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Towards demand based innovation policy? The introduction of shocks as innovation policy instrument

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No. 1182

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TOWARDS DEMAND BASED INNOVATION POLICY?

– The introduction of SHOKs as
an innovation policy instrument

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ABSTRACT: This paper aims to provide an overview of the recently introduced demand based innovation policy instrument in Finland - the Strategic Centers for Science, Technology and Innovation (in Finnish - SHOKs). SHOKs are formed to support the innovative activities of existing industries in Finland with emphasis on industrial renewal through innovation. The focus in this paper is on the current state of SHOKs, the role of different actors in their formation process, the organization of SHOKs, the development of strategic long-term research agendas and short-term research programs, the challenges related to intellectual property rights, and co-operation between different SHOKs. The paper compares these dimensions across SHOKs and tries to highlight some potential threats and opportunities that might arise. The underlying interview data shows that, while SHOKs are fairly similar in most of the dimensions, there are differences in partner selection, industry specificity, and formulation of research areas. It should be noted that individual SHOKs are in very different stages of development as some have existed for two years and others are still to be established.

Keywords: SHOK, demand-based innovation policy, policy instruments, national systems of innovation

JEL: O31, O32, O33, O34, O38

1. Introduction

Demand based national innovation strategies have become more prevailing since the introduction of the Lisbon Strategy in 2004, which emphasized EU level efforts to drive the union towards a more dynamic and competitive knowledge-based economy capable of sustainable economic growth with more and better jobs, a greater social cohesion, and respect for the environment. This has also motivated policymakers in Finland to find a balance between science/technology-based and demand-based innovation policies. In Finland, innovation policy has traditionally been more technology-orientated. Thus, the somewhat new emphasis on demand-driven orientation created a need for new strategic choices in drafting and implementing national innovation policy. This need was acknowledged by several government-initiated reports that identified a number of global challenges for Finland.

The identification of these challenges provided the basis for a line of argumentation, according to which the public and private actors of the Finnish innovation system should invest more and systematically in R&D activities. Public investments have traditionally been distributed rather evenly over all innovative activity in Finland. Through the Strategic Centers for Science, Technology and Innovation (henceforth SHOKs – the Finnish acronym), the aim is to break with the tradition and lay more emphasis on the economic relevance of innovative activity as the decisive criterion for public funding while, at the same time, acknowledging also the significant role of research as a prerequisite for innovation. The overall objective is to promote growth and renewal of the economy and to generate employment.

The initial ideas leading to the establishment of SHOKs emerged in 2003 at the Research and Innovation Council (RIC), which is chaired by the Prime Minister of Finland, and advises the Finnish government and its Ministries in important matters concerning research, technology, innovation, and their utilization and evaluation. It is responsible for the strategic development and co-ordination of the Finnish science and technology policy as well as of the national innovation system as a whole.

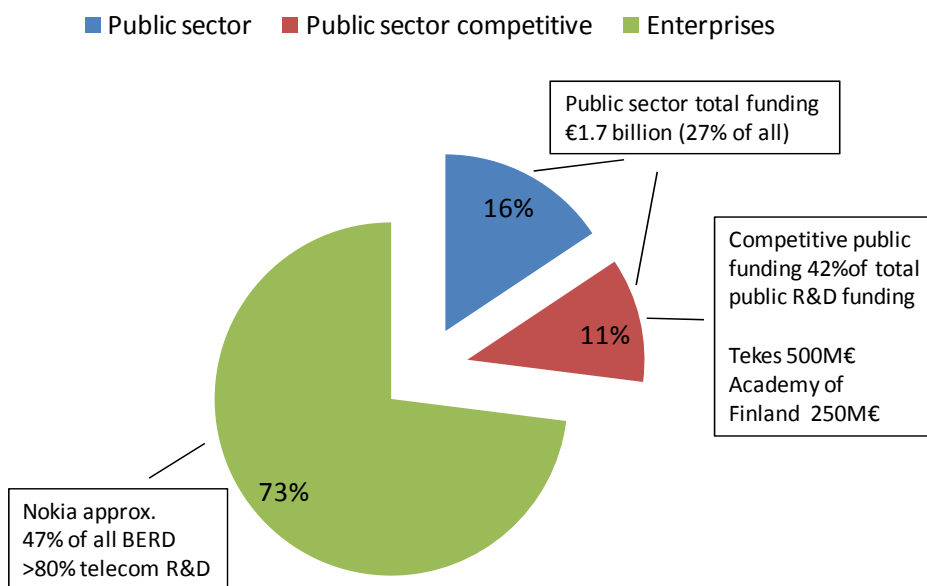
RIC's SHOK initiative is largely grounded in two separate, wide-reaching assessments by both the government and RIC evaluating the structure of publicly funded research in Finland.¹ In its report on Finland's globalization published in 2004, the government claimed that, in order to generate and maintain high-quality competitive excellence in Finnish industry and education, it would be necessary

¹ The final report on "Finland's competence, openness and renewability" of the "Finland in the Global Economy" project in 2004, and the RIC report titled "Internationalization of the Finnish science and technology" (in Finnish) in 2004.

to create centers or agglomerations endowed with a sufficiently large critical mass in their respective sectors. According to the report, the creation of such centers would necessarily imply exclusionary strategic choices, but, at the same time, also facilitate a targeted allocation of limited resources to those sectors of industry and academia considered most significant regarding the competitiveness of the Finnish economy. In its own assessment published later in 2004, RIC implicitly approved the conclusions derived by the government. In the report, RIC emphasized the importance of setting priorities and selective decision making regarding international co-operation as well as in developing national operations. In congruence with the argument, RIC's report suggested the establishment of new internationally noticeable high-quality programs, and centers of innovation, research and development.

