J Knowl Econ (2012) 3:36–52
DOI 10.1007/s13132-011-0053-8

Women Resource Centres—A Creative Knowledge Environment of Quadruple Helix

Malin Lindberg · Inger Danilda · Britt-Marie Torstensson

Received: 23 March 2011 / Accepted: 8 June 2011 /
Published online: 24 June 2011
© Springer Science+Business Media, LLC 2011

Abstract Creative behaviour has been claimed to be a vital ingredient for the inventions and innovations that are indispensable for the dawning knowledge society. The causality between creativity, knowledge development and innovation ascribes creative knowledge environments an important role as work settings in which people produce new knowledge. The Creative Knowledge Environment approach reaches beyond the Triple Helix model—promoted in innovation policy and research—in its potential to acknowledge creative environments outside academia, industry and government. This is a relevant contribution since the public funding of Triple Helix constellations has been criticised for paradoxically consolidating old structures rather than opening up for creative change. In this article, the model of Women Resource Centres (WRCs)—developed in Sweden and internationalized throughout Europe—serves as an example of how creativity in the organization of joint action networks can make new knowledge and innovation prosper. These centres were initiated in order to promote gender equality in regional development policy, enhancing women's realization of business ideas and innovations. The model of Women Resource Centres illustrates the need for further development of predominant models for promoting innovation. Suggested concepts such as Creative Knowledge Environments and Quadruple Helix have the potential to increase the diversity of actors and areas being acknowledged as important in the expanding knowledge economy, by including the civil society and creative industries. However, the example of WRCs exposes an aspect of creativity and

M. Lindberg (✉)
Luleå University of Technology, 97187 Luleå, Sweden
e-mail: malin.lindberg@ltu.se

I. Danilda
Encounter AB, Kristianstad, Sweden
e-mail: inger.danilda@quadruplehelix.com

B.-M. Torstensson
Winnet Sweden, Gävle, Sweden
e-mail: britt-marie.torstensson@winnetsverige.se

innovation that is not properly addressed in the suggested models, namely the aspect of gender.

Keywords Creative Knowledge Environment · Triple Helix · Quadruple Helix · Innovation · Innovation system · Women Resource Centres

Introduction

The world's economies are today increasingly driven by knowledge. New wealth is created by the application of knowledge to improve productivity and to create innovations, i.e. new products, services, systems and processes. In order to enhance such innovative processes, Creative Knowledge Environments are required. These environments 'exert a positive influence on human beings engaged in creative work aiming to produce new knowledge or innovations' ([14], p 1). In policy, the importance of joint action networks—e.g. Triple Helix constellations with participants from the public, private and academic sectors—has been stressed in order to enhance innovation (c.f. [17]). The public funding of such joint action networks has been criticised for paradoxically consolidating old structures rather than opening up for creative change. A narrow range of actors and areas has been prioritized, ignoring the contribution from other sectors and alternative constellations to the growth of the knowledge economy [18, 19]. In this article, the model of Women Resource Centres serves as an example of how creativity in the organization of joint action networks can make new knowledge and innovation prosper. The empirical study illustrates the need for further development of predominant models for promoting innovation. Suggested concepts such as Creative Knowledge Environments and Quadruple Helix will therefore be scrutinized from their potential to increase the diversity of actors and areas being acknowledged as important in the expanding knowledge economy [6, 7, 14, 18–21].

The article starts with a description of the research design of the presented empirical study. Then, the issue of Creative Knowledge Environments—suggesting an expansion of Triple Helix—is discussed in the light of existing research and contemporary EU policy. The suggested concepts of Quadruple Helix and Quattro Helix are thereto outlined. This is followed by a recite of how the model of Women Resource Centres was developed in Sweden and internationalized throughout Europe. The main features of the model are also highlighted. Finally, the issue of Women Resource Centres as Creative Knowledge Environments of Quadruple Helix is analysed, and conclusions are drawn about how the diversity of actors and areas can be extended in a way that benefits the dawning knowledge economy.

Research Design

In the R&D project *Lyftet* (*The Lifting*), pursued by Luleå University of Technology and Mälardalen University in Sweden during 2002–2005, four regional joint action

networks came together in order to 'lift' their experiences of promoting women's entrepreneurship and innovation to a joint platform of knowledge (www.ltu.se/web/projekt/lyftet). These four networks were constituted by Emma Resource Centre and SAGA in North Sweden, as well as entrepreneurial women and equal terms in Mid Sweden. In all of the networks, representatives from Women Resource Centres took part. Participating at two dialogue seminars arranged within each network, the network members shared experiences with each other as well as with the four researchers being involved. The data presented in this article emanates from transcribed recordings and notes from these dialogue seminars as well as from internal documents from the four networks and public reports about Women Resource Centres. The dialogue seminars indicate that the research process in *Lyftet* was conducted by means of a participatory research approach, also known as action research or interactive research [1]. Participatory research has a long tradition within Nordic work life sciences, where dialogue conferences have been a common method to initiate dialogues within and between different actors of the society. In the participatory research approach, knowledge is developed jointly by researchers and the actors concerned by the research issues. Thus, the knowledge development in *Lyftet* has been characterized by a mutual influence between practice and theory. Also, this article is written in a participatory manner by authors representing the public, private, academic and civil sectors.

