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## RESEARCH PAPER

# Can processes make relationships work? The Triple Helix between structure and action

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This contribution seeks to explore how complex adaptive theory can be applied at the conceptual level to unpack Triple Helix models. We use two cases to examine this issue – the Finnish Strategic Centres for Science, Technology & Innovation (SHOKs) and the Canadian Business-led Networks of Centres of Excellence (BL-NCE). Both types of centres are organisational structures that aspire to be business-led, with a considerable portion of their activities driven by (industrial) users' interests and requirements. Reflecting on the centres' activities along three dimensions – knowledge generation, consensus building and innovation – we contend that conceptualising the Triple Helix from a process perspective will improve the dialogue between stakeholders and shareholders.

## Introduction

The aim of this paper is to explore the application of complex adaptive theory at the conceptual level to unpack the processes at play in the social relationship between the various actors engaged in Triple Helix relations. We argue that work on the Triple Helix (see Saad and Zawdie, 2008; Carayannis and Campbell, 2009; Arthur and Moizer, 2013; Anstett and Lamari, 2013; House of Commons, 2013) tends to follow a simple assumption of cause and effect – have an agency, have a positive outcome. Many discussions portray the Triple Helix as a policy apparatus not unlike a machine; by reducing the machine to parts and managing them, innovation will occur. Understanding of the whole emergent value is less clear.

Much of the discussion about the Triple Helix has focused on the individual elements and attempting to manage the whole, not on understanding how the emergent property may come about (i.e. from social interaction). This paper suggests there may well be a need to reconceptualise the Triple Helix. The paper offers complex adaptive systems (CAS) thinking (e.g. Stacey, 2005) as one way of doing this by focusing on relationships, emergence, patterns and iterations. While we cannot pretend to conceptualise adequately all such complex issues at the social level, we will argue that the existing Triple Helix model should be broadened to include the local interaction of actors and not just agencies. We contend, for the moment, that reconceptualising the Triple Helix from a social interaction perspective is a useful starting point. We draw on a number of exemplary cases for illustration. These are the Finnish Strategic Centres for Science, Technology & Innovation (SHOKs) and the Canadian Business-led Networks of Centres of Excellence (BL-NCE).

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## The Triple Helix

### *The blurring of boundaries and emergence of hybrid organisations*

The Triple Helix of university–industry–government relations can be conceptualised as a multi-structural, multi-functional and non-linear model of innovation. The Triple Helix (Etzkowitz and Leydesdorff, 1998, 2000; Etzkowitz *et al.*, 2000) offers a perspective that explains the developments, relationships and interaction which exist among various stakeholders and shareholders of innovation. This model replaced the orthodox model of innovation, linear and substantive in nature, with something more fluid and dynamic. The Triple Helix in its 'final' form (see Figure 1) is concerned with 'generating a knowledge infrastructure in terms of overlapping institutional spheres, with each taking the role of the other and with hybrid organizations emerging at the interfaces' (Etzkowitz and Leydesdorff, 2000, p.111).

In their first joint publication, Etzkowitz and Leydesdorff (1995) contend that changes in knowledge production and distribution are at the heart of innovation. Innovation at the national level was seen as a transformational ingredient determined by the functions and interactions of university, industry and government. However, the actual interactions needed to be reconceptualised and operationalised in new ways. The understanding that emerged from this research was that the three institutional spheres fulfilled their traditional functions, but also assumed the role of others at various places and times (e.g. Etzkowitz and Leydesdorff, 2000; Etzkowitz, 2003). For instance, in addition to their traditional roles, universities start new ventures, firms provide higher education-level training for their employees, and governments can act as venture capitalists.

These changes in the function of each institutional sphere are brought about through evolving relations. The relations among university, industry and government become closer as communication networks and hybrid organisations emerge. Their relations can be characterised as simultaneously competitive and cooperative.

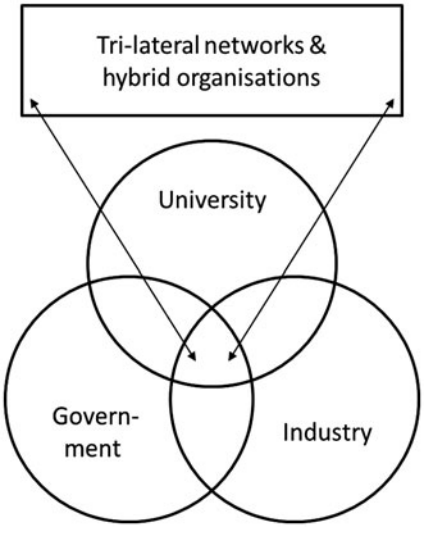


**Figure 1.** The Triple Helix
Source: Adapted from Etzkowitz and Leydesdorff (2000).

Moreover, the university is recognised as just as important in innovation as industry and government. Yet, much of the writings on the Triple Helix treat it as substantive [in Rescher's (2001) sense]. At the beginning of the debate, the focus was on differentiating the newly emerging Triple Helix concept from other notions and contexts. The Triple Helix literature has more recently undergone a process of differentiation (Meyer *et al.*, 2014). On the one hand, there is Etzkowitz's neo-institutional approach, which focuses on networking and exchanges between different organisational spheres of the Triple Helix. On the other, Leydesdorff's model is concerned with capturing the neo-evolutionary mechanisms of exchange among three typical functions – wealth creation, knowledge production and normative control.