Based on RIC's report, the government made a decision in 2005 to reallocate and provide additional resources for publicly funded research. Thus, RIC set up another committee in 2005 to conceptualize the SHOKs, a task that was completed in 2006. Based on this work Tekes, and to some extent also the Academy of Finland, started their work on facilitating the establishment of the SHOKs in sectors that are considered best to meet the long-term needs of Finnish industry and society. The first SHOK was established by the forestry sector in 2007. Another three are operational by now (ICT, metal products and mechanical engineering, as well as energy and environment) and two more will be operational in 2009 (health and well-being as well as built environment innovations (i.e. construction)). The emergence of SHOKs has a significant impact on the future allocation of public R&D funding. The current share of public R&D funding is illustrated in Figure 1.

Figure 1. R&D investments in Finland (Total 6.2 billion €, 3.45 percent of GDP in 2007)



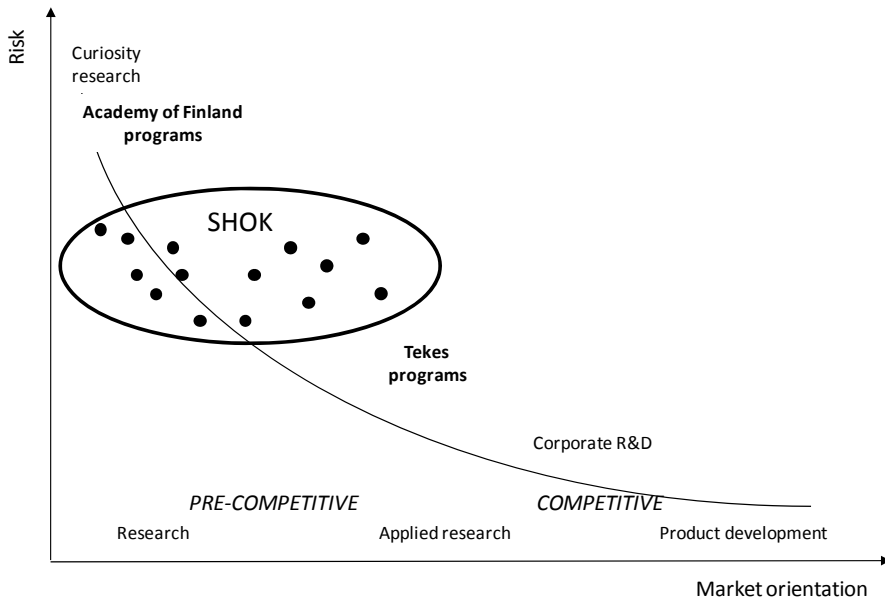
Source: Statistics Finland

According to the current vision SHOKs will account for roughly 20% (123 million €) of Tekes' annual public support for R&D and innovation by 2012. Tekes has indicated that it is committed in long-term to the operations and development of SHOKs, and will finance research programs on long-term basis. Overlapping parts of other current Tekes programs will be integrated into SHOKs in a three to four years time.

In each SHOK companies, universities, research institutes, and other partners will first agree on a joint strategic research agenda (SRA), basically a vision of the projected needs of companies regarding the development of technology and innovations five to ten years into the future. The SRA is then *jointly* operationalized into several long-term research programs including their segmentation into individual projects. The research programs are implemented through these projects. In the programs, participants develop shared know-how, shared technology and service platforms, and utilize shared research environments and research tools. The research programs serve the purpose of creating a strategic foundation of knowledge and the basis for the development of applications. In subsequent stages, results arising from SHOK research programs can be applied in projects either within or outside SHOKs. To this end, purely corporate projects implementing more applied approaches are an integral part of the SHOK concept as well.

Having said this, however, the characteristic nature of research efforts and technology development in SHOK programs is mainly long-term and pre-competitive with a broad group of the SHOK shareholders and external participants being jointly engaged in research. As an exception, one SHOK stated explicitly that its research will tend to favor a relatively shorter horizon with results expected to have an impact on markets within two to three years from the initiation of projects. This SHOK was compared to an accelerator speeding up the process of technology diffusion from the university lab to the markets. In Figure 2 below the different types of research associated with SHOKs is illustrated by positioning the research activities in the broader framework of the Finnish innovation system.