Creative Knowledge Environments Expanding Triple Helix

The innovation literature provides a good understanding of the importance of innovation for economic and social change. Innovation introduces novelty in the economy, and it has been claimed that without this novelty, the economy would settle into a stationary state with little or no growth. Innovation is thus regarded as crucial for long-term economic growth. Innovation has also been proven to be an explanatory factor behind differences in performance between regions and countries. Innovative countries and regions display higher productivity and income than less innovative ones [10]. The importance of innovation for growth is acknowledged in the new strategy—EU 2020—for the long-term development of the European Union. The strategy emphasises three aspects of development: smart growth, sustainable growth and inclusive growth. Smart growth implies developing an economy based on knowledge and innovation. Sustainable growth means promoting a more resource efficient, greener and more competitive economy. Inclusive growth includes fostering a high-employment economy delivering social and territorial cohesion [9]. To this, Carayannis and Campbell [7] stress that knowledge development is crucial for sustainable development of society and the economy.

Innovation implies a process of organizational learning and knowledge creation. It reflects organizational capacity for change and adaptation [10]. Creative behaviour in organizations has been claimed to be 'a vital ingredient for the inventions and innovations that are increasingly important in our world as it becomes more knowledge-dependent' ([14], p 3). Creativity in knowledge development can, according to Carayannis and Campbell ([7], p 47), be 'linked by innovation to knowledge application and use in the wider society'. They add that without

creativity, the knowledge input for the innovation process would be severely hampered. Based on this causality between creativity, knowledge development and innovation, it has been suggested that Creative Knowledge Environments are indispensable for innovation. These environments 'exert a positive influence on human beings engaged in creative work aiming to produce new knowledge or innovations' ([14], p 1). Creative Knowledge Environments thereby equal work settings in which people produce new knowledge. Hemlin et al. [14] accentuate the need to identify and classify Creative Knowledge Environments as well as increase the understanding of the creative processes taking place within these environments. A central question is what types of work settings—and which of their attributes—stimulate creativity. According to the authors, creativity in a work place depends upon its immediate environment as much as upon the culture and goals of the organization, sector and country in which it operates. They list a number of components making each Creative Knowledge Environment unique, including task characteristics, discipline/field, individuals, group characteristics, general work situation for individuals, physical environments, organization and extraorganizational environment.

Hemlin et al. [14] also recite existing research on creativity, concluding that creativity depends on a combination of motivation, domain-relevant understanding, skills, social structures, the actors in the knowledge domain and social actors. Creativity thus involves interaction between individuals, situations, contexts, processes, products and evaluators. The authors claim not to be surprised that groups including members from different cultural or disciplinary backgrounds tend to be more creative than more homogenous groups. This is due to the fact that individuals approach the task of knowledge production from their own perspective. Another common finding is that creativity can be enhanced by a change of environment or reference frame. Different reference frames or preconceptions can be combined and a specific perspective can be transferred into a new area, spurring new thoughts and solutions. Ghaye and Gunnarsson [12] expose how organizational complexity can lead to innovative gridlock if not properly managed. In order to avoid gridlock, creativity must be encouraged through an appreciative culture, enabling the employees to work and learn together and to be innovative. This requires a shift in the employees' mindsets. The authors regard creative thinking as the ability to generate new ideas and to see things with fresh eyes. This definition is confirmed by Carayannis and Campbell [7], adding that creativity can take part top-down as well as bottom-up.

In policy, the importance of joint action networks—e.g. Triple Helix constellations with participants from the public, private and academic sectors—for fostering innovation has been stressed. Carayannis and Campbell ([6], p 218) state that the Triple Helix model is "very powerful in describing and explaining the helices dynamics of 'university-industry-government relations' that drives knowledge and innovation in the gloCal knowledge economy and society". The growing importance of joint action networks such as Triple Helix is spurred by a societal development from Mode 1 to Mode 2 and even to Mode 3. In the early 1990s, Gibbons et al. [13] labelled traditional forms of knowledge development as Mode 1, referring to researchers operating primarily by themselves—in 'ivory towers'—seeking answers to questions identified as relevant by the researchers themselves. In contrast, the

concept of Mode 2 was introduced in order to describe a more interactive form of research, developed during the last decades, where new knowledge is developed jointly by researchers and actors outside the academy. This interaction makes both the research questions and the research results relevant and useful for a broader spectrum of societal actors [4, 13, 22]. Lately, the concept of Mode 3 has been launched addressing the multi-level governance that characterizes the new regional growth policies of EU and its member states. This type of governance comprises several different actors, levels and activities, which all have to be coordinated in order to foster innovation and growth. Mode 3 thus bridges systems theory and knowledge [5].

Hemlin et al. [14] recognize the concept of Triple Helix as an attempt to explain how new knowledge and innovations are created, and draw parallels to the attempt of Creative Knowledge Environments to do the same. The Creative Knowledge Environment approach complements the Triple Helix model, however, by adding an essential element, namely the element of creativity. The characteristics of the environments spurring knowledge production remain concealed in the Triple Helix model. The authors note that in the Triple Helix literature, only three types of Creative Knowledge Environments are acknowledged: academia, industry and government. They suggest that the field of Creative Knowledge Environment research can be considered to embrace the Triple Helix approach, but that it is broader in its attempts to analyse each actor within Triple Helix as Creative Knowledge Environments. In this article, it is suggested that the Creative Knowledge Environment approach might reach beyond the Triple Helix approach also in its potential to acknowledge creative environments outside academia, industry and government, i.e. the civil society and the non-profit sector. The public funding of joint action networks based on Triple Helix has been criticised for paradoxically consolidating old structures rather than opening up for creative change. A narrow range of actors and areas have been prioritized, ignoring the contribution from other sectors and alternative constellations to the growth of the knowledge economy [18, 19].