### *From networks to spaces to processes*

The Triple Helix framework suggests that tri-lateral networks of actors in science, industry and government are growing, and that the boundaries among the three spheres are becoming increasingly blurred (Meyer *et al.*, 2014). Research has dealt with tri-lateral networks: far less work has dealt with hybrid organisations at the touch points, especially with how actors and agencies interact at the social level. Actors engaged in bringing the spheres together need to integrate activities across three Triple Helix spaces (Etzkowitz, 2008), what could be termed 'neo-institutional arrangements':

(1) knowledge spaces, which focus on the collaboration of different actors with the aim of improving local conditions for innovation by concentrating on related research and development activities and other relevant operations;
(2) consensus spaces, which create ideas and strategies in a Triple Helix of multiple reciprocal relationships among institutional sectors (academic, public and private); and
(3) innovation spaces, which realise the goals articulated in the previous phase, establishing and/or attracting venture capital.

There are numerous examples of policies and programmes created and implemented to boost the interactions of university, government and industry for the betterment of the local region and boosting national aspirations (see Etzkowitz and Ranga, 2009).

Policy-makers have launched initiatives to make the university and other research organisations more focused on perceived industry and user needs (e.g. Rip, 2011). Many of these initiatives have emerged in conjunction with the Triple Helix, at times making explicit reference to it (e.g. when Vinnova, the Swedish innovation agency, was established in the early 2000s). This movement to foster industry and user-relevant research has led to the establishment of applied research centres and/or 'centres of competence' which are expected to drive economic development and innovation nationally. In some instances, new organisations have been created outside the traditional institutions, such as the university, which have been perceived to be at the heart of developments in fast-moving fields (such as the biomedical field) and are often seen as knowledge integrators and connectors (Meyer *et al.*, 2014). It may be instructive to examine these centres in more detail to explore

whether CAS and its process perspective could help develop a better understanding of the interrelationships among the different stakeholders and shareholders.

## A complex adaptive systems perspective

### *Process thinking, social situations and local interactions*

CAS (Stacey, 2005) is a process-thinking perspective that seeks to explain social situations *via* local interactions – in this case, among academics, universities, government and business – rather than focusing solely on the actual artefacts of such interactions, such as spin-outs. Adopting a CAS perspective would allow individual agents in the Triple Helix spaces to pay particular attention to local communications and patterns of behaviour, and to focus on the present rather than just the future (Mead, 1934).

By adopting a process perspective (Rescher, 1995, 2001), a set of basic social processes can be created, nurtured and connected, which is likely to enable competence centres to grow organically, thereby creating fertile ground on which Triple Helix and innovations can play, interact and collide. In this way, for example, TH organisations can avoid the trap of becoming too 'structured' and unable to produce anything more than incremental improvements/innovations, which is a problem that is typical of many large organisations focused on research, development and innovation.

### *The Triple Helix as process rather than structure*

From this position, the Triple Helix should not be seen as a 'thing' that can and should be managed and controlled (a noun). Rather, it should be seen and talked about as a verb, something that is there and takes on a shape, form and life of its own. To unpack this, we need to explore how people appreciate the Triple Helix. According to Vickers, 'an appreciation involves making judgements of facts about the "state of the system", both internally and in its external relations' (Vickers, 1965, p.40). This type of judgement, termed reality judgement by Vickers, is concerned with the means by which humans make sense of their surroundings through their experience of the past and present, and their forecasts for the future. In addition to reality judgement, Vickers identified a type of judgement, which he termed 'value judgement', which is concerned with what significance such facts may have for the appreciator. In addition, value judgements 'cannot be proved correct or incorrect; they can only be approved as right or condemned as wrong by the exercise of another value judgement' (Vickers, 1965, p.71).

For Vickers, the relationship between reality judgements and value judgements was close and mutual since facts are relevant only within the context of judgements of value and *vice versa*. Thus, appreciative judgements (of reality and value), according to Vickers, reflect the implicit and, to a large extent, unconscious views of what the appreciator deems relevant or irrelevant in distinguishing certain aspects of situations; it is this process which Vickers terms an 'appreciative system'. It is termed a system since it is viewed as a whole in which 'a change in one part of the system is likely to affect and be dependent on changes elsewhere' (Vickers, 1965, p.67). Although Vickers' writings on appreciation were developed in the context of policy-making, focusing on the setting of norms and values as opposed to goal seeking, Checkland (1981) viewed the work of Vickers as describing and explaining widely

the processes characteristic of social systems, such as the Triple Helix. Vickers' appreciative system was described by Checkland (1985, p.762) as a cyclical process in which

> … our previous experiences have created for us certain standards or norms, usually tacit (and also, at a more general level, values, more general concepts of what is humanly good or bad); the standards, norms and values lead to readinesses to notice only certain features of our situations; they determine what 'facts' are relevant; the facts noticed are evaluated against the norms, a process which both leads to our taking regulatory action and modifies the norms or standards, so that future experiences will be evaluated differently.