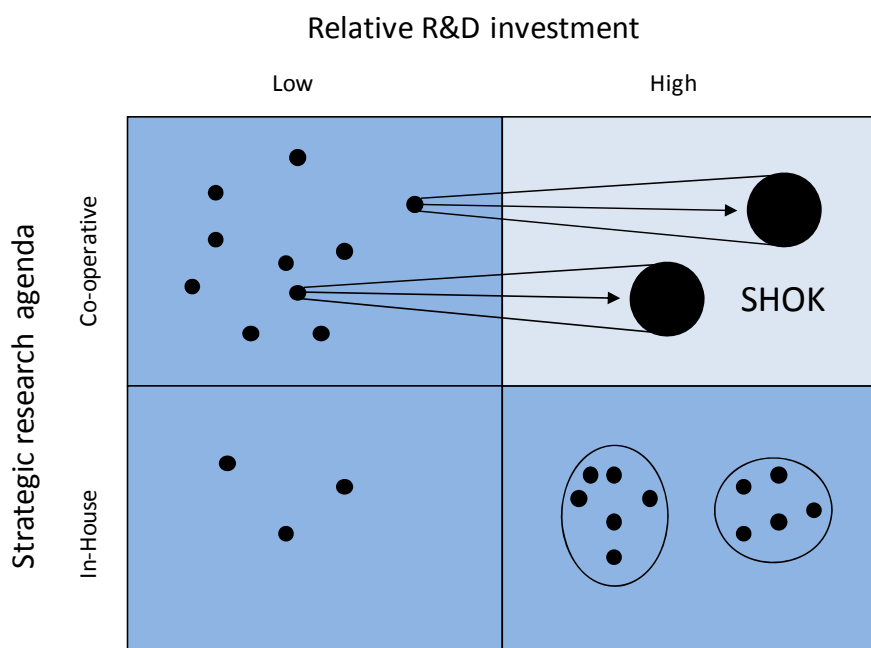
Figure 2. Positioning of SHOKs in the Finnish innovation system



Source: Adapted from FIMECC presentation material

SHOKs focus on pre-competitive research activities partially overlapping with currently existing programs by the Academy of Finland (basic research) and Tekes (applied research). The competitive research and development is viewed to be in the domain of in-house corporate R&D and, thus, is not integral to the concept of SHOKs. This focus on collaborative pre-competitive research is illustrated in Figure 3.

Figure 3. The role of SHOKs in R&D



Source: Adapted from FIMECC presentation material

The research activities conducted within SHOKs can be assessed along two simplified dimensions: the strategic research agendas (in-house vs. co-operative) and relative R&D investments (low vs. high). Prior to the emergence of SHOKs the co-operative R&D-projects were characterized by low investments leading to short-term projects. In this dimension, SHOKs provide an environment in which resources can be pooled together creating larger programs with sufficient critical mass and long-term financial commitment that allow researchers to focus on research activities instead of acquiring funding. The smaller short-term collaborative projects will naturally exist along-side the SHOKs research activities. For the in-house corporate R&D activities SHOKs will provide possibilities for conducting more R&D, as SHOKs provide additional resources (internal and external via collaboration) for research, and companies can focus on developing the created knowledge into commercial applications. In addition, companies can identify potential new partners with whom they want to co-operate outside the SHOK environment in more application orientated R&D. One of the aims of the SHOKs is to incorporate more openness into the innovative activities of the industries, which would benefit both the companies in their efforts to introduce new commercial applications, and at the same time, provide more long-term resources for public sector research.

The openness of co-operation in SHOK programs is also reflected in the general IPR guidelines according to which all participants of single programs are provided with the right to use any IPR emerging out of the programs' research world-wide and across the entire corporate structure without having to provide additional compensation to the original inventor of the IPR.

The administrative core of each SHOK is a limited company (henceforth SHOK management company) with the SHOK participants constituting its shareholders. In addition to companies, this includes also universities, research institutes, and other partners such as polytechnics and intermediating organizations. The management company has a coordinating role preparing program funding applications, taking care of the internal organization of SHOK operations, and mediating between shareholders. As the corporate perspective is supposed to dominate and have a direct influence on research in SHOKs, universities and research institutes have been allocated a cumulative share of around 30 percent in the respective SHOKs, and the remaining 70 percent is allocated to industry participants. Shareholders of SHOKs are privileged to have board representation, to participate in the design of the strategic research agendas and the research programs, and, thereby, to have an influence on the substance of research to be conducted in the SHOK environment.

This does not imply, however, that SHOK research is to be carried out in a close circle of shareholders exclusively. On the contrary, it is seen that broad domestic and international networking with actors

that are endowed with strategic excellence in the relevant fields of industry and academia are prerequisite for the viability of SHOKs. Not being shareholders, these external actors are not entitled to board representation in SHOKs, and, thus, do not have the right to make decisions regarding research agendas. They will, however, be integrated into the design phases of programs as their complementary expertise is regarded a valuable contribution. External actors will be integrated into the implementation of programs and projects on contractual or other provisional basis. External participants will also have the same unlimited right of use to IPR emerging out of SHOK programs as have the shareholders. The allocation of IPR is, therefore, linked to the participation, not the ownership, in SHOK programs and the respective projects. In addition to the shareholders (companies, universities, research institutes, etc.) and external participants, public funding organizations (most notably Tekes - the Finnish Funding Agency for Technology and Innovation – and to some extent the Academy of Finland) commit themselves to providing funding for the centers in the long term.

Regarding the interrelation between the growth of economic productivity and the role of SHOKs, it is important to note that, according to general view, productivity growth increases in two dimensions: first, through the growth of productivity in existing firms, and second, via creative destruction, when firms of low productivity exit the economy and new firms of higher productivity enter it. SHOKs were created primarily to serve the former dimension by increasing the value added and improving efficiency in existing firms. The latter dimension has excluded from the context of SHOKs, as they are being addressed through other innovation policy instruments. Nevertheless, SHOKs are expected to have spill-over effects impacting start-up activity, for example.