The expressed need for an expansion of the Triple Helix approach have spurred the introduction of alternative concepts, such as Quadruple Helix, Quattro Helix and Quintuple Helix. In this section, the rationale behind these alternative concepts will be described. Carayannis and Campbell [6, 7] suggest an extension of the Triple Helix to a Quadruple Helix model of knowledge and innovation. Their Quadruple Helix model adds ‘the public’ to government, universities and the economy as a fourth helix. The Quadruple Helix thus emphasises the importance of also integrating the perspective of the media-based and culture-based public. The rationale behind this extension is that culture and values influence every national innovation system. This includes media, creative industries, culture, values, life style and art. The Quadruple Helix thus stresses the importance of a pluralism of a diversity of agents, actors and organizations. Carayannis and Campbell ([6], p 206) underline that the ‘pluralism of knowledge modes should be regarded as essential for advanced knowledge-based societies and economies’. The same authors have also introduced the concept of Quintuple Helix, providing a framework for analysing sustainable development and social ecology connecting knowledge and innovation to the environment. The Quintuple

Helix embeds the Triple Helix and the Quadruple Helix. The relationship between the three models is described like this:

> "Triple Helix focuses on knowledge production and use in context of 'industry-university-government relations'. Quadruple Helix extends the Triple helix by adding the helix of 'media-based and culture-based public'. The Quintuple Helix contextualizes the Triple Helix and Quadruple Helix by further adding on the helix of 'environment'." ([7], p 42).

The concept of Quadruple Helix has also been used by Mac Gregor et al. [20] and Maldonado et al. [21]. These authors suggest a somewhat different content in the fourth helix, though, adding civil society to the existing university, industry and government helices. According to Maldonado et al. [21], civil society organizations occupy a strategic position in public life and represent a broad spectrum of social groups, expressing their needs and demands. They describe how knowledge production lately has come to focus the needs of government and the market, at the expense of the researchers' autonomy and the needs of civil society organizations. Such organizations are defined as citizen groups, associations, NGOs, not-for-profit research institutes and independent think tanks. Maldonado et al. ([21], p 1) discern how 'members of the Quadruple Helix will have a collective responsibility to contribute to the building of fairer societies and to help find innovative solutions to the problems that face the world today—on a local and global scale'. Mac Gregor et al. [20] present a study of 16 European innovation ecosystems, scrutinizing whether a Quadruple Helix architecture evolves from a Triple Helix architecture. They discern a number of changes in contemporary innovation systems, including a broader range of actors who are innovating, to which policy instruments will have to be adapted. According to them, the Triple Helix is not a sufficient condition for long-term economic growth, suggesting that the civil society needs to be incorporated in order to make the model complete. They conclude that interesting cases of Quadruple Helix can be found in innovation ecosystems where the Triple Helix has been implemented before, adding that the crucial ingredient is not the Triple Helix in itself, but rather the innovation commitment of the involved actors.

There are some examples of EU-funded projects being pursued based on the organizational logic of Quadruple Helix. In the Central Baltic region of European Union, the project *Quadruple Helix Central Baltic* is pursued organized in accordance to a Quadruple Helix model, gathering public authorities, entrepreneurs, universities and civil society actors/NGOs. The project addresses the need to integrate gender mainstreaming in regional policies for promotion of entrepreneurship, innovation and clusters. It also promotes cross-fertilization between a business area where many women are active (tourism) and research and tech-based areas where mainly men are active (ICT) (www.balticfem.com/en/quadruple.html). The project *Creating Local Innovation through a Quadruple Helix (CLIQ)* is pursued 2008–2011, aiming to promote innovation in 16 European local innovation ecosystems by means of a Quadruple Helix constellation. In *CLIQ*, the Quadruple Helix refers to the interaction of knowledge institutions, enterprises, government and civil society. The overall aim of the research pursued in *CLIQ* is to explore and further define the Quadruple Helix model in innovation and policy practice (www.cliqproject.eu).

In the same sense as Maldonado et al. [21], Mac Gregor et al. [20] and the projects described above use the concept of Quadruple Helix embracing a fourth helix of civil society, Lindberg [18] launched the concept of Quattro Helix. Her investigation of the actors actually being involved in the organization of four joint action networks promoting innovation in Sweden exposed a modified strategy compared to the publicly furthered Triple Helix model. All four networks had deliberately involved the civil (non-profit) sector besides the private, public and academic ones. What the civil society actors seemed to contribute with was a complementary function, securing both the survival of the network's member organizations as well as the realization of projects not fitting the organizational logic of the university or the public financiers. Moreover, the civil society actors were important in the knowledge development, thus shaping the organizational strategies somewhat different compared to the emphasis upon universities within the Triple Helix model. The four networks might thus be described as organizing a Quattro Helix instead of a Triple Helix. The four helices are in these cases occupied by private companies, public authorities, civil society actors and knowledge organizations, respectively. The same organizational strategy of Quattro Helix was found when analysing the internationalization process of Women Resource Centres [8]. The Quattro Helix model is illustrated in Fig. 1 below.

In the next section, the model of Women Resource Centres will be described as an example of how creativity in the organization of joint action networks can make new knowledge and innovation prosper.