Based upon Vickers' writings on appreciation and the notion of an appreciative system, Checkland and Casar (1986) developed a diagrammatic representation of an appreciative system (see Figure 2). The model is shown as a recursive cycle in which the starting point, namely the flux of events and ideas, is one in which past experiences encourage and condition an individual to see something relevant from the flux of events and ideas. To make sense of this relevance, judgements are made about it, which leads to actions which become part of the flux of events and ideas. Such actions modify our standards of fact and value in which future experiences will be evaluated differently. The process of appreciation is viewed as one of relationship-managing in which reality and value judgements are the result of the previous history of the system. Furthermore, the process of appreciation may modify the standards of both the past and the future. Arising from appreciation is a decision on how to act on relationships which lead to action. The model of an appreciative system is a dynamic one which 'reproduces a continually changed self' (Checkland and Casar, 1986, p.5) and which is continually open to new inputs from the flux of events and ideas, which is the Triple Helix, and suggests it is very much a process, not a substantive thing.

In short, Vickers' appreciative system, which is an example of the process perspective, adds value to the existing thinking on the Triple Helix. It sets down the basic parameters not only for planners of national innovation systems, but also for interaction with clients, stakeholders and shareholders. Vickers' system provides a

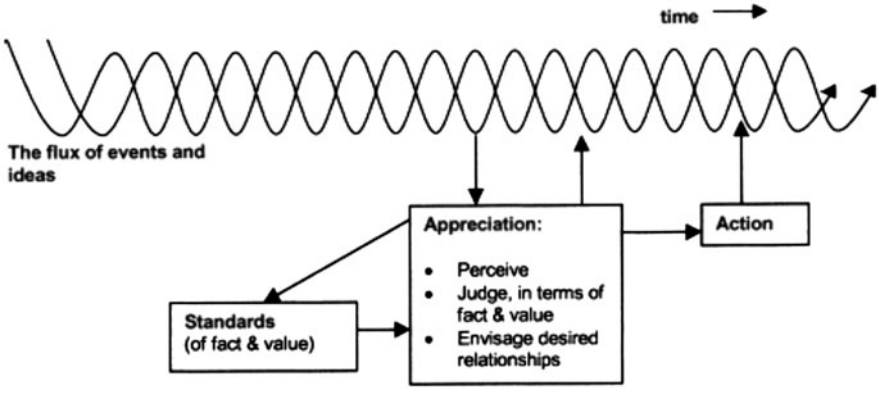


**Figure 2.** The structure of an appreciative system
Source: Adapted from Checkland and Casar (1986).

framework for what we ought to be talking about in enabling the Triple Helix to flourish. It helps address basic organisational design issues that can be expressed in such questions as: Can I trust you? Will we be able to discuss it? Is meaningful communication possible across different communities of practice? Can we agree to cooperate to the mutual benefit of the parties involved? In the following we aim to demonstrate, drawing on two cases, that there may be value in applying this perspective to the Triple Helix context.

## Methodological approach

### *Purpose and general approach*

The purpose of this paper is to make a case for the notion that CAS thinking can contribute meaningfully to better appreciating and understanding Triple Helix relations. We have made the case in our review of the literature that the Triple Helix focuses on institutions and organisations and how they relate to each other, emphasising a blurring of boundaries and the emergence of new organisational forms of collaboration rather than focusing on the processes of interaction. Drawing on further analysis of two exemplary Triple Helix organisations, we present a detailed case that a process view of emerging hybrid Triple Helix forms is needed to ensure that these agencies enable local interactions. The following subsection introduces our rationale for selecting the two cases in some detail before we describe our data collection and analysis approach. After offering background on the two cases and presenting evaluations on the basis of document analysis and interviews, we attempt to demonstrate why and how CAS thinking could be relevant. We then explore in a final step what the implications of a process view could be for developing managerial strategies in a Triple Helix context.

### *Case selection*

We adopted a purposive approach to sampling, seeking to select two cases of Triple Helix organisations that aim to create not only structures but also spaces for interaction. More specifically, we identified two centres, the Finnish Strategic Centres of Science and Technology (SHOKs) and the Canadian Business-led Networks of Centres of Excellence (BL-NCE). These two agencies were identified for three reasons. Both countries in which the case organisations are located – Canada and Finland – have applied a wide range of centres of excellence over a long period of time to drive innovation, thus allowing both the visible and invisible structures to bed down, and social interactions to occur naturally. Secondly, they provide a landscape in which contextual conditions relating to innovation and economic development exist, including policy, government and regional requirements for setting up and managing Triple Helix mechanisms. Such countries as Canada and Finland, with corporatist business and innovation cultures, may be more susceptible to government-instigated activities to create organisations that promote and manage research and innovation. Canada and Finland can be seen as being corporatist societies and business systems, having been labelled as social democrat and meso-corporatist (Whitley, 1992). Finally, when exploring the social relationship aspect of this paper, the sharing of tacit knowledge *via* social interactions and relationships suggests a need to focus on knowledge flows and learning networks, which each country has.