This paper aims to provide an overview of the current state of the SHOKs, what kind of challenges and opportunities SHOKs and their participants will have, and what kind of more general concerns and beliefs are associated to the emergence of SHOKs. This paper draws on official published and unpublished communications, and interviews to provide a broad overview of the SHOKs.

The paper is structured as follows: Section 2 provides an overview of general economic indicators of the clusters around which the SHOKs are formed; Section 3 focuses on different dimensions of the SHOKs such as the organization, roles of participants, formation of research agendas, and challenges related to intellectual property rights (IPR); and Section 4 concludes by synthesizing the discussion and highlights potential threats and opportunities that might be related to SHOKs.

2. Established industry clusters as a basis for SHOKs – An overview of general indicators

SHOKs are or will be built around existing Finnish industrial clusters. Currently these include the forest, information and communication (ICT), metal products and mechanical engineering, health and well-being, energy and environment, and construction clusters. Table 1 provides some general economic indicators and other facts to illustrate the clusters' significance in the Finnish economy.

Table 1. Facts and figures of industry sectors related to SHOKs (numbers based on 2006 statistics)

| | Forest | ICT | Metal & engineering | Health & well-being | Energy & environment | Construction |
|-------------------------------|--|---|---|---|--|---|
| Core industries | Paper and pulp production Wood products | Electronics Software Telecom Services Content | Raw metals Metal products Machinery and vehicles Marine technologies | Private and public health & social services Health technologies Pharmaceuticals | Energy and fuel production & distribution Water maintenance Waste management & recycling | Construction Construction materials Design Maintenance |
| Total turnover (expenditures) | 30 billion € | 70 billion € | 46 billion € | 15 billion € (54 billion €) | 32 billion € | 48 billion € |
| Exports | 15 billion € | 15 billion € | 20 billion € | 2 billion € | 12 billion € | 6 billion € |
| Employment | ~130 000 | ~240 000 | ~183 000 | ~500 000 | ~62 000 | ~390 000 |

Source: Adapted from Tekes, 2008 (Ihminen - Talous – Ympäristö: Valinnat tulevaisuuden rakentamiseksi)

It is evident that the SHOK related clusters account for most of the Finnish exporting activity (about 70%) and a large share of total employment (about 55%). That being said, creating an innovation policy instrument such as SHOKs around these strategically important clusters is not only a way to promote innovation in general, but an explicit and strategic choice to concentrate governmental and private resources on predetermined areas of research in those sectors of the industry that constitute vital pillars of the economy.

In the following, we discuss the most central dimensions of SHOKs to shed light on their current state and the respective operational principles underlying their activities. The data used in this discussion is based on interviews with the CEOs of the respective SHOK companies, Tekes representatives, and individuals intensively involved in the preparations of SHOKs that, at the time of writing this report, were still to be established. The semi-constructed interviews (7 in total involving 10 individuals) were conducted between January 23rd and February 2nd, 2009. The following discussion is presented on an aggregate level for two distinct reasons; firstly, to allow partial anonymity to interviewees with the intent to obtain as in-depth insights as possible, and secondly, to elevate the analysis above and

beyond the level of fragmented individual opinions for the benefit of identifying thematic patterns of wider scope.

3. The current state of SHOKs – A multidimensional cross-section

The dimensions presented in this paper take account of the current statuses of SHOKs, their respective formation and participant selection processes, the formation of the strategic research agendas and their partition into SHOK research programs, the applied or intended IPR principles, and the collaboration between SHOKs.

3.1. The formation and partner selection processes

While the Academy of Finland, the respective industry confederations, and the enthusiasm of involved companies have been major drivers in bringing SHOKs to life, one of the most central roles in the initiation and implementation of SHOKs has been played by Tekes. With a clear emphasis on the pre-formation stages, Tekes has provided support for SHOKs throughout the process by creating the preconditions for operations as well as encouraging and consulting SHOKs in their internal development and organization. This comprises also the co-ordination of the co-operation between different SHOKs. In many cases Tekes initiated the formation process, and through rounds of consultant inquiries and workshops for interested parties, core groups of companies were identified, which then continued with the actual planning and implementation of SHOKs. Even though Tekes has had a crucial role as an initiator, SHOKs have always been intended to be demand driven with the industry taking an active role and responsibility in planning, coordinating, implementing and managing SHOKs including the design of the framework for research conducted in them. Thus, with the start of actual operations, Tekes takes a more passive role as a sounding board for emerging ideas.

Another central phase in the formation process of SHOKs is the selection of partners that, as shareholders of the respective SHOKs, are provided with the rights to board representation, participation in the formulation of research agendas, and the use of emerging IPR. In this dimension, the SHOKs have applied somewhat different policies. While some SHOKs were not restrictive in their partner selection welcoming all interested parties to participate, in some SHOKs partners were selected with care by the core group of corporate partners. Details on the selection criteria remained largely undisclosed. While universities and certain research institutes were always considered important partners, some partner candidates such as polytechnics and technology parks were excluded from a number of

SHOKs. Simultaneously, however, a small number of SHOKs considered polytechnics as important partners in diffusing knowledge emerging from SHOK research to every day practices. Along the same lines, there are also significant differences between SHOKs in the diversity of the selected partners. In some cases SHOKs were created around the existing actors in the field, while others are more diversified and have included partners that have not co-operated earlier but have now identified potential collaboration opportunities within SHOKs.

