Discussion initiative

Utilising the results of research, development and innovation in the real estate and construction sector

Discussion initiative of the National Audit Office 2013

Utilising the results of research, development and innovation in the real estate and construction sector

Summary of NAO's workshop on 11 April 2013

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On 11 April 2013, the National Audit Office arranged a workshop titled 'Utilising the results of RDI in the real estate and construction cluster'. This discussion initiative, which was prepared on the basis of the workshop, contains an introduction to the topics discussed at the event, the papers written by the introductory speakers and a short abstract based on them. The contents of the discussion initiative will be published in the report series of the National Audit Office.

The National Audit Office would like to thank all those taking part in the workshop and in the preparation of the publication for their inputs, which enabled us to compile the contents of the event into a discussion initiative.

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Contents

Abstract

On 11 April 2013, the National Audit Office (NAO) arranged a workshop titled 'Using the results of research, development and innovation (RDI) in the real estate and construction cluster (KiRa cluster)'. This publication is based on the results of the workshop.

The publication contains an introduction to the topics discussed at the workshop, the papers written by the introductory speakers and an abstract based on them and the summary given by the workshop coordinator and editor of the publication.

The contents of the workshop and the publication are thematically based on the *broadening of the field of 'public responsibility' aimed at ensuring better use of new knowledge and expertise in the KiRa cluster*.

The broadening of the field of public responsibility requires new practices and procedures so that the field can be governed. The broadening of the field of responsibility is based on concrete and increasingly urgent challenges in education, research, innovation and expertise and challenges to which the KiRa cluster must also be able to respond in a new manner. In problem-solving situations it often transpires that these challenges and the gaps concerning knowledge, expertise and other areas are problems of wicked nature. Such problems are shaped by their environments and occasionally they are on a case-by-case basis without any clear recurring structure. Moreover, they do not have clearly defined start or finish and there are no clearly defined criteria for solving them. All this means that trying to solve wicked problems can easily lead to new problems that are even more difficult.

The workshop and the publication are a manifestation of three general requirements that condition each other:

- *broadening and interpreting responsibilities concerning increasingly complicated social problems within and between political-administrative systems and doing this by using governance instruments in a new manner*;
- i*mproving, by means of knowledge, the chances of a new responsible approach* to issues concerning built environment by focusing on the basis of the success of the KiRa cluster in knowledge, expertise and innovation and in better utilisation of them (knowledge policy, strategy, assessment, etc.); and
- *improving the knowledge and expertise base of steering and governance* in practical issues (quality of construction, health of the living environment, energy economy, etc.).

This publication examines these needs from different perspectives, discusses the current strengths and weaknesses of the cluster and seeks to find coordinates for change and development.

According to this publication, the renewal of the KiRa cluster as a practical process is based on five key factors:

- forces of change;
- (national and international players and networks and change processes);
- awareness of the current state of the traditional approach and the need to change it;
- outlining of the new (corrective or renewing) operating model;
- steering and governance bringing the above elements together and supporting them; and
- knowledge, expertise and innovation supporting the above-mentioned elements.

This discussion initiative presents ideas and interpretations concerning these key renewal factors. NAO is also planning to conduct a performance audit of the topics discussed at the workshop and in the publication. NAO will also report on RDI in its annual report to be published in 2014. The purpose of this publication is to supplement and diversify the knowledge base and content of the audit report and the annual report and to broaden the communications, interaction and learning process of the workshop. This will become reality when the introductory speeches held at the workshop and its main results (and their interpretations) are published.

The KiRa cluster is facing both internal and external forces of change.

- External forces of change include demographic changes, internationalisation, new service needs and technological shifts. Different types of problem (such as moisture and mould problems and the need to save energy) are also external forces of change. From a broader perspective, digital transition, green growth and social responsibility act as drivers involving both threats and opportunities.
- Important internal forces of change include awareness and identification of problems, open debate on conflicting opinions and joint target-setting or definition of problems. Most of these forces of change are evolving in the joint area of knowledge, values, policies and citizen participation, which remains unstable. Change governance is partially a matter of bringing about interaction between these elements.

As areas for governance and as governance environments, the KiRa cluster and the sector of built environment contain an exceptionally complex combination of problematic interdependencies, a sizable accumulation of (national) wealth and a concentration of a large number of players, values, objectives, steering instruments and players carrying out steering.