Furthermore, one could argue that SHOKs and BL-NCE may be appropriate for facilitating meaningful exchange among Triple Helix stakeholders to enable innovation, perhaps even more than existing agencies, because these new organisations allow the various actors to interconnect, collide and create new value propositions while focusing on their respective core activities (Leydesdorff and Meyer, 2010). These hybrid centres are relatively new environments, which can be seen as a form of structural innovation (Howells and Edler, 2011) that clearly defines and provides new spaces in which Triple Helix-type relationships interact (Meyer *et al.*, 2014).

### *Data collection and analysis*

This study draws on an analysis of stakeholder interviews and policy documents, including evaluation reports. The time range of the study is 2013–2014. Following Hardee *et al.* (2004; see also Grant *et al.,* 2014), we draw on policy document analysis using the policy circle Ps.[1] This approach has been used to make sense of other complex areas which focus on relationships and interactions more than actual outcomes, such as family planning, overseas aid and economic development. We adopted this approach to ensure that the main policy components were reviewed and to show that policy-making occurs in varying political, social, cultural and economic settings. These affect how policies are developed and implemented, which depicts the complex and non-linear nature of policy, just like the Triple Helix itself.

The analysis of policy documents was triangulated with six anonymised, semi-structured interviews with key stakeholders from the business, government and academic spheres connected to BL-NCE and SHOKs. The purpose of these interviews was to gain the perspectives of the different stakeholders involved in the formation, delivery or use of innovation policy; how it evolved; and their evaluations of the specific actions taken thus far. An interpretive approach was adopted to provide insight into 'the complex world of lived experience from the point of view of those who live it' (Schwandt, 2001, p.118). The ontological assumption is that reality is constructed within the sphere of innovation systems at the national level and specifically by personnel at all levels 'through their action and interaction' (Orlikowski and Baroudi, 1991, p.14). The epistemological assumption is that 'findings are literally created as the investigation proceeds' (Guba and Lincoln, 1994, p.111).

## Observations from the exemplary cases

Social interaction is dependent on collective structures which are put in place to enable communication and dialogue. Complex adaptive systems may be a useful way to understand large differences in the performance of Triple Helix agencies. Both of the Triple Helix cases are examined in some detail. Then we explore how a process perspective based on complex adaptive systems can help unpick the social interactions within the Triple Helix.

### *Canadian Business-led Networks of Centres of Excellence*

The BL-NCE illustrate how an industry-led competence centre can complement academic-focused centres of excellence. The Canadian government invested $C46 million over four years in the BL-NCE programme. The goal was to deliver the government's science and technology strategy. BL-NCE have enriched research,

new product development and service innovation capacity and focus in specific funded networks. These funded research networks cover environmental science and technologies; natural resources and energy; health and related life sciences and technologies; information and communications technologies; and management, business and finance. This approach has encouraged the development of industry–university research partnerships (89 projects involving 378 researchers). The research itself is intended to address user-specific needs by involving the private sector closely in the design and conduct of the research.

A closer look at the differences between BL-NCE and the traditional, academic-led NCEs indicates considerable differences. The research agenda in BL-NCE is set by the private sector, which also contributes to financing the centres (Table 1). The BL-NCE approach can be viewed as a partnership model that requires more interplay and negotiation among Triple Helix agents from different backgrounds. Academic and private sector partners are equally engaged, and those best positioned to deliver results are funded. The funded networks are strategically managed by a not-for-profit consortium that represents to a large extent the private sector and leverages funding from both industry and government to fund research which is 'use-inspired' (Stokes 1997) and closely connected to new product development, revenue generation and job creation. Funding for each network ranges between $C8.9 million and $C12.4 million and has been awarded for the four-year period from 2009 to 2013 (Performance Management Network, 2012). These networks are neither exclusively industry-driven applied research centres nor are they academic-driven centres of excellence. A process of engagement needs to take place for these structures to work effectively, which is decidedly un-linear.

This approach helps to fill a perceived gap in the innovation process between proof of concept and product development, and the commercialisation of the new product or service. The freshness of the business-led model is that the teams of researchers funded by each network can be university-based, private sector-based, based in a not-for-profit organisation, or a combination of the three (Performance Management Network, 2012). A good deal of thinking about how to operationalise these developing hybrid structures has enabled new ways of allocating resources, capturing industry interest and enticing relevant large businesses to join in. However, unlike smaller university-hosted centres, academic buy-in suffers, and small and medium-sized enterprises (SMEs) are not always fully involved. Much work has focused on ensuring that the structures are in place, but there has been limited work on how to make things happen at the social relationship level.