These selection policies apply to potential future partners as well. According to the interviews, SHOKs have somewhat different points of view regarding the selection of and openness towards new partners in subsequent share offerings. While some are open to new partners and already bring new partners onboard, others seem to be more contained with their present efforts being focused on establishing the co-operation among the current set of partners. Expanding the accessible pool of expertise was mentioned as one of the potential incentives to broaden the shareholder base.

In addition to the selection of ordinary shareholders, partner selection policies had to be drawn up regarding co-operation with partners external to the shareholder base as well. These include foreign companies and research organizations (for example universities and research institutes), and to some extent SMEs in Finland. While foreign organizations cannot participate in SHOKs as ordinary shareholders receiving governmental funding due to the legal requirements of publically funded research, it should be noted that some larger foreign owned corporations do own Finnish affiliates in Finland, which are eligible to participate in SHOKs. Another much debated group of participants are SME companies. The focus of SMEs on short-term R&D objectives was seen as a major factor contributing to the rare presence of SMEs in SHOKs that are designed to carry out more ambitious, strategically oriented long-term research. The majority of SMEs was further argued to lack the sufficient resources to participate in share offerings. That being said, both foreign organizations not owning Finnish affiliates and SMEs can and will be integrated into SHOK operations as external partners in research programs on a contractual basis.

3.2. SHOK management companies as the administrative core

As already mentioned, the core of each SHOK is the management company taking care of most of the administrative responsibilities related to SHOK operations. At this point, it should be noted that SHOKs are in different stages of development. While the forest cluster -SHOK was established in 2007 as the first of SHOKs, two SHOKs are currently in the preparation phase with plans to be established in the course of 2009. Table 2 presents some basic data on the SHOK management companies serv-

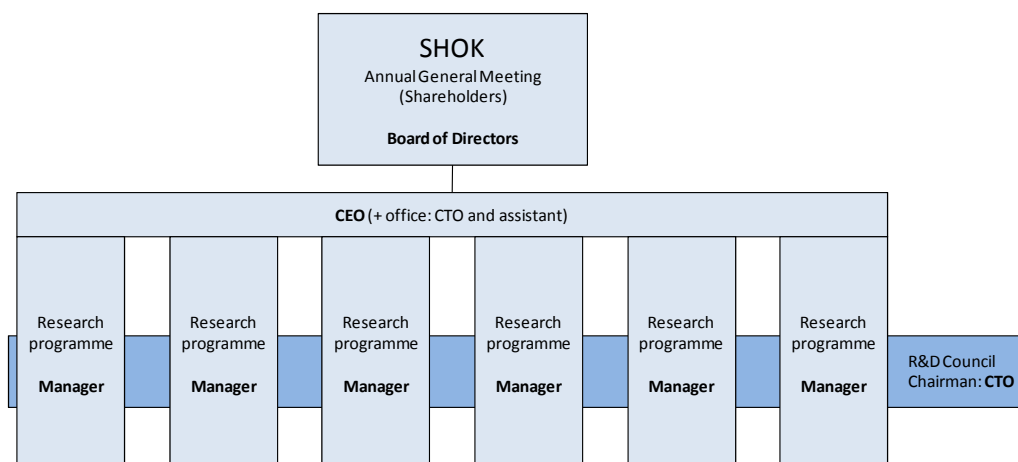
ing as the administrative core in SHOKs. The list of current shareholders and members of the board are listed in Appendix I and Appendix II.

Table 2. The current status of the SHOKs

| | Forestcluster (Forest) | TIVIT (ICT) | FIMECC (Metal & mach.) | Cleen (Energy & envir.) | Health & well-being | Construction |
|---------------------------|--|---|------------------------|-------------------------|---------------------|------------------|
| Partners selected | Yes | Yes | Yes | Yes | Almost | In the process |
| Company established | 2007 | 2008 | 2008 | 2008 | Spring 2009 | ~2009 |
| Employees in the company | 3 full-time; 1 part-time program manager | 3 full-time; 4 part-time program managers | 2 full-time | 1 part-time acting CEO | Light | Light |
| Strategic research agenda | Yes | Yes | Yes | Yes | Unpublished | To be formulated |
| Research programs | 1 funded 1 in the process | 4 funded | 1 in the process | 0 | 0 | 0 |
| Planned research programs | 4 | 6 | 4 | 8 | NA | NA |
| Total number of programs | 6 | 10 | 5 | 8 | NA | NA |

To provide the capital stock for the already operational SHOK management companies the interested/selected partners have participated in an initial directed share offering. In addition to capital provided by shareholders, Tekes has provided financial assistance in the initial stages of the management companies. In fully operational SHOKs, the running costs of the management companies, mostly salaries, are usually covered by a small overhead from the funded research programs, though in some distinct cases a membership fee is collected instead of an overhead. The companies themselves are fairly small with 2-3 full-time employees and part-time managers for each of the research programs. Even the largest SHOK management company (TIVIT) has currently only 3 full-time employees and 4 part-time program managers. Figure 4 depicts the typical SHOK organization and its structure.

Figure 4. An example of the organizational structure of a SHOK



Source: Adapted from FIMECC presentation material

Established SHOK management companies have usually 2 to 3 different types of shareholders, based on which board representation is allocated. Usually the type of a shareholder candidate determines the required initial investment. The amount of investment usually ranges between 40.000€ and 120.000€, and varies among SHOKs with universities, research institutes and other non-corporate actors being generally required a smaller investment. The categorization enables the participation of organizations of different sizes. The board of a typical SHOK management company has pre-determinedly allocated 3/4 of available seats for company representatives while the remainder of seats is reserved for universities, research institutes and other participants. The structure is a reflection of the purposefully industry dominated partner selection process.