In an ideal situation, a policy and its values and knowledge are interacting and complementing each other. In such a situation, values and objectives steer and guide knowledge, activities and renewal. At the same time, knowledge helps to assess the direction and scale of objectives, means and (occasionally) even values. In the KiRa cluster, the trend is also increasingly towards such interaction. However, the interaction in the cluster is not yet on a satisfactory basis. Because of unsatisfactory level of interaction, the values, objectives, methods, players and knowledge do not always meet or the meeting between them is only partial. Moreover, they often 'compete' with each other in a harmful manner. The proposals made during the past few years to establish a new 'strategic centre for science technology and innovation (SHOK) for built public-sector environment', to create a minister and development strategy for built environment and to create a new forum bringing together different players and the focusing of the strategic research agenda are examples of the challenges concerning the interaction between values, knowledge, players and instruments within the cluster.

In Finland, the core of the RDI activities in the KiRa cluster is in the private sector. Market failures, changes in the ownership and structures of the companies in the sector and the short-term nature of the operating framework have made RDI less attractive for the Finnish KiRa sector. At the same time, these factors also provide a basis for public intervention and steering. However, in the public research and funding system, the practical nature, slow pace of change and underdeveloped research culture of the KiRa cluster weaken the sector's chances to compete for research resources.

Judging from the speeches held at the workshop, the following factors weaken the effectiveness of the steering and governance model of the KiRa cluster in Finland:

- The current steering model is inflexible and segmented and contains strong path dependencies. This means that it favours narrowly based solutions and practices;
- With its market connections and supply-based operating models, the steering model leads to more short-term and narrowly based activities;

- The steering model does not contain a coherent steering entity with integrated contents and tools that would focus on the KiRa cluster (players and modes of steering);
- Some of the (vertical) basic solutions of the steering model are vague; In the public sector, there is too much emphasis on the top-down steering dimension, while little attention is given to other operating levels (meso level, bottom-up);
- There are a large number of steering players and the responsibilities and relationships between them remain vague;
- The relationship between steering elements and ideologies (markets, regulation, objectives, needs, values) remains vague;

The general problems concerning the effectiveness of the steering and governance model listed above make it more difficult to assess the model. They also make the governance model less transparent and leave less room for renewal, knowledge, expertise and innovation in the KiRa cluster. Furthermore, the problems also make it more difficult to manage RDI in the cluster and can easily lead to a situation where it supports well-established operating practices. In such a situation, knowledge, expertise and innovations do not act as drivers boosting comprehensive renewal of the KiRa sector but respond to the challenges in a reactive manner. The forces of change must be found elsewhere.

User and customer orientation as a new basis for Finland's innovation policy and strategy poses a challenge to traditional KiRa steering structures (in the public sector and other areas) and questions the direction and contents of the current RDI. It also requires new knowledge and expertise infrastructures. The process towards more demand and customer orientation in the KiRa cluster is still in its infancy. The sector has traditionally based its operations on preselected values, pre-planned needs, a supply-oriented approach and standardised operating models/outputs. Changing this basis into a model in which the emphasis is on the choices and preferences of individuals, customers, users and consumers will not happen overnight. At the workshop, the basic assumption was that the adoption of a new governance model requires knowledge that is structured and directed in an entirely new manner, and new operating models.

At the moment, steering in the KiRa cluster is based on reactive governance of the sector's risks. In this approach, the emphasis is on the identification, solution and limitation of problems defined by players dispersed over a wide area. As efforts are being made to transform the KiRa cluster from an industrial cluster into an overall player in the built environment interacting with other sectors, the cluster must radically change its operating and steering model. It must also be able to identify

risks in a broader framework. It must be able to see the economic and other opportunities lost as a result of adherence to traditions and introspective approach, the economic losses incurred by the central government and the private sector as a result of the failure of new promising development paths, and the risks to citizens' well-being.

Problems in the steering and decision-making in the public administration are reflected in the KiRa sector in different ways. The challenging operating environment of the sector, a broad field of operators at different levels and a unique operating culture serve as a justification for putting the sector into the focus of the development work. It was proposed at the workshop that the sector should be made into a pilot for testing new steering and governance models.

The role of knowledge and expertise as a KiRa instrument and steering tool and as a prerequisite for efficient and effective use of other steering instruments is becoming increasingly important. Diverse and fresh knowledge both challenges and supports the change in steering and governance. For this reason, the piloting of the new steering and governance model should start with an examination of the governance of RDI activities.