To encourage innovation, we advocate that new hybrid Triple Helix forms should be viewed not only as structures but arguably as systems in which social processes occur. Rather than focusing predominantly on creating structures for innovation, we argue that there is value in refocusing attention onto the social relationships between partners to enable 'faster to market' innovation. SHOKs and BL-NCE platforms should be seen as a systemic process that brings together a broad range of shared ideas between the partners to enable innovation to flourish. They should be understood as encompassing developer communities that follow broadly defined agendas, or guiding images, that are linked to use and application and negotiated continuously (see, e.g. Kuusi and Meyer, 2002).

The following key points are based on a synthesis of, and extracts from, the formal evaluation report to the Canadian government by Performance Management Network (2012):

**Table 1.** Comparison between BL-NCE and traditional NCE

| | Business-led NCE | NCE |
|---|---|---|
| Description | Managed collaborative virtual network that delivers a research programme | |
| Lead | Private sector | Academia |
| Host institution | Not-for-profit consortia representing the private sector | University/some not-for-profit examples |
| Network leader/scientific director | | Director of the not-for-profit consortium |
| University-affiliated (professor, clinician etc.) | | |
| Research agenda | Private sector-driven research topics | University strategically determined research agenda with stakeholder input |
| Duration | Four years | Five years (renewable) |
| Direct research costs | 50% of direct research costs can be supported by BL-NCE funds; balance to be made up of private sector and non-federal cash and in-kind contributions | Majority of research costs paid out of NCE funds; contributions from the private sector strongly encouraged |
| Administrative costs | 75% of administrative costs can come out of BL-NCE funds; balance to be made up of private sector cash and in-kind contributions | Majority of administrative costs paid out of NCE funds; contributions from the private sector strongly encouraged |
| Research area | Targeted to five priority areas identified in the science and technology strategy: (1) environmental science and technologies; (2) natural resources and energy; (3) health and related life sciences and technologies; (4) information and communications technologies; (5) management, business or finance | Open or targeted competitions |
| Funding source | NCE funds flowing through the three granting agencies | |
| Research providers | University labs, private sector labs and government labs | Mainly university labs |
| Role of government scientists | No direct funding, but eligible for student support if adjunct professors bring their own resources to the NCE | |

Source: Adapted from Kavlie (2010), Kavlie and Sleeckx (2011) and Zulkifli (2009).

- the business-led approach (including the development and implementation of a strategic plan, project selection and oversight) is an enabling factor in ensuring that research addresses the needs of industry;
- many of the expected outcomes of the BL-NCE programme may have been too ambitious given the four-year timeframe;
- the complexities in establishing business-led networks may have been underestimated;
- the unique characteristics of each network have resulted in some flexibility in BL-NCE programme implementation, which reflects local and regional aspects;

- networks have struggled to establish network agreements involving all parties;
- resolving intellectual property rights (IPR) issues in each network has delayed research projects;
- all networks make use of conferences, workshops and meetings to share research results among network partners, funders and the broader community;
- all networks have been successful in terms of establishing and building partnerships, helping partners learn to work together, share intellectual property and build a knowledge base;
- the approach has exceeded requirements in matching funds. To date, a significant proportion of the non-BL-NCE funds (83%) originate from the private sector (46%) and other public sector organisations (federal and provincial) (37%). However, funds are not being used at the rate anticipated because of delays in network implementation; and
- current indicators and measures of how networks work are not always useful. For example, publications were hardly relevant to business-led networks. More relevant indicators, such as improvement to technology readiness, were preferred. One key improvement would be to ensure that reporting requirements are less academic.

The extent to which network research will have been mobilised by partners and translated into technical applications, products and processes is still embryonic and is intertwined with the nature of the research itself. The commitment of partners and the extent to which a programme of collaborative, use-inspired research has led to new products and new service delivery is perhaps one of the main reasons why this hybrid form has been a success. This is coupled with a novel training and mentoring process:

> I have learnt so much from listening to my commercial partner about how to frame and conceptualise what needs to be done to make the product easier for manufacture, rather than just trying to make the product better, that it has made me a better researcher. (Junior researcher)

In short, training for both academic researchers and commercial research partners exists to make sense of each other's agenda; intellectual, disciplinary and professional baggage; and ways of working. Mentoring has enabled industry representatives to be directly involved in all phases of research and project management. To borrow a phrase from Harper Lee (1960), 'You never really understand a person until you consider things from his point of view … Until you climb inside of his skin and walk around in it'. Finally, when looking at technological innovations, spatial productivity was evident, but using spatial productivity as the lens revealed how the BL-NCE formed the creation of linkages with local actors (see Rodriguez-Clare, 1996).