The Women Resource Centre Model

In the early 1990s, public funds were initiated by the Swedish government to encourage the establishment of Women Resource Centres (WRCs). Since then, WRCs all over the country have worked to increase women's participation in—and benefit from—regional development policy. There exist at the moment approximately 150 WRCs in Sweden. At the national level, the WRCs are represented by the non-profit organization Winnet Sweden. Gradually, the WRC model has been exported to other European countries. This internationalization has been supported by various European Union funds encouraging transnational cooperation. In 2006, the association Winnet Europe was formed, gathering WRCs in 21 of the 27 EU member states (www.winneteurope.org). At the moment, a WRC Capitalization Project is pursued in order to secure the presence of WRCs across Europe (www.winnet8.eu). According to Lindberg [18], WRCs can be classified as innovation

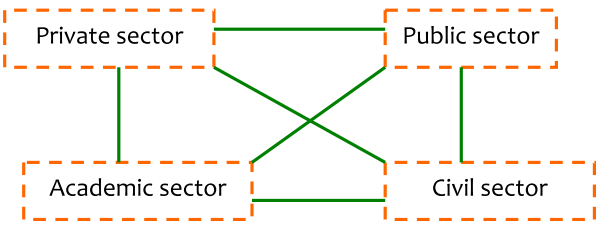


Fig. 1 The Quattro Helix model [8]

systems[1] in the sense that they link actors from different spheres of society in order to develop new knowledge to be transformed into innovations. However, they do not entirely correspond to the models being promoted in contemporary innovation policy and research. As will be exposed in this section, they have involved a different range of actors and areas than the ones highlighted in the Triple Helix model, thus constituting an example of how creativity in the organization of joint action networks can make new knowledge and innovation prosper.

The WRC model will now be described more in detail. The initiation of public funding to encourage the establishment of WRCs in Sweden was motivated by the severely uneven representation and resource distribution between men and women in regional development policy program. The funding to WRCs was intended to reinforce the pre-existing grass root movement of women's organizations enhancing women's ability to live and work in rural areas. Over the years, WRC has come to constitute a model for achieving gender equality in regional development policy in both rural and urban regions. The main target group of WRCs are women wanting to realize their ideas of new businesses, innovations, employment, projects, etc. The WRCs provide these women with business counselling, information, training and joint action networks. Thereto, policy makers and civil servants constitute an important target group for the WRC activities, striving to affect the formulation and implementation of policy programmes from a gender perspective. According to Winnet Europe, the main functions of a WRC are to:

- Empower women
- Be a neutral meeting place for networking groups of women
- Be a centre for information and documentation
- Give women advice (counselling and mentorship) how to realize their projects or business ideas
- Mediate contacts with women's networks

The WRCs have been formed by the needs identified in their immediate surroundings, entailing that each WRC has its own, unique profile. This implies that their organizational form differs. Many WRCs are NGOs, managed by idealistic committees in which the members receive no financial reimbursement for their efforts. Both the Swedish and European head organizations of WRCs are NGOs. Some WRCs constitute a part of the business departments at the municipality, thus incorporated in the public sector. Others are run by private enterprises (SMEs) in close cooperation with other local actors and/or running WRC on behalf of a municipality. Irrespective of their unique profiles, several of the WRCs have commonly developed a certain type of business counselling. This type of counselling is characterized by non-hierarchical relations between the counsellor and the person being counselled. In contrast to traditional forms of business counselling to (potential) entrepreneurs in Sweden, the WRC type of counselling does not

[1] 'Innovation systems' are a type of joint action networks where actors from the public, private and academic sectors cooperate. The main purpose with this cooperation is to enhance the development of new knowledge that is relevant to all three sectors, and to transform this knowledge into innovations.

presuppose that the client is subordinate to the advisor, passively accepting the knowledge being passed on. Instead, the WRC model emphasises an exchange of knowledge where both the client and the counsellor are expected to contribute on equal terms. The business ideas are thus discussed in a mutual manner and are not subject to condemnation or glorification from the counsellor [15, 16]. This strategy of empowerment and mobilisation of women's own resources also permeates other WRC activities such as training and networking.

The construction of joint action networks involving different groups and actors is another feature of the WRC model. In order to help women realize their ideas, WRCs have systematically constructed new constellations of actors that are capable of contributing. Depending on the geographical context, WRCs have involved, e.g. SMEs, global corporations, banks, business development centres, employment offices, public authorities, research institutes, consultants, educational associations, NGOs and foundations. The involved actors adhere to different sectors of the society—the public, private, academic and civil (non-profit) sectors. Each actor has contributed with knowledge about for example financing, product development, marketing and work–life balance. Within areas such as health care, tourism and local food production, WRCs have organized joint action networks of SMEs working together with public authorities, universities and NGOs in order to strengthen the potential for innovation and commercialization of new products and services.

Besides business counselling and construction of joint action networks, the WRC model comprises project development and implementation. The projects managed by WRCs target different areas identified as crucial for the expansion of women's entrepreneurship and innovation. The development of certain business areas—such as tourism, health care, culture/arts, handicraft/design and ICT—has constituted the core of many WRC initiatives. Projects have targeted entrepreneurship among different groups of women such as for example ethnic minorities, unemployed or students at universities. Other initiatives have focused on provision of gender equality awareness and training for policy makers and business advisors. Some initiatives have comprised lobbying activities promoting policy measures securing the influence and benefit of women in regional development policy. Such lobbying activities have taken place locally directed to municipalities and business development actors, regionally to the County Administrative Boards, nationally to governmental agencies and public ministries, and internationally to the European Commission.

The business areas targeted by the WRCs activities have primarily been the ones where most women are working. Due to the strongly gender segregated labour markets in Sweden and Europe, the private and public service sector has been ascribed a central role in WRCs efforts to attain gender equality in regional development policy. In the case of WRCs, the service sector includes health, care, tourism, culture/arts and handicraft/design. However, the ICT sector—characterized by a predominance of men as employees and entrepreneurs—has also been given high priority even since the first WRCs started in the late 1980s. WRCs have thereto been involved in establishing thematic centres focusing on women and technology, designing specific programmes for attracting more women to ICT and initiatives for cross-fertilization between the ICT sector and the tourism sector. Some WRCs have

also been involved in reinforcing gender equality within the steel industry and other male dominated sectors.