Governance of change, discontinuity, unpredictability, complexity and conflict is the main challenge facing the new steering and governance model. It can be achieved by promoting risk governance inherent to each of the elements and the use of the opportunities (business and service concepts, etc.) contained in them. This means that development and piloting require entirely new thinking and operating models (innovation) that do not merely challenge the development based on existing knowledge.

Finding a balance between different steering elements (values, knowledge, regulation, markets) is essential and, at the same time, central to shaping and developing the new operating model. For developing the systemic innovation described above, we need time, mutual adjustment of different steering elements (knowledge, markets, regulation, etc.) and procedures and forums where values, objectives and problems are outlined in a dialogue and where they are also questioned. The workshop and the publications that it has produced are one such forum.

1 Introduction

Timo Oksanen

'What is common between the assessment of the environmental impacts of road and power plant construction and the provision of municipal services based on different cooperation arrangements involving private and public sector players? What is common between the interpretation of the building of the international community, which forms the basis for the European regulatory regime, and the measurement of the productivity of the public sector? And what is common between the above and the efforts to put the knowledge and expertise potential within and around the real estate and construction cluster (hereafter KiRa cluster) into more efficient use? The fields of public activities and perhaps the fields of public responsibility directed at different processes in particular have expanded to cover increasingly differentiated tasks, which as a result of the differentiation require broader expertise. The entity of different procedures that aim to provide answers to these new challenges is commonly referred to as governance.'[1]

'Built environment is becoming increasingly complex and the expertise requirements for professionals in the sector are becoming higher all the time. There is a wide gap between the education, training and research inputs and the development needs of the sector.'[2] 'In the Committee's view, deficiencies in the quality of construction are one reason for the health hazards. Because of an inadequate knowledge base it is only possible to give rough estimates of the quality of construction and changes in it.'[3]

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[1] *From the book 'Governance' Uuden hallintatavan jäsentyminen (edited by Karppi, Ilari and Sinervo, Lotta-Marie), Tampere 2009, 7 (with minor additions by the editor of this publication).*

[2] *Rakennetun omaisuuden tila (State of Finland's built environment) 2013. ROTI report, Finnish Association of Civil Engineers 2013, 41.*

[3] *Report of the Audit Committee ' Moisture and mould problems in buildings' 1/2013 vp., 11.*

1.1 Background and purpose of the publication: to support institutions and instil a new sense of responsibility in them

On 11 April 2013, the National Audit Office (NAO) arranged a workshop titled 'Using the results of RDI in the KiRa cluster'. This publication is based on the workshop and particularly on the introductory speeches given at the workshop. The publication contains an introduction to the topics discussed at the workshop, the papers written by the introductory speakers and a summary based on them.

The above introductory sentences sum up the idea of the workshop from different perspectives: It was a demonstration of three different requirements, which, while different, conditioned each other:

- broadening and interpreting responsibilities concerning increasingly complicated social problems within and between political-administrative systems and doing this in a new manner using governance instruments;
- improving, by means of knowledge (knowledge policy, strategy, assessment, etc.), the chances of a new responsible approach to issues concerning built environment by focusing on the basis of the success of the KiRa cluster in knowledge, expertise and innovation and in better utilisation of them; and
- improving the knowledge and expertise base of governance in practical matters (promoting and assessing quality of construction, safety and health of the living environment, etc.).

The contents of the publication are based on the broadening of the field of 'public responsibility', in which the aim is to ensure better use of new knowledge and expertise in the KiRa cluster. The broadening means and requires new practices and procedures so that the broadening process can be governed. The broadening of the responsibility is based on concrete and increasingly topical challenges in education, research, innovation and expertise and challenges to which the KiRa cluster must be able to respond in a new manner.

The knowledge accumulated at the workshop will have two main uses:

1. as a source of information for the planned performance audit in the sector covered by the workshop; and

2. as background material for the chapter in NAO's annual report discussing RDI, which will be published in 2014.

The chart in Annex 1 to the publication illustrates the role of a workshop in the information acquisition process.

The 'institutional environments' (1–2) for using information referred to above are important. However, the institutional environments do not cover all the information accumulated during a workshop or all the areas in which it should be used. When the institutional environments for using the information are proportioned to a workshop and its multifaceted working process, it transpires that the environments are differentiated, structured for their own specific needs and built in a manner that helps to simplify the workshop's information contents. It is easily ignored that a workshop is always a potential environment for personal learning and a broader dialogue that requires its own special communication channels.