The services the management companies provide for their owners are currently fairly limited as the focus is on preparing and initializing research programs. In addition to these immediate tasks, they are also coordinating the research activities in the SHOKs by bringing together interested partners and facilitating the dynamic revision of the strategic research agendas. Furthermore, raising awareness of the SHOK as a concept among its members and potential new candidates is an ongoing activity as well. In the future, the range of available services will be further extended. Many of the management companies expressed their intention to provide IPR services and to facilitate in networking in the national and international contexts. While all of the established SHOKs report a fair number of *planned* research programs, only two of them are coordinating funded *operational* programs at the time of writing this report.

3.3. Strategic research agenda and research programs

As already touched upon in the introduction, shareholders jointly design a strategic research agenda (SRA). The initial SRA is usually laid out already prior to the foundation of the respective management companies and often designed by a core group of participants with the final set of shareholders often being unknown at these early stages of operations. Later, SRAs will be periodically updated with all shareholders contributing to its planning.

In line with the basic principles of SHOKs as an instrument to introduce a more demand driven perspective to industry-academia co-operation, industry participants have taken a dominant role also in the operationalization of SRAs into specific research programs with academic participants being less active in general. However, as profound scientific expertise especially in the area of very early stage technologies often locates within the academia and research institutes, some SHOKs have allocated universities and research institutes more responsibility in identifying relevant research areas.

The intended length for single research programs varies between SHOKs. For some the estimated length varies between three and five years, while others have longer durations ranging from five up to ten years. In a few SHOKs, some of the research was expected to require even 20 years of pre-competitive development before yielding technology that could be transferred out of the pre-competitive context of SHOKs into the competitive realm of corporate R&D. With that being said, the length of single programs is largely dependent on the area of research. Research in biotechnology, for example, is a more lengthy and unpredictable endeavor than in ICT. The scientific ambition of SHOK programs and the stage of development of technologies therein are further major factors affecting the expected duration of programs. Programs aiming at more radical innovations and focusing on infant stage technologies require significantly more time than programs developing incremental innovations for established technologies.

Public communication on SHOK research agendas has stressed the role of radical innovations as the objective of SHOK research while de-emphasizing the role of incremental innovations. The official publicly stated purpose of SHOKs is not to support conventional corporate R&D. Rather, the intention is to extend research endeavors into earlier, scientifically more ambitious phases of technology development than before while keeping strategic long-term needs of the industry as a guideline in the design of agendas. In the majority of interviews, however, the role of basic research did not emerge as a crucial factor impacting the research agendas of SHOKs. Either its role was explicitly played down, or it was barely paralleled with more applied research in its importance. Only in few cases was the role of basic research emphasized explicitly. The limited role of basic research is also evident in the fact that only few interviewees referred to the Academy of Finland as a significant partner in the preparation and creation of the respective SHOKs or as a discussion partner in future formulation of research programs.

When developing new technologies, products, and processes, the need for new business models might become relevant due to changes e.g. in distribution channels and value chains. Some SHOKs indicated that this is a crucial part of their research agenda, while others indicated that the development of new business models remains the responsibility of single companies as this dimension is argued to be beyond the pre-competitive context of SHOKs.

3.4. IPR practices and challenges

As already mentioned in the introduction, SHOKs aim to have open IPR policies in the co-operation between shareholders. All participants, be they shareholders or external actors, of individual re-

search programs are provided with the right to use any IPR emerging out of the program's research world-wide and across the entire corporate structure without having to provide compensation to the original inventor of the IPR. The ownership to the IPR remains with the inventor. While being in line with the concept of pre-competitive co-operation, this openness in IPR guidelines still creates certain challenges for different partners.

One of the challenges introduced by the open IPR policies is the possibility for free-riding, where a partner is only involved in programs to gain the rights to use emerging IPR without putting forth actual research effort. All interviewees indicated that this challenge will be tackled by requiring all participants to invest sufficiently into the programs, relative to their size and role in the respective research.

Another challenge related to IPRs is the issue of promoting new start-ups in SHOKs. As mentioned in the beginning of this paper, SHOKs were created primarily to increase the value added, and to improve the efficiency of existing firms through the process of industrial renewal based on innovative activities. This implies that, by definition, SHOKs are less start-up orientated than many other innovation policy instruments. Be that as it may, however, the reason why this aspect is brought forth here is the fact that the ability of technology based start-ups to attract external capital, a vital precondition for survival, is dependent on having a strong IPR position. Given the global, corporation-wide rights to use the IPR emerging from research programs, the possibilities for having a strong IPR position are fairly limited. This deteriorates incentives to establish new ventures aiming to exploit eventual technological spillovers from SHOK research that are not pursued further by existing partners. Somewhat surprisingly this aspect has not been considered explicitly in almost any of the SHOKs. When asked to respond explicitly, however, many interviewees contemplated that this matter could "surely be worked out" should a need or an opportunity for creating new start-ups emerge.