As was stated earlier, WRCs can be classified as innovation systems in the sense that they link actors from different spheres of society in order to develop new knowledge to be transformed into innovations. However, the recite above reveals that they do not entirely correspond to the models and norms displayed in contemporary innovation policy and research. Firstly, they differ in the range of actors and areas being involved. Secondly, they differ in the measures for business counselling being utilized. Both these differences imply that the WRCs creatively have elaborated the prevalent models for promoting innovation one step further. WRCs thus constitute an example of how creativity in the organization of joint action networks can make new knowledge and innovation prosper. In the next section, this statement will be further elaborated by analysing the WRC model as Creative Knowledge Environments of Quadruple Helix.

Women Resource Centres—Creative Knowledge Environments of Quadruple Helix

In this section, it will be discussed how the WRC model can be understood in the light of concepts such as Creative Knowledge Environments and Quadruple Helix, thus addressing the need for further development of predominant models for promoting innovation. The concepts of Creative Knowledge Environments and Quadruple Helix will be scrutinized from their potential to increase the diversity of actors and areas being acknowledged as important in the expanding knowledge economy.

As depicted earlier in this article, the causality between creativity, knowledge development and innovation ascribes Creative Knowledge Environments an indispensable role in innovation. In the sense of being work settings in which people produce new knowledge, Creative Knowledge Environments are similar to WRCs. Knowledge development based on locally identified needs is inherent in the WRC model. This is since their assignment is to promote gender equality in regional development policy, which implies a creative combination of two separate areas: women's initiatives in entrepreneurship and innovation as well as public promotion of joint action networks for innovation. As Hemlin et al. [14] accentuate, creativity in a work place depends upon its immediate environment as much as upon the culture and goals of the organization, sector and country in which it operates. As immediate environments, WRCs display creative working methods, such as their own type of business counselling, characterized by non-hierarchical relations between the counsellor and the person being counselled. This reflects the appreciative culture described by Ghaye and Gunnarsson [12], enabling the employees to work and learn together and to be innovative. The culture and goals of the policy sectors relevant to WRCs—as well as of the country in which they were initiated—also affect their function as creative environments. The policy sectors of regional development policy and gender equality policy are both influenced by the Swedish model of public welfare and gender equality. Gender mainstreaming is the main strategy used by the government in order to achieve

gender equality, meaning that all policy areas—including regional development policy—shall take a gender perspective into consideration in all of their policy measures. The imposed connection between gender equality and regional development induces WRCs to creatively establish these connections in both theory and practice. This has been the origin of several organizational and methodological innovations by WRCs.

The creative structures of WRCs make it possible to claim that they could be classified as Creative Knowledge Environments. Hemlin et al. [14] accentuate the need to identify and classify Creative Knowledge Environments as well as increase the understanding of the creative processes taking place within these environments. A central question is what types of environment—and which of its attributes—stimulate creativity. This will be examined here concerning the WRC type of Creative Knowledge Environments. The authors list a number of components making each Creative Knowledge Environment unique, including task characteristics, discipline/field, individuals, group characteristics, general work situation for individuals, physical environments, organization and extra-organizational environment. In order to map the WRC model as a type of Creative Knowledge Environment, it will now be assorted according to these components. The WRC model implies tasks as business counselling, information, training, construction of joint action networks and lobbying. The operative fields of WRCs are gender in regional development on the one hand and the services sector on the other. The individuals working in or enjoying the support of WRCs are mostly women. But also policy makers and civil servants are targeted by WRC efforts. The group characteristics are primarily formed by the joint action networks constructed by WRCs, where the members act as role models for each other and inspire one another to realize their ideas. The general work situation provides tasks inducing creativity, such as the novel type of business counselling and lobbying for the cross-fertilization between gender equality and regional development. The physical environments of WRCs are mostly small, since the core organization consists of a few employees and/or entrepreneurs, and varying, since each WRC is organized differently. The organizational forms of WRCs include NGOs, public authorities and private firms. In the WRC organization of joint action networks, actors from four sectors of the society are involved—the public, private, academic and civil sector. The extraorganizational environment for WRCs is heavily influenced by the government's terms for funding, ascribing them the difficult task of increasing women's participation in—and benefit from—regional development policy.

Hemlin et al. [14] state that creativity involves interaction between individuals, situations, contexts, processes, products and evaluators. This is true also for WRCs. They gather individuals in possession of certain roles—as potential entrepreneurs, as business advisors, as policy makers, as NGO representatives—and put them in a certain situation and context of promoting gender equality in regional development policy. The processes of common knowledge development among these individuals often result in product development, i.e. new services, goods, methods and organizational structures. The evaluators of the WRC results are ultimately the women and public authority representatives being targeted by the activities. The creativity induced by the WRC model reflects the statement of Hemlin et al. that groups that include members from different cultural or disciplinary backgrounds tend

to be more creative than more homogenous groups. The WRC model opens up the arena of regional development to women, who constitute a group, that have been marginalized on this policy area. They also widen the scope of areas being considered by regional development policy, by emphasizing the importance of the service sector. By extending the scope of actors and areas, the WRC model offers a change of environment or reference frame. According to Hemlin et al. [14], this enhances creativity. The WRC model thereto combines different reference frames or preconceptions in that they connect gender equality to regional development, thus spurring a creative cross-fertilization between different areas. This also reflects that a specific perspective can be transferred into a new area, spurring new thoughts and solutions, e.g. when the gender equality perspective spurs the development and implementation of measures to increase the share of citizens participating in regional development policy. Another example is when the regional development perspective on innovation and growth spurs the gender equality measures to enhance women's entrepreneurship.