A workshop is a diverse learning, communication and interaction event and for this reason there is a great risk that when it is over the participants again embrace their daily routines, which include a traditional division of labour, well-established working practices and other operating models. This means that that dialogues and information with new content are often reduced into a passing flow of information, which, while having a short-term effect, is soon forgotten amidst the many other information flows and activities around the participants. This report, which NAO will publish on line, is an attempt to avoid this and to make the information accumulated at the workshop more easily available and to facilitate the workshop learning processes.

1.2 Frame of reference of the workshop and the publication

The many challenges in the area covered by the workshop, the diverse project background in institutions and the fact that the research, evaluation and auditing practices of the KiRa cluster are few in number and highly differentiated mean that the publication is not based on a single conceptual or other frame of reference. It is also impossible to create such frame of reference by means of a workshop or a publication. This limitation applies to 'governance', 'knowledge' and 'innovation', not to mention the new creative way of combining them. The subject of the

publication 'in the KiRa cluster' leaves many questions unanswered[4]. For example, it is possible to concretise the talk about governance by referring to the fact that the transition from administration to governance means a certain shift from traditional instruments of government power (norms, budgets) to a more diverse and softer set of instruments (information, programmes, evaluations, negotiations, cooperation across boundaries). However, the basis, values and procedures of 'governance' as a 'new and broader approach to public responsibility' are still somewhat vague.[5] Unless we are prepared to take risks and adopt new operating models in a state of uncertainty, rapid changes, combined with traditional approaches, may take us into even more problematic situations.[6]

If we just expect 'governance' and its different subsectors (such as knowledge and innovation) to be as clear and explicit as the approach of the public sector to responsibilities and steering over the centuries before its methods are tested in practice, we are in the danger of squandering its promise in such matters as the meeting of KiRa challenges. In practical life, we cannot expect to have an explicit theory but must also be able to reflect on our own starting points.

On the other hand, the new concepts, models and operating schemes processed by and offered for the use of researchers, evaluators and auditors also need to be 'kindled' and tested on practical forums, such as workshops. This is especially the case when we are tackling the wicked problems that have arisen during the past decade and that are of new type or more numerous than before. When we are dealing with them, it is clear that RDI and education and their governance practices and policy steering need new horizons, approaches and procedures rather than the clarification of old practices.

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[4] In this publication, depending on their perspective and emphasis, the authors talk of the KiRa cluster, KiRa sector and the sector of 'built environment'. This is not merely a question of terminology or perspective but also involves a conceptual problem. Especially Matti Kokkala discusses different aspects of this in his paper.

[5] See also Koivisto, Ida: Hyvän hallinnon muunnelmat (Variations of good governance), Helsinki 2011.

[6] Similar priorities are also contained in the action plan for research and innovation policy adopted in 2012. Under the plan, Finland should move from an innovation policy built on predictable and accurately defined operating environments into a broad-based innovation policy incorporating the measures supporting supply and demand. It is based on an unstable, uncertain and fuzzy environment. These require a new approach to risk taking and experiments (2012, 11–14).

This publication should be read as a contribution raising new questions and challenges rather than as a product within the structured frame of reference of a scientific collection of papers, manual or analysis. Moreover, the publication is not intended as a practical manual, which would allow the user to avoid the long-term and occasionally tiresome development and evaluation work with the problems, conflicts and different interpretations concerning the daily governance of RDI activities. The publication is intended as a set of questions rather than as a set of answers. The publication has already achieved its purpose if it causes the readers to think and be doubtful about their own and other people's knowledge about all major issues in the area and answers to them.

1.3 Purpose of the publication

The publication is primarily intended as a discussion initiative highlighting the need for a new analytical approach, perspectives and debate between KiRa and sectors adjacent to it and within them. Thus, the publication forms a necessary and important continuation to NAO's audits covering different aspects of Finland's innovation system and its parts, the earlier seminars, workshops and brainstorming sessions arranged by NAO in cooperation with other players and publications produced on the basis of them, and other similar projects (such as Sitra).[7]

1.4 Themes of the workshop and the presentations: common threads

In Chart 1, the themes of the introductory addresses and those of the papers contained in this publication are loosely grouped around Erik Arnold's model describing the expertise and innovation system[8].