### *Strategic Centres for Science, Technology and Innovation (SHOKs)*

SHOKs were created in Finland to be a collaborative venture among the Ministry of Employment and Economy (MEE), the Finnish Funding Agency for Technology and Innovation (Tekes), the Academy of Finland and the Confederation of Finnish Industries (EK). The first centres became operational in 2009. A unique aspect of the

Finnish SHOKs is that research is organised at the cluster level, and they are incorporated as not-for-profit companies which coordinate Triple Helix-type activities. It is estimated that, in the Nordic context, such limited companies would each require around 10 million euros of public funding annually. The funding base of SHOKs and their networks are considerably larger than in most other countries (on average, a SHOK receives some 50 million euros of initial capital compared with around 20 million euros for the Swedish equivalent). The size of these centres and the way they have been organised as legal entities are markedly different from other Triple Helix-type institutions.

The Finnish SHOKs are broadly similar to the joint technology initiatives planned under the European Framework Seven Programme. Their tasks are somewhat different because they cover entire industries, facilitating industrial renewal and fostering radical breakthrough innovations in their industry cluster, including the allocation of substantial programme funds. Subsequently, the shareholders representing the industry cluster also need to agree with the participating academic actors on strategic research agendas, as well as on the governance structure and procedures for resource allocation. SHOKs also act as a channel for training and recruitment, and a novel way in which to monitor developments in, and of, entire clusters.

The Finnish government is committed to funding these centres and their research through sizeable investment. Between September 2008 and September 2012, the main funding body, Tekes, provided a total of 343 million euros to the SHOK programmes. An average of 40% of the research conducted by the SHOKs is being co-funded by the companies involved. The Academy of Finland has channelled funding to areas of research in which the SHOK companies operate, and has offered special sources of funding for these areas. The financing model is based on an average of 60% of funding coming from Tekes and an average of 40% of the research conducted in the SHOKs being co-funded by the companies involved. SHOKs are also encouraged to apply to the various European Union research programmes for additional funding. In short, six new public–private partnerships for accelerating the innovation processes have been established, with the main goals being to renew industry clusters and create radical innovations. SHOKs are seen as being a permanent cooperation and interaction forum.

The governing structure, responsibilities and principles are clear, and they are based on Finnish company law. However, given the nature of the project work, these centres tend to have a limited life span. Another key consideration has to do with the initial capital requirement for the limited company. In the case of a Finnish SHOK, the minimum capital requirement is estimated to be around 2 million euros. The legal incorporation of the SHOK is plagued with contractual issues, such as those arising from intellectual property rights, but the issue is avoided if the centre is a linear extension to an existing business. The Finnish experience demonstrates that businesses have a wide range of needs reflecting differences across industries. SHOKs are a new type of platform that seeks to ensure that the knowledge created is available and taken further by several waves of businesses. New knowledge created in the competence centre is initially taken up by the front-running, typically large firms. In an ideal world, the leading business activities are being followed by the second and third waves of businesses – SMEs in particular.

In the last five years, SHOKs have become one of the main instruments of Finnish innovation policy and perhaps even its flagship programme. We can also argue that SHOKs are the closest organisational form in existence to an ideal Triple Helix

organisation. Evidence from an early, survey-based assessment of four of the six centres by the Finnish Federation of Industries (Annala and Ylä-Jääski, 2011) confirms the impression gained from our interviews and policy document analysis that SHOK programmes are successfully industry-driven and that genuine collaboration occurs. According to the report, the centres have provided a brand new type of information exchange, resulting in additionalities, such as the formation of consortia and collaborations with new partners, again suggesting a reconceptualisation of the Triple Helix as a process that is needed. The report states that this 'would hardly have been possible without the SHOK concept' and that 'SHOKs have provided the necessary framework' (Annala and Ylä-Jääski, 2011, p.4). A more recent evaluation has taken a more sceptical view (Lähteenmäki-Smith *et al.*, 2013), suggesting that while academia remains to be convinced, Finnish industry is happy with the approach.

The scale of the centres requires more elaborate governance and management structures than in most of the other centres we studied. The status of the SHOKs as limited liability companies has some clear benefits and limitations. In short, each SHOK consists of the coordinating function, which is jointly owned by the parties, and a virtual research organisation simultaneously. Contractual issues have reportedly emerged, for example, about intellectual property rights. According to our interviewees, this one area has plagued the incorporation and start-up phase of the centres (see also Gustafsson and Järvenpää, 2011).

Apart from formal reporting requirements, the SHOKs have set up a structure that includes a board of directors, a company steering group, and a research and development council, as well as strategic steering groups to develop and agree on a strategic research agenda. Many of these boards and groups have rotating memberships to ensure broad engagement. Whatever the eventual outcome of this approach, it has created a platform for exchange and perhaps even a cluster-level consensus space in the Triple Helix sense. In one of the centres, around 100 person days were involved in the initial planning of the strategic research agenda that the shareholders representing the industry cluster needed to agree on with the participating academics. In the future, programme planning is anticipated to involve around 20–30 industry and academic representatives.

A more recent evaluation study (Lähteenmäki-Smith *et al.*, 2013, p.16) reports that SHOKs are 'industry-driven', but have 'struggled to convince the academic community of the value of participation of the concept as a whole', that agendas tended to be based 'more on compromise than on a shared commitment to achieving excellence', that 'public sector decision-makers and consumer groups … should be better integrated into many of the SHOK's activities', and that there is a lack of internationalisation, cross-SHOK collaboration and systematic monitoring of the relevant key performance indicators. However, this sceptical view also acknowledges that SHOKs are important in occupying the gap in the catalogue of research and innovation mechanisms.