As stated above, the WRC model proclaims that the predominant models for promoting innovation must be further developed on two levels: The range of actors and areas being involved and the measures for business (and innovation) counselling being utilized. For example, the WRC model reaches beyond the model of Triple Helix that emphasises the importance of three sectors: the public, private and academic (c.f. [17]). The examination of WRCs reveals how a fourth group of actors has been central to their innovative processes, namely the civil (or non-profit) sector [18, 19]. This sector is constituted by NGOs running their activities in a non-profit manner, thus reaching beyond the borders of commercial enterprises, political institutions and scientific academy. NGOs with limited financial resources are rarely perceived as key actors in the partnerships for local and regional development, however. The pivotal role of NGOs in the WRC model encourages a further development of the limiting conception of Triple Helix. Suggested concepts such as Quadruple Helix and Quattro Helix address this need for concept development. Here, it will be discussed how the WRC model can be understood in the light of these suggested concepts. The concepts will also be scrutinized from their potential to increase the diversity of actors and areas being acknowledged as important in the expanding knowledge economy.

As recited above, Carayannis and Campbell [6, 7] suggest an extension of the Triple Helix model to a Quadruple Helix model, adding 'the public' to government, universities and the economy as a fourth helix. Specifically, it is the media-based and culture-based public they have in mind. This includes media, creative industries, culture, values, life style and art. The Quadruple Helix model thereby reflects two of the main features of the WRC model, namely their focus on creative industries as well as their emphasis of values. As described earlier, the development of certain business areas—including culture, art and design (i.e. creative industries)—has constituted the core of many WRC initiatives. Thereto, the WRC focus on the business area of health can be interpreted as congruent with the Quadruple Helix focus on life style. The importance of values is also reflected in the WRC model, in the sense that it emanates from the value of a gender equal society in general and a gender equal regional development policy in particular. In the WRC type of business counselling, values of equal relations and mutual exchange of knowledge between

the counsellor and the person being counselled stand out as a pivotal element. An interesting observation is that the value of gender equality has induced the WRC model to reach beyond the Quadruple Helix model suggested by Carayannis and Campbell. This is since the WRC model embraces all kinds of service industries where most women are active as entrepreneurs, not only the ones included in the media-based and culture-based public. The WRC model thus induces the Quadruple Helix model to be developed even further.

The concept of Quadruple Helix has also been used by other authors but in a slightly different sense. Mac Gregor et al. [20] and Maldonado et al. [21] suggest an alternative content in the fourth helix, adding the civil society to the existing university, industry and government helices. Civil society organizations are defined as citizen groups, associations, NGOs, not-for-profit research institutes and independent think tanks. Maldonado et al. assess that such civil society organizations occupy a strategic position in public life. Mac Gregor et al. state that the civil society needs to be incorporated in order to make the Helix model complete. This kind of extension of the Triple Helix model is similar to the WRC model's inclusion of the civil society—both in their own organizational forms but also as partners in joint action networks. Many WRCs—including the Swedish and European head organizations—are organized as NGOs. In their formation of joint action networks, the WRCs have included civil society actors such as educational associations, NGOs and foundations. Possibly, the reason for the WRC inclusion of the civil society is their reinforcement of pre-existing grass root movement of women's organizations, most of them constituting NGOs. This way, the WRC model is not only congruent with the Quadruple Helix model but also with the Quattro Helix model suggested by Lindberg [18, 19].

From the analysis above, it can be concluded that the WRC model reflects both the Quadruple Helix and the Quattro Helix models. Here, these models will also be scrutinized from their potential to increase the diversity of actors and areas being acknowledged as important in the expanding knowledge economy. The overall impression is that the need for an extension of the dominating Triple Helix model to include a broader range of actors and areas permeates the WRC model as well as in the Quadruple Helix and Quattro Helix models. In order to increase women's participation in—and benefit from—regional development policy, the WRC model stresses the necessity to change the narrow spectrum of actors and areas considered of importance to innovation and growth. WRCs all over Europe have exposed how many women urge to realize their ideas of new businesses, innovations, employment, projects, etc., if only given proper support. Women as actors and areas occupying many women are thus pivotal in the extension suggested by WRCs. They thus constitute an example of creative thinking in the organization regarding how joint action networks can make new knowledge and innovation prosper. The extension proposed by WRCs also includes civil society actors. This is congruent with the Quadruple Helix suggested by Mac Gregor et al. [20] as well as by Maldonado et al. [21]. The Triple Helix model has tended to ignore non-profit incentives behind knowledge development and innovation, maybe because of the conviction that NGOs with limited financial resources are not suited to be key actors in the partnerships for local and regional development. A broader approach to knowledge development and innovation, acknowledging the role of the civil sector,

might bring about a change in the assessment of NGOs within innovation policy and regional development policy. In the same sense, it can be suggested that also the Creative Knowledge Environment approach might reach beyond the Triple Helix approach in its potential to acknowledge creative environments outside academia, industry and government, i.e. the civil society and the non-profit sector.

Also, the Quadruple Helix model proposed by Carayannis and Campbell [6, 7] underlines the importance of a diversity of agents, actors and organizations. Their extension relies on the media-based and culture-based public, though, rather than the civil society in itself. However, this sort of public remains somewhat unclear regarding which particular agents, actors and organizations who are supposed to be included. There are both private, public, academic and civil society actors active on the areas of media, creative industries, culture, values, life style and art. It is thereby not guaranteed that this kind of Quadruple Helix actually involves additional actors outside the Triple Helix model of government, industry and academy. At the same time, the extension to media-based and culture-based public might bring about a diversity of actors anyway since it highlights an area which up till now has not been exposed much in the predominant innovation policy (c.f. [18, 19]). In sum, the suggested models' potential to increase the diversity of actors and areas in the formation of joint action networks for innovation relies on three pillars—the inclusion of the civil society, of women as actors and of areas employing many women, as well as of the media-based and culture-based public. The models thus offer three different versions of extension of the prevalent Triple Helix model, all of them capable of acknowledging the importance of a wide range of actors and areas in the expanding knowledge economy.