[7] *See NAO 2010 and 2011 and 2011a.*
[8] *For more details, see Arnold 2004, 12–16.*

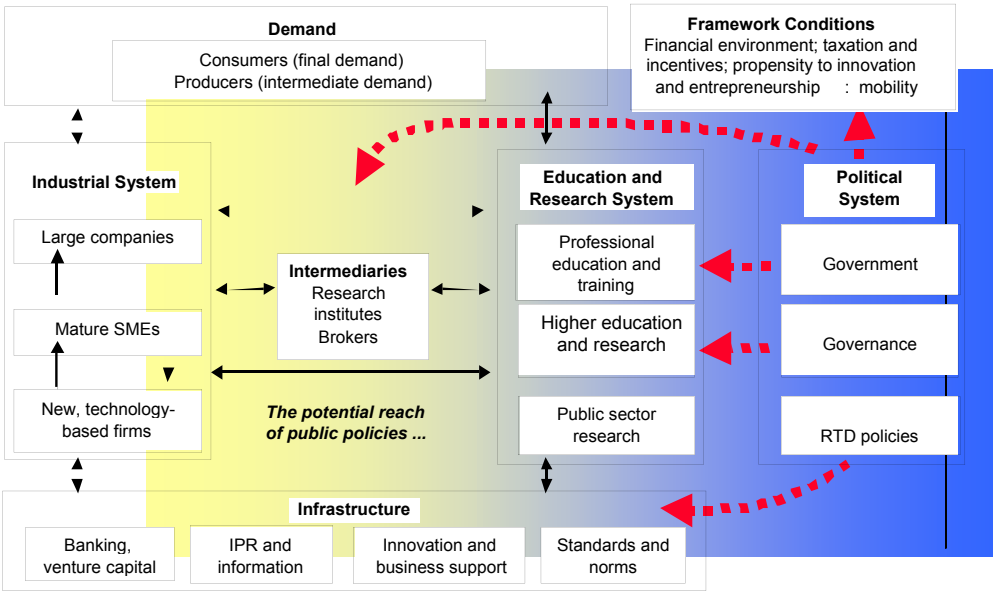

CHART 1. Expertise and innovation system, Arnold 2004.

Like the 'cluster' concept, the 'expertise and innovation system model' (ISM) described in Chart 1 has been subject to growing criticism, not only as a concept and a basis for ideas, but also as basis for guiding practical activities. It is considered too clumsy, undifferentiated and inflexible and it has also been criticised for excessively simplifying the complex relationships between policy areas and practical needs. At the same time, it has also been said that it fails to provide an adequately detailed agenda for policy measures.[9]

However, there are substantial differences between the conclusions made by the critics: On the one hand, there are those who want to replace the entire model of thinking with a new, more sensitive, more nuanced and more contextual approach. Innovation platforms, ecosystems and environments have been outlined as new types of conceptual space. At the same time, there have also been efforts to give the innovation system model a new and more detailed content as an instrument for analysis, evaluation and policy.

The benefits of ISM as a frame of reference for this publication can be summed up as follows: ISM always urges the reader to ask: 'What does

[9] *About the first-mentioned, see for example Miettinen 2002. About the development of the model, see especially Bergek et al. 2011 and about the challenges and problems concerning systemic reviews also Valovirta et al. 2011.*

this matter (such as the reorganisation of sectoral KiRa research in the middle of Chart 1) mean in relation to a wider operating entity?' At the same time, ISM contains conditions, limitations, requirements and other dimensions concerning the operating environment that a successful solution to a problem (such as inadequate research on energy options in housing construction) requires. This helps to take into account the requirements that other parties must consider as a result of the corrective measures and to anticipate any problems and side effects that they might cause elsewhere (such as additional costs). Furthermore, ISM helps to register the positive side effects of the measures in wider operating entities. At the same time, ISM also prevents the solution of problems with the well-established logic of governance and markets, where problems are 'outsourced' or where they are expected to be solved quickly irrespective of their context or scope. By opening the horizons of individual diagnoses, measures and evaluations as part of a larger entity, the innovation system model provides an important tool for limiting what are called partial optimisations.[10]

ISM contains a number of problems. They can best be managed by repeatedly asking: 'Where and in which type of environment do the problems highlighted in ISM occur?' and 'How does this environment affect the occurrence of the problems, their nature and the choice of solutions?'