## Towards a process view of the Triple Helix

Freeman (1987), Nelson (1993) and many others used systems thinking to explore social-based systems in the 1980s and 1990s. Perhaps it is now time to reconceptualise how we view and explore social interactions in the Triple Helix. The fine-grained evaluation of competence centres presented here has indicated how Triple Helix practices are informed through university, industry and government interaction,

which is the process by which things work. The classical view of the Triple Helix dominates the literature and can be summarised as focusing on the actual product of Triple Helix activity; the desire to establish and measure the stability of these products; and the fact that each product can be used in a predictive way, as if following a predetermined formula (Rescher, 1995, 2001; see also Table 2). This view suggests that when agents make gestures towards Triple Helix organisations delivering innovation and economic well-being, using metrics such as journal papers, patents and spin-out companies, they assume that the Triple Helix structure is what is delivering the benefit and that it can be managed. They make no allowance for agents to collide and interact to produce the patent or journal paper. A process view focuses on the experiences of those engaging collectively in one or more Triple Helix activities (research, patenting, commercialisation of innovation and spin-out companies). Indeed, no Triple Helix episode can be absolutely planned as it will be in a continual state of flux and will always have an element of unpredictability.

This research suggests that the Triple Helix should be conceptualised as a process. This can best be explained via an analogy; namely, the Triple Helix collaborators' ability to engage in unstructured play (i.e. not following a preset game plan) by taking opportunities as and when they arise, being able to see them happen, knowing almost instinctively what to do and how to behave to achieve an intended outcome. The interaction, connectivity and networks of Triple Helix stakeholders and shareholders are the essence of a Triple Helix, not the end result. New Triple Helix forms should be seen as connectors and not as controllers.

Much of the work on applying CAS pertains to how academics relate to teaching, research and consultancy (Grant and Wakelin, 2009) and how business strategy is informed (Hackney *et al.*, 2006). However, to expand on this work, the concepts have been extended to the Triple Helix. This has been undertaken because a CAS perspective allows a Triple Helix to exist outside the university and outside the sphere of government and industry.

A plexus web concept might be used to conceptualise the interconnections between the various elements above. The plexus web concept allows a nexus to be concerned with all the components of the nexus. However, the concept of a plexus stresses that they are interconnected in co-dependent and associated ways, and that the interconnectedness is made obvious through people's experiences, actions and beliefs, which interlock *via* meaning, form, matter and network (Capra, 2003) – elements which are outlined below (see Figure 3). These new forms, derived from the Triple Helix model, stress the need for constant negotiation and adjustment between the three spheres, but at the local agent level.

**Table 2.** Substantive and process perspective

| Substantive perspective | Process perspective |
|---|---|
| Substance (product) over activity (process) | Activity (process) over substance (product) |
| Stability (permanence) over flux (impermanence) | Flux (impermanence) over stability (permanence) |
| Continuity (predictability) over novelty (unpredictability) | Novelty (unpredicatbility) over continuity (predictability) |
| Contrarities (separation) over contradiction (simultaneity) | Contradiction (simultaneity) over contrarities (separation) |

Source: Adapted from Rescher (1995, 2001).

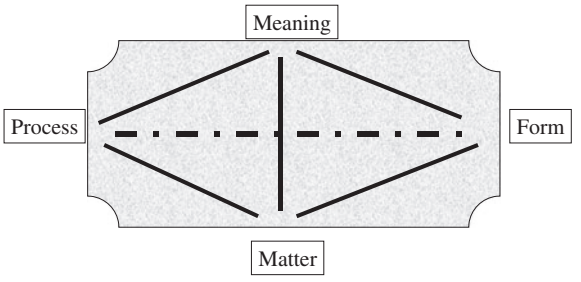


**Figure 3.** Counteracting forces
Source: Capra (2003).

> I have to confess: once I received the invite to join the programme, I start to work with my counterparts to try to develop new products, and I stop thinking and worrying about what the host organisation is doing … I simply just want to get on with the task at hand. (Senior practising engineer)

The operation of these relationships has tended to be presented as a substantive 'thing' – something that is permanent, rigid and functional, albeit fluid, something that can be managed. Yet, a non-linear model of innovation requires each actor to take up the role of the other, and pushes for the creation of hybrid organisations, nimble in developing innovation. Nevertheless, implementation and working issues can be difficult to reconcile.

> Having worked on a national project of strategic importance on renewable energy, I am still confused as to who owns the idea. Is it me? My university? The Canadian government? All I know is the work is good; working with similar interested and like-minded colleagues is fantastic, and I am sure, when we lick it, it will help Canada. (Professor of engineering)

Even these new hybrid organisational forms tend to adopt a manage-and-control approach at the expense of connecting and allowing agents and agencies to collide naturally.