Conclusions About Creative Knowledge Environments of Quadruple Helix

From the analysis above concerning Women Resource Centres as Creative Knowledge Environments of Quadruple Helix, a number of conclusions can be drawn. Firstly, it can be concluded that Women Resource Centres *can* be classified as a certain type of Creative Knowledge Environments, characterized by a Quadruple Helix organization. WRCs are similar to Creative Knowledge Environments in the sense of being work settings in which people produce new knowledge. As immediate environments, WRCs display creative working methods, such as their own type of business counselling. The connection between gender equality and regional development—imposed by the Swedish government—has induced WRCs to creatively establish such a connection in both theory and practice. The WRC type of Creative Knowledge Environment is characterized by tasks such as business counselling, information, training, formation of joint action networks and lobbying; by women, policy makers and civil servants as individuals; by group characteristics of joint action networks and by varying physical environments and organizational forms. The WRC model opens up the arena of regional development to women, who constitute a group which has been marginalized on this policy area (c.f. [18, 19]).

Secondly, it can be concluded that the WRC model constitutes an example of how creativity in the organization of joint action networks can make new

knowledge and innovation prosper. As mentioned above, WRCs display creative working methods—such as their own type of business counselling and their creative combination of two separated policy areas: gender equality and regional development—resulting in several organizational and methodological innovations. By extending the predominant way of forming joint action networks for innovation, they have increased the number of innovators and innovations in their surroundings. Their inclusion of women, areas employing many women and the civil sector has spurred the development of new policy and concepts. This leads to the third conclusion that new concepts such as Quadruple Helix and Quattro Helix *can* cast a light over the development of new organizational forms within regional development policy and innovation policy. The civil society, as well as the creative industries, has to be included in the models in order for these models to reflect the practice of joint action networks promoting innovation. Finally, the fourth conclusion is that all of the suggested models of Creative Knowledge Environments, Quadruple Helix and Quattro Helix are capable of acknowledging the importance of a wide range of actors and areas in the expanding knowledge economy. The proposed models thus increase the understanding of how creative behaviour in organizations spurs the innovation that is important in our increasingly knowledge-dependent world (c.f. [14], p 3).

However, the example of WRCs introduces an aspect of creativity and innovation that has not been properly addressed in the suggested models of Creative Knowledge Environments and Quadruple Helix, namely the aspect of gender. The gender perspective inherent in the WRC model is a driving force behind their transformation of the innovation promotion arena to become inclusive rather than exclusive. According to the theoretical stream of 'doing gender', gender can be understood as a constitutive part of organizational processes and organizations [2]. Gender is then regarded as an ongoing activity and interaction performed among and between women and men. This perspective relates everyday practices and activities to an institutional and structural level. The origin and developments of doing gender is found in works by West and Zimmermann [24] and Fenstermaker and West [11]. One of the main contributions of gender research is the exposure of how gender often is done in ways that creates dichotomies, e.g. between 'men' and 'women' or between 'femininity' and 'masculinity [3]. At a structural level, this leads not only to segregation—e.g. on the labour market—but also to hierarchies where areas associated to 'men' and 'masculinity' often are ascribed higher value—e.g. by higher wages and faster careers. In practice, this implies an uneven distribution of power and resources between women and men, visible e.g. in public promotion of innovation in Sweden. The WRC model counteracts the segregation and hierarchy between men and women in regional development policy by exposing that the capability to innovate is not connected to a person's biological sex. Rather, it is the estimation of men—and of men dominated business areas—as 'better fit' to innovate that hampers the innovative potential among certain groups of citizens.

An awareness of these restricting ways of doing gender has to permeate policy and research in order to make new knowledge and innovation prosper. The dawning knowledge economy thus requires counteracting gender segregation and hierarchy. Parken and Rees [23] have analysed how different definitions of the knowledge economy affect the gender beneficiaries of policy, research or business funding.

They conclude that a narrower view within economic geography—interpreting knowledge economy as research and development focused upon technological innovation—reinforces prevalent gender structures. For example, the European statistical service Eurostat considers only 'output and employment for high-tech manufacturing activities and knowledge intense industries' (ibid, p 4). In their survey of European innovation policy, there was no evidence of gender reflexivity in sector policies (targeting automotive, bioscience, ICT, etc.) or in the choice of sectors for funding. This is reflected in the WRC model, acknowledging the norm of men and men dominated business areas in regional development policy and the need for gender equality efforts in public promotion of innovation.

However, as noticed by Parken and Rees [23], in the transition to the knowledge economy some niche areas of work have been created where women can make a significant contribution. Such niche areas for women are particularly to be seen in symbolic knowledge and consumer facing roles. In this symbolic knowledge work of distinguishing products and building brand value, women dominate as entrepreneurs in public relations, event and media management. The WRC model underlines the importance of business areas similar to the ones mentioned by Parken and Rees, including culture, art and design (i.e. creative industries). The WRCs thus introduce women as important actors in the dawning knowledge economy, aiming to widen the scope of actors and areas considered of importance in theory and policy—thereby reaching beyond restricting gender constructions. This way of including women entails a risk, however, as highlighted by Parken and Rees. In their symbolic knowledge roles, women are being asked to profit from their gendered knowledge of women dominated lines of businesses, and from the gender sterotypes in society. This might lead to reinforcement of segregating and hierarchical gender structures, instead of change. The WRC model provides a slightly different interpretation of this risk, stressing that the creative combination of women's initiatives and regional development policy blurs the boundaries between women and men dominated areas and thus challenges the gendered norms permeating public promotion of innovation. A prerequisite for this is that the categories of 'women' and 'men' become unnecessary when esteeming innovative capability, though. This prerequisite is not yet fulfilled by the WRC model, still stressing the importance of 'women' as main targets for their efforts and as a part of their own brand—Women Resource Centres.