The KiRa cluster itself is already an extremely diverse and varied environment for the definition, interpretation and solution of RDI-related and expertise problems. In each environment, there is a need for a horizon within the KiRa cluster and a horizon extending outside it. Different environments simultaneously form ISM sections and 'lenses' that are useful in the examination of the model. We also need broader cluster-level lenses (such as RDI) that are similar to those discussed at the workshop so that we do not end up with excessively rigid and mechanical definitions: values, objectives, instruments (policy, operating policies, regulation and steering) or to knowledge processes that cause matters to become excessively simple or rigid (research, evaluations and audits).

In addition to an overview, we also need more detailed views, even if they made the overall situation more complicated. At policy level, these include the priorities in the field of user orientation, width and the multiple levels and environments laid out in Finland's national innovation

[10] *See for example ROTI 2013, 18 and in more detail pp. 12–13. Cf. from a different perspective NAO's audit report 227/2011, 115 (NAO 2011 b), which also highlights the long time span of the climate and energy policy measures.*

strategy (local or global, national, regional and global). In knowledge processes, in order to get a more detailed picture, we need to examine the interfaces of the KiRa cluster and the ICT cluster and analyse different user and customer groups.[11]

The above-mentioned elements (local and international nature of the innovation environment, user orientation, etc.) each represent different environments of the innovation system. This means that each of them requires individual attention, differentiated examination and focused measures. Nevertheless, ISM can still serve as a useful umbrella and frame of reference for the examinations.

To sum up, the ISM described in Chart 1 thus provides a loose set of coordinates or heuristics for this publication, which

1. guides the authors to examine issues within a frame of reference that goes beyond their own themes

2. and helps the reader to see the themes, issues and ideas highlighted by individual authors as part of the broader operating and structural entity of RDI taking place in the KiRa cluster and its interaction with other players.

For various reasons, the outlining of ISM in the KiRa cluster and the details of the individual elements are only vaguely described. The presentations show that as an entity of players and as an operating entity, the KiRa cluster is extensive and has only vague boundaries. As Kokkala said at the workshop: 'We don't have any better concept'. Internationally, too, the cluster concept is doing well and is being used in the development of different evaluation models[12]. Even though there have already been promising openings[13], high-quality governance of this entity is currently impossible, even on the basis of comprehensive analyses and information compilations. Any efforts to do this would lead to an excessively narrow perspective. Even if some people question the whole existence of the increasingly connected KiRa cluster, the formation of cluster knowledge

[11] *See for example the recent evaluation of strategic centres for science, technology and innovation (RYM Oy) (Publications of the Ministry of Employment and the Economy 1/2013).*
[12] *See Christensen et al. 2012.*
[13] *See ROTI project.*

is still in its infancy.[14] In this respect, the concept of the KiRa cluster somewhat resembles the concept of a broader innovation system. This is an international problem, which also concerns the availability of international comparison information.[15]

1.5 Presentations given at the workshop and the papers contained in the publication: key points

The papers contained in the publication are a collection of fairly independent views on issues concerning the utilising of RDI in the KiRa cluster. The authors also approach the matter from different angles. In addition to the KiRa cluster, other basic concepts (such as steering, governance and built environment) are also treated differently in the papers. The fact that the concepts (such as governance) are not yet well-established in the field in question, the aim of the authors to highlight reform needs by using new definitions (such as wicked problem) and the fact that the theme discussed in the publication is not well-established or well-structured are some of the reasons for the large number of different concepts appearing in the presentations. The publication should be read as a discussion initiative and a contribution to a debate and not as a manual. As a discussion initiative, too, the publication gradually becomes clearer and richer as the different authors give their own perspectives and add to the value of the publication. The matter could perhaps also be summed up by saying that the wicked problems encountered in the area discussed in the publication should, both in the publication and in practice, be approached from different perspectives and as a joint effort and not from a narrow basis, or in a segmented or differentiated manner or as a package[16].

In her presentation 'Tulevaisuuden haasteet ja mahdollisuudet' (Challenges and opportunities of the future), Mari Hjelt lists some of the most important social (national, international, regional and local) drivers

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[14] *At the same time, a number of international frameworks for systematic evaluation of clusters have been developed in recent years. See for example, Christensen et al. 2012 and Muller et al. 2012.*

[15] *See Building Renovation and Modernisation in Europe: State of the art review. ERABUIL 2008, p. 10 pp.*

[16] *See Vartiainen 2012, 103.*

of the KiRa cluster. She highlights population growth, globalisation, climate change and urbanisation as such drivers. The impact mechanism of the drivers is filtered and concretised through various sub-challenges (finiteness of natural resources, social well-being and safety) into a cluster of challenges surrounding the KiRa cluster. However, at the same time, awareness and identification of these challenges provides a 'lever' for turning challenges into opportunities (new business, etc.). This incorporates Hjelt's main perspective or the above-mentioned 'lens into the innovation system'. Using it as a basis, she interprets and concretises the social challenges of the cluster.