> The fact that SHOKs are organised as limited companies facilitates business executives' commitment to, and involvement in, their activities. For instance, when they come to SHOK board meetings, they know instantly what the key tasks of the board are. They are used to this type of work and process in their business context, so the process outline and the type of topics to be addressed are very clear for them right from the start. We can then fully and effectively focus on the important substance issues. At the same time, if we speak of a university-led organisation that has its own ways and operational practices, the situation is quite different. Business managers are often less motivated and committed, as they do not have a clear idea of the objectives and how the process works. So, in this way, SHOKs as limited companies offer an ideal framework and process for business leaders to commit to the work. It rather brings these two worlds together. (Senior manager)

This suggests that any output, invention, spin-out, patent and so forth arising from the industry–academic relationship is not the Triple Helix itself, but only one interplay, and that the Triple Helix should be viewed as a term that explains the interlocking

and intertwined objects/entities that continually interact in new organisational forms. These can be summarised as follows:

- manage and nurture dialogue, communication, interactions and collisions among people looking at solving the issue; do not always worry about what their host institution or company may think in terms of governance, ethics, their own value chains, and so on;
- enable interaction among consumers, suppliers and partners to allow these agents the opportunity to collide and interact. The actual interactions cannot be forced or manufactured, but resources are needed to enable them to occur, such as chat rooms, virtual collaboration systems, access to big data and to intelligent agents;
- nurture the network effect of interconnectedness among academia, company and industry value chains. These fluid processes enable emergent properties to occur naturally and are, in effect, the continual interplay between agents and agencies, where there is participation, collaboration, openness, trust and a genuine desire to gain from shared understanding and involvement; and
- re-orchestrate services and access to consumers, suppliers and partners. Look at new Triple Helix arrangements as verbs rather than as nouns.

Such arrangements are essential if organisational deviants, mavericks, eccentrics and subversives are to be tolerated, accepted and encouraged (Rescher, 2001).

Triple Helix studies to date have tended to measure only two or three of the four main Triple Helix functions. The quantitative studies focus on matter; that is, what they perceive the nexus of the Triple Helix to comprise, what can be captured and measured, such as patents. Qualitative studies tend to be preoccupied with form, which suggests order, organisation and relationship. These are usually measured by quality factors, such as the quality of communication among partners. Very few studies to date address the idea of meaning. Meaning reflects the emerging shifts in the thematic patterning of human action (Stacey, 1996, 2005). This shift in thematic patterning could be called learning, but in this case, individual or collective learning can happen simultaneously. As the plexus web stresses, individuals cannot learn in isolation from the rest of the network. They learn from being part of it and acting *via* local interactions. As with the notion of meaning, the notion of process has been touched on by a few studies looking at the links among teaching, research and scholarship, but it has never been made central. The research presented here makes the process notion explicit in the shape of new hybrid organisational forms linking university, industry and government.

## Conclusions

In this contribution, we illustrate how a CAS perspective can add value to the notion of a Triple Helix. While we do not contest that organisational structures can have an impact on whether innovation occurs, we hope to have presented a case that highlights how important processes can be. Taking a CAS perspective on hybrid organisational forms encourages us to place more emphasis on the processes of interaction among Triple Helix stakeholders, such as local and regional communications and

patterns of behaviour. A CAS perspective highlights that it is the collision of agents and not simply underlying structures that makes a Triple Helix relationship. Agencies matter, but so do agents and how they interact.

In terms of implications for practice, we advocate that new Triple Helix organisations need to develop approaches that encourage social interactions, collisions and interplay among stakeholders to occur naturally and spontaneously rather than by managerial *diktat*. Process-oriented strategies need to accomplish the following:

- the participation of diverse actors;
- meaningful agendas and themes that are relevant to stakeholders and shape interactions;
- reduction of paradoxes and anxieties in collaborations of university, industry and government; and
- 'everyday' conversation of commercial and academic researchers about delivering value for members and wider stakeholders.

Rather than dwelling on structures, we contend that conceptualising the Triple Helix from a process perspective will improve the dialogue between stakeholders and shareholders to achieve a more balanced view of the whole innovation process.

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## Note

1. This approach focuses on the problem the new organisational form seeks to address. The second P is the people, who are the stakeholders, actors, agents, agencies and shareholders in the new hybrid form, and whose agenda is being satisfied (both overtly and covertly) by the policy. This is followed by the next P, which is for place. Place is to ascertain how much foreground and background is given to each player/agent/agency contained within the network to see who has pride of place and why. This is followed by an exploration of the actual policy-making – that is, how the policy of creating and operationalising the hybrid structure was developed and implemented. This P was not adopted for this study. Nor was the price tag P – that is, the cost of the policy options and how resources are allocated. This was because of insufficient access to policy-makers to gauge how they implemented the policy within their respective agencies. The next P of the policy circle is for paper – that is, what is actually stated in the policy about the purpose of the new organisational forms. The final two Ps are for programmes and performance – the programmes and activity that have resulted and how well they have achieved their intended goals.

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