Particular tensions exist also between the industry and universities regarding the use of input and output materials of research within SHOKs and how different parties are compensated for making inventions. The latter aspect is especially relevant for top researchers who usually have many attractive alternative channels for obtaining research funding and compensation for inventions. These individuals might have low incentives to engage in SHOK related research, because the free right of use across all participants limits the possibilities of designing attractive compensation schemes. The interviewees had very different opinions regarding this challenge. While others identified it as important, others had not even considered it a problem. Many conceded that there is a significant amount of misinformation regarding the matter among the involved parties, but were also confident that

misunderstandings will eventually clear up once SHOKs are more established and different parties have more experience in working together.

The final challenge related to IPRs is the existing and potential differences in IPR practices between different SHOKs. The issue constitutes a problem when different SHOKs come to the conclusion that they have a common interest in a specific research area want to collaborate in a joint research program or project. The differences in IPR practices were mentioned by many interviewees. At the same time it should be noted that SHOKs are currently more concerned with making sure that the initialisation of their own operations and research programs is successful than thinking of possible problems regarding inter-SHOK co-operation.

3.5. The interaction between SHOKs

Despite the current pronounced focus of SHOKs' on their own internal affairs, there is existing collaboration between SHOKs on a more strategic level. SHOKs have a joint foresight group consisting of the respective SHOK management teams, which meets regularly to discuss potential areas of collaboration and other aspects relating to potential collaboration on different levels reducing the risk of overlapping programs and projects among a number of other benefits. Many SHOKs have already identified potential overlap areas between different SHOKs. This has influenced in particular SHOKs that are less established in their activities.

4. Conclusions

In addition to providing a brief but concise description of SHOKs as a new instrument in Finnish innovation policy, this report sets out to investigate their state of development and organization of operations along their most central dimensions. These include the role of different actors in the formation process, the organisation of SHOKs, the development of strategic long-term research agendas and short-term research programs, emerging challenges related to intellectual property rights, and co-operation between SHOKs. The paper compares these dimensions across SHOKs and tries to highlight some potential threats and opportunities that might arise.

As the initiation of SHOKs was more or less centrally coordinated by governmental agencies, mostly Tekes, SHOKs share many identical features with each other. The organizational structures, for ex-

ample, are almost identical as are the guidelines regulating the assignment of emerging IPRs and the related rights of use. SHOKs share also the same basic understanding regarding the modes of cooperation between SHOK participants, the importance of extending co-operation beyond domestic borders, and the objective to produce radical rather than incremental innovations.

On the other hand, the findings indicate slight differences between SHOKs in some dimensions. While a number of individual SHOKs acknowledge the importance of academic and research institute partners by regarding them important SHOK partners and including them in the design of strategic research agendas, many SHOKs have implemented a much more industry-driven approach rendering the role of non-corporate partners secondary. Challenges regarding the viability of established IPR regimes were also faced with varying degrees of concern with some SHOKs taking active measures to identify and avoid conflicts, while others were either less aware of problems or trustful in the emergence of ad hoc solutions should conflicts arise. Conflicts regarding IPR exist especially between industrial and academic partners.

The findings lay the basis for a brief discussion of some emerging opportunities and threats regarding the impact of SHOKs on a broader level. Clear opportunities arise from the re-allocation of public and private resources on the identified strategic sectors of industry and academia. It is expected to increase the effectiveness of governmental support, as resources in the selected sectors reach levels that have a greater potential to make a noticeable impact. This, in turn, enables the chosen strategic sectors of the industry to increase their value added through innovation and, thereby, improve their productivity and global competitiveness. At the same time, universities, research institutes, and other actors linked to these sectors gain additional resources, and are able to raise the level of scientific ambition and relevance of research.

In contrast to allocation strategies based on politically charged agendas, SHOKs enable the allocation of resources on the basis of expected economic and societal impact, corporate strategies, and the existing knowledge base. Furthermore, as participants are required to make significant investments into SHOKs, they are expected to have the necessary incentives to commit to and take responsibility in the success and impact thereof.

Achieving a critical mass is not limited to the pooling of financial resources alone. Through intensive, institutionalized, and strongly interdisciplinary co-operation between previously isolated parties, SHOK participants are able to tap into a shared pool of knowledge, a critical mass of expertise, that potentially leads to entirely new approaches in research enabling the emergence of (i) radical innova-

tions, (ii) an increase in the quality of research, and (iii) a further reinforcement of the strong interaction between central knowledge producers (academia) and its users (industry). Such integrated co-operation implicitly emphasizes application- and problem-driven modes of research that are more potent in spawning competitively relevant technology than is research conducted within the confines of single scientific disciplines.

The potential threats and challenges that might emerge with the introductions of SHOKs are related to the ability of companies to open up their innovative activities, their commitment to long-term research, challenges in collaborating with external partners (universities in particular), IPR issues, the gray area between pre-competitive and competitive research, and the potential strengthening of existing industrial sectors at the expense of new emerging industries.

One of the key tasks and potential challenges is to motivate the companies to open up their innovative activities and to create an atmosphere of trust and collaboration. In some SHOKs this openness has already been a practice, while for others this requires significant changes in attitudes towards collaboration and sharing knowledge even with competitors. Cultural traditions are difficult to break and will require lengthy sustained efforts and determination on several levels in companies.