Hjelt opens up an extensive entity of activities and, above all, new opportunities around digital transition, green growth and social responsibility. However, even from this perspective, a positive future is not guaranteed. Making use of the opportunities requires a systematic, focused and long-term approach from all parties. However, according to Hjelt, the public sector plays a central role in the RDI activities of the KiRa cluster (as a customer, regulator and a creator of markets).

While Hjelt highlights the macro-environment of the KiRa cluster as a challenge and an opportunity, Matti Kokkala focuses on the special identity, structure, time span and research tradition (or lack of it) of the KiRa cluster in the wider entity of expertise and innovation. The perspectives presented by Hjelt and Kokkala challenge and complement each other and reveal the bidirectional challenges faced by the cluster and its system environment.

Kokkala's starting point is that the systems (transport infrastructure, water supply, sewers, energy, data communications, services...) expand and become interlinked. A built environment based on Kokkala's presentation increasingly resembles a large well-integrated factory and provides a platform for all other activities. 'Technological development, particularly the development of energy and information technologies, has led to a situation where the boundaries of traditional industrial clusters have become blurred. Thus, instead of the term real estate and construction cluster, we often hear the term 'built environment', under which enterprises and other operators providing information technology, energy generation and distribution services or end user services are also included in the joint 'operating ecosystem'.'

In this entity, innovations at value-network or system level, rather than the innovations made by individual players, assume a key role. This makes the innovation activities of the cluster more complicated and provides it with an environment that differs from that of many other clusters. The unorthodox and complex nature of the cluster's innovation environment makes it necessary to define the central and local

governments' role in a new or more accurate manner. The lack of leader enterprises, profit expectations among operators on the market, long-term nature of the cluster's RDI activities and a poorly developed research culture also contribute to this development. Finally, Kokkala examines the institutional and operating gap that may arise between Tekes and the Academy of Finland. He asks who will assume responsibility for research on major social issues in a situation where industry is the player but the benefits and impacts of the research will only be seen in the distant future, making the investments commercially unattractive.

In his presentation, Lauri Tarasti talks about the effectiveness of legal regulation, thereby supplementing and concretising the discussion on the new opportunities provided by the KiRa cluster (Hjelt) and the special needs/environment of RDI (Kokkala). How does legal regulation function as a factor promoting and enabling knowledge and expertise in the KiRa cluster or has it rather become an obstacle to them? Tarasti highlights these issues in a lucid and concrete manner by examining building regulations, EU norms, energy issues and the quality of construction.

He points out that in practice, legal regulation can fulfil and has, to a various degree, fulfilled all above-mentioned roles: as a promoter and enabler of RDI and, occasionally, as an obstacle to it. As examples, Tarasti mentions the snow load on roofs, fire safety and civil defence shelters and at EU level, sulphur emissions by ships and aircraft noise. He also examines the 'dialectics' between knowledge and values as a factor fundamentally defining the use of knowledge, measures taken by the central and local government and the role of the private sector as a promoter of the use of knowledge and expertise. At the same time, the description of competitive tendering and public procurement provisions illustrate the tensions that exist between different regulatory objectives and values and that are also relevant to the promotion of RDI activities. Ultimately, the problem boils down to the problems of evaluation and measurement. If we are unable to reliable weigh or measure what is good in the procurements, we end up using quantitative standards and criteria and at the same time drift further away from the 'sustainable path' that RDI might perhaps lead us to.

Like Hjelt and Tarasti, Olli-Pekka Heinonen focuses on the macro environment of the KiRa cluster and the framework that this environment has created for RDI and its governance. However, Heinonen moves from future challenges (Hjelt) and the problems of legal regulation (Tarasti) to the complex problems of governance. Heinonen starts his presentation by examining the change features of the areas that are governed. He makes a distinction between complex, knowable, known and chaotic environments. Instead of the known environment, governance is increasingly dealing

with an unknown, rapidly changing, turbulent and fuzzy environment. Changes in the environment also give rise to more difficult problems.

