambition of this paper has been to shed light over how the way of observing a network-like phenomena impact on what aspects are possible to get clear images of, and eventually, to conceptualise. In line with what's suggested by Von Krogh *et al.* (2012), we argued for the importance of awareness of what type of observations are useful in investigations of what aspects of an indicated network-like phenomenon. However, we do not make any ranking of the identified three types of observations logics, but rather argue that each makes it possible to observe certain aspects of an investigated phenomenon – while it will be difficult to get clear pictures of others. We showed that one-sided observations can contribute with clear images of connectivity, that dyadic observations can give clear images of non-linearity and that multiple observations can give extensive images of self-organising; that is, all can contribute with different images of a network-like phenomenon. However, it is important to note that whether one-sided, double-sided or multiple observations are chosen, all observations of a network-like phenomenon are made on the same level – that is the network level. The differences among the observation logics are that they can give individual actors, interacting parties, and direct and indirect actors' view of a network-like phenomenon. Hence, we argue that 'level of analysis (Wilke and Ritter, 2006) is a distinction that might fit for certain research topics, but becomes irrelevant for observing network-like phenomena.

This leads to a final conclusion, and a suggestion for future research: The final conclusion is that each research project concerning a network-like phenomenon should rest on a conscious choice of observation logic; an awareness that network-like phenomena always take place on a network level; and finally, a consciousness that each observation logic can provide clear images of certain – but not all – forces involved. This implies that researching network-like phenomena in general should allow a plurality of ways to observe.

A suggestion for future research is that while studies of network-like phenomena from one-sided and double-sided observations has provided a rather rich flora of images and conceptualisations of connectivity and non-linearity, there is still a need for multiple based observations able to provide extensive images of self-organising. The role of self-organising of network-like phenomena is of particular importance to understand processes that were exemplified in the two short empirical illustrations presented in the introduction. How can self-organising be identified and acted on, in network-like processes with benefits for businesses, organisations and society at large? And how can self-organising lead up to outcomes considered as detrimental for society at large be identified and counteracted? To understand how businesses, governmental and non-governmental organisations are involved in self-organising in network-like phenomena deserve increased attention in future research.

Notes

[1] https://coronavirus.jhu.edu/vaccines/timeline

[2] https://coronavirus.jhu.edu/vaccines/timeline

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