Returning to the new EU strategy for regional development—Europe 2020—it can be claimed that Women Resource Centres as Creative Knowledge Environments of Quadruple Helix contribute to at least two of the top priorities. These are smart growth, developing an economy based on knowledge and innovation, and inclusive growth, fostering a high-employment economy based on social cohesion. Knowledge, innovation and democracy thus interrelate, as stated by Carayannis and Campbell [6, 7]. This interrelation has yet to be recognized in the implementation of the new policies, though. The conclusions drawn in this article motivate a policy recommendation to include a wider range of actors and areas in the innovation policy priority patterns, blurring the existing demarcation between manufacturing and creative industries, between commercial and non-profit actors and activities as well as reaching beyond segregating and hierarchical notions of gender.

References

1. Aagaard Nielsen K, Svensson L (eds) (2006) Action research and interactive research—beyond practice and theory. Shaker, Maastricht
2. Acker J (1999) Gender and organisation. In: Saltzman CJ (ed) Handbook of the sociology of gender. Plenum, New York
3. Butler J (1990) Gender trouble—feminism and the subversion of identity. Routledge, London
4. Campbell DFJ (2006) The university/business research networks in science and technology: knowledge production trends in the United States, European Union, and Japan. In: Carayannis EG, Campbell DFJ (eds) Knowledge creation, diffusion, and use in innovation networks and knowledge clusters. Praeger, Westport
5. Carayannis EG, Campbell DFJ (2006) "Mode 3": meaning and implications from a knowledge systems perspective. In: Carayannis EG, Campbell DFJ (eds) Knowledge creation, diffusion, and use in innovation networks and knowledge clusters. Praeger, Westport
6. Carayannis EG, Campbell DFJ (2009) 'Mode 3' and 'quadruple helix': toward a 21st century fractal innovation ecosystem. Int J Technol Manag 46(3–4):201–234
7. Carayannis EG, Campbell DFJ (2010) Triple Helix, Quadruple Helix and Quintuple Helix and how do knowledge, innovation and the environment relate to each other? A proposed framework for a trans-disciplinary analysis of sustainable development and social ecology. International Journal of Social Ecology and Sustainable Development 1(1):41–69
8. Danilda I, Lindberg M, Torstensson B-M (2009) Women resource centres—a Quattro Helix innovation system on the European agenda. Paper presented at Triple Helix VII, 17–19 June 2009, Glasgow, UK
9. European Union (2010) Europe 2020—a strategy for smart, sustainable and inclusive growth. Communication from the commission
10. Fagerberg J, Mowery DC, Nelson RR (eds) (2005) The Oxford handbook of innovation. Oxford University Press, Oxford
11. Fenstermaker S, West C (eds) (2002) Doing gender, doing difference—inequality, power and institutional change. Routledge, London
12. Ghaye T, Gunnarsson E (2009) Creating cultures of appreciation: organisational innovation through employee well-being. In: Döös M, Wilhelmson L (eds) Organising work for innovation and growth experiences and efforts in ten companies. VINNOVA Report 2009: 22. VINNOVA, Stockholm
13. Gibbons M, Limoges C, Nowotny H, Schwartzman S, Scott P, Trow M (1994) The new production of knowledge—the dynamics of science and research in contemporary societies. Sage, London
14. Hemlin S, Allwood CM, Martin BR (eds) (2004) Creative knowledge environments—the influences on creativity in research and innovation. Edward Elgar, Cheltenham
15. Johansson AW (1997) Att förstå rådgivning till småföretagare (To understand business counselling to SMEs). Dissertation. Bjärred: Academia adacta
16. Johansson AW (2008) Förändrad rådgivning - ett sätt att frigöra kvinnors företagsamhet (Changed business councelling—a way to liberate women's entrepreneurship). In: Larsson P, Göranson U, Lagerholm M (eds) Sesam öppna dig! Forskarperspektiv på kvinnors företagande (Sesam, open up! Research perspectives on women's entrepreneurship). VR 2008:20. Vinnova, Stockholm
17. Leydesdorff L, Etzkowitz H (1996) Emergence of a triple helix of University–Industry–Government Relations. Science and Public Policy 23(5):279–286
18. Lindberg M (2007) Deconstructing gender and innovation—four regional networks challenging Sweden's innovation policy. Paper presented at past, present and future, 14–17 June 2007, Umeå, Sweden
19. Lindberg M (2010) Samverkansnätverk för innovation - en interaktiv & genusvetenskaplig utmaning av innovationspolitik och innovationsforskning (Joint action for innovation—a participative and gender scientific challenge of innovation policy and innovation research). Dissertation, Luleå University of Technology, Luleå
20. Mac Gregor SP, Marques-Gou P, Simon-Villar A (2010) Gauging readiness for the quadruple helix: a study of 16 European organizations. J Knowl Econ 1(3):173–190
21. Maldonado V, Lobera J, Escrigas C (2009) The role of higher education in a new quadruple helix context. Paper presented at Triple Helix VII, 17–19 June 2009, Glasgow, UK
22. Nowotny H, Scott P, Gibbons M (2001) Re-thinking science—knowledge and the public in an age of uncertainty. Polity, Cambridge
23. Parken A, Rees T (2010) Total control? The gendering of 'triple helix'. Paper presented at Triple Helix VIII, 20–22 October 2010, Madrid, Spain
24. West C, Zimmermann DH (1987) Doing gender. Gend Soc 1(2):125–151