As SHOKs are industry-driven and aim to promote long-term research, there is a potential risk that companies exposed to the demands of the 'quartile-economy' are more interested in short-term solutions rather than investing in risky long-term research. This might manifest as short-sighted designs of research agendas based on these short-term corporate objectives. This also relates to the current financial crisis, which might stifle enthusiasm to engage in completely new type of co-operation.

Related to the co-operation between companies and universities, the incentives for top researchers to participate in SHOK research might be lower than expected, as the potential returns from other types of industry sponsored projects outside SHOKs are much higher. These individuals need to identify some non-monetary incentives in participating in the SHOK collaborations.

With respect to IPR policies in SHOKS, the unrestricted right to use inventions and other materials resulting from SHOK research programs might be seen as a potential threat for universities' preconditions to conduct research outside the context of SHOKs. Whether this will translate into a tangible problem is an issue that will not find answers before more practical experience of actual operations has been gained. This also relates to the emergence of spin-off companies from universities, because

the IPR position of new start-ups might be too weak to attract external financing. From a social welfare perspective it would be recommendable that practices be designed for these eventualities to avoid foregoing the opportunity to develop potentially valuable applications.

Related to the number of partners in each SHOK, there is a risk that an oversized base of partners might jeopardize the efficiency of decision-making, and result in inefficient compromises in the allocation of resources and in the quality of research. Furthermore, this might dilute the concept of excellence sought after by the SHOK concept.

It also seems that some SHOKs are more confined to their pre-existing industry structure than others. This potentially reinforces the existing industrial structure, which might prevent new potential industries to emerge and gain sufficient public support. That being said, some SHOKs have adopted a more open policy by including a wide range of partners sharing a vision, according to which their collaboration produces new and innovative applications.

As a final note, it should be stated that there exists a clear lack and fragmentation of information about SHOKs as well as their future role in the Finnish innovation system. This lack and fragmentation concerns actors both in the private and the public sectors.

APPENDIX I – Shareholders (Health & well-being and Construction are yet to be established)

| | Forest | TIVIT | FIMECC (Research council) | Cleen |
|-----------------------------------|--|---|---|--|
| Companies | Stora Enso UPM Metsäliitto-group Myllykoski Metso Kemira Ciba Finland Andritz Tampfelt | CSC – IT Center for Science Digita Elektrobit Technologies Elisa Inno-W Jyväskylän Turbiini L M Ericsson NetHawk Nokia Nokia Siemens Networks Okmetic Plenware Prizztech Stonesoft Technopolis TeliaSonera Finland VTI Technologies | ABB Andritz Boliden Kokkola Cargotec Finn-Power KONE Konecranes Kumera Metso Outokumpu Outotec Rautaruukki Raute STX Europe TietoEnator GMR | ABB ÅF-Consult Andritz Ekokem FCG Planeko Fortum Foster Wheeler Energia Gasum Helsingin Energia Hollming Kemira Kumera Kuusakoski Lassila & Tikanoja Metso Neste Oil Outokumpu Outotec Pohjolan Voima Rautaruukki Stora Enso The Switch Engineering UPM-Kymmene Vaisala Vantaan Energia Vapo Vattenfall Verkkö Wärtsilä Finland |
| Universities & poly- tech's | Lappeenranta Univ. of Tech. Helsinki Univ. of Tech. Åbo Akademi University of Jyväskylä | Helsinki Univ. of Technology Helsinki School of Economics Helsinki University Joensuu University Jyväskylä University Oulu University Tampere Technical University Tampere University University of Art and Design Åbo Akademi Arcada (Polytech) Cent. Ostrobothnia (Polytech) Metropolia (Polytech) Laurea (Polytech) Mikkeli (Polytech) | Helsinki School of Economics Helsinki Univ. of Technology Lappeenranta Univ. of Tech. Hanken Tampere Univ. of Technology University of Art and Design University of Jyväskylä University of Oulu University of Vaasa Åbo Akademi Laurea (Polytech) Metropolia (Polytech) | Helsinki University Helsinki Univ. Of Technology Joensuu University Lappeenranta Univ. of Tech. Tampere Univ. of Technology University of Vaasa University of Jyväskylä University of Kuopio University of Oulu Åbo Akademi |
| Research institutes | VTT Metla | VTT | VTT | VTT Metla |
| Other | | Culminatium Helsinki-Region Centre of Expertise Technopolis Ventures Teknologiakeskus Hermia The Network for Intelligent Transport - ITS Finland TIEKE – the Finnish Information Society Development Centre Turku Science Park Viestinnän keskusliitto | Technology Centre Hermia | Finland's environmental administration Finnish Meteorological Institute MIKES |

APPENDIX II - Composition of the board (Health & well-being and construction are yet to be established)

| | Forest | TIVIT | FIMECC | Cleen |
|---------------------------|--|---|--|--|
| Companies | Andritz Ciba Finland Kemira Metsäliitto-group Metso Myllykoski Stora Enso Tampfelt UPM | Elisa Ericsson Nokia Nokia Siemens Networks TeliaSonera VTI Technologies | Cargotec Finn-Power Kone Konecranes Metso Rautaruukki STX Europe | ABB Fortum Helsingin Energia Kuusakoski Metso Neste Oil Wärtsilä |
| Universities & polytech's | One joint seat | Helsinki Univ. of Technology Tampere Univ. of Technology | Tampere Univ. of Technology | Åbo Akademi |
| Research institutes | VTT Metla | VTT | VTT | VTT |
| Other | | Hermia Technopolis | | |