Heinonen highlights what are called wicked problems, which are in many ways different from what are called tame problems[17]. The latter are simple, of routine character, easy to understand and clear. With their complex dependencies and dynamics, new wicked problems or wicked problems that, in the light of new understanding or knowledge, have been more reliably identified resist traditional governance attempts or solutions by making them both expensive and ineffective.

Increasingly complicated problems require the shifting of attention from expert procedures to a more broad-based inclusion and a shift from vertical to horizontal governance and organisational structures. According to Heinonen, with their vertical ministry structures, our governance instruments still operate with an opposite logic. He says that there are already new types of governance instrument available to us. However, there is no 'unified, awareness-based or published governance policy behind them, and it has be to created'. Heinonen also analyses the different dimensions of the required changes in the operating approach, the aim of which is to ensure strategic agility amidst the changes in the operating environment described above. In addition to the overall survey helping to define the organisation of change, the focus of the presentation is on the important internal prioritisation of the change process, which also becomes more focused within the KiRa cluster: 'Changing the operating culture is more important than strategies in the KiRa sector.'

Tuomas Pöysti continues the examination of the macro environment of the KiRa cluster. He focuses on a number of issues highlighted in the discussion (such as the steering model) but also introduces new elements. First, Pöysti discusses NAO's role as the organiser of the workshop, using NAO's new strategy (VTV2020) as a basis. Under the strategy, the aim of the National Audit Office is to create prerequisites for the renewal of the public administration and general government finances and to support the process. NAO's new proactive operating model that has resulted from the strategy also provides performance audits with a new role under which they will act as an 'engine for developing the public administration'. This workshop, which will serve as an important information-acquisition

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[17] The distinction between wicked and tame problems has established itself as a conceptual umbrella in social studies under which such issues as complex structural problems have been analysed. See Vartiainen 2012, 95 and 102–114 and more generally Hautamäki & Ståhle (ed.) 2012, 9, 11–12, 26–27, 32–34 and 114–117.

instrument for the planned audit, helps the audit to assume this new role by providing it with a new meeting point and information-acquisition forum.

When describing the background to the change, Pöysti applies the problem analysis which was also used by Heinonen and supplements it with an extensive review of the wicked problems facing Finnish society and the country's economy. According Pöysti, from the perspective of Finland's public finances and the country's economy in general, the KiRa cluster is surrounded by major challenges, such as the structural shock of the economy, elimination of the sustainability gap, ageing population, general competitiveness problems and the challenges of the digital network society. As interdependencies increase, the above-mentioned challenges and the more concrete role of the KiRa cluster as a mainstay of Finland's national wealth also create a need for more effective governance and use of RDI in the KiRa cluster. Using this as a basis, Pöysti proposes that the KiRa cluster should be made into a test area of knowledge-based policy-making. In addition to referring to challenges of more general nature, Pöysti also extensively justifies his proposal by pointing at the problems inherent to the KiRa cluster: He highlights such matters as new materials and energy efficiency, the need to make urban structures more compact, quality problems in construction, and new environmental health risks.

After detailing some of the specific challenges to the KiRa cluster in the area of knowledge culture and knowledge structures, Pöysti calls for the highlighting of a 'phenomenon-based effectiveness'. In his view, attention should be shifted from effectiveness tools (norms, policies, standards) to normative basic assumptions of effectiveness and to the end results of activities at the level of daily life. On this basis, Pöysti also discusses various steering models and ultimately returns to his proposal: 'Development of steering in the real estate and construction sector could also serve as a good test laboratory for the development of the Government's steering policy'.

1.6 Common thread of the presentations: instruments or culture - or policy?

Judging from the presentations, the KiRa cluster is facing numerous challenges and opportunities. The challenges and opportunities involve both general questions and specific issues within them that concern the

use of RDI in the cluster. The relationship between them may not be entirely clear.

When the general content of the presentations is examined, it seems that they have one issue in common: Are there enough tools available that will allow the unorthodox internal and external RDI environment of the KiRa cluster (plus its players and new opportunities), which does not lend itself to strengthening or stimulating RDI activities and expertise, to achieve an adequate operational capability in terms of its challenges? In addition to this general question, there are also other issues highlighted in the papers. A closer examination of the papers may give rise to a question whether the challenges of knowledge use are in fact a matter of attitudes and operating culture and not a matter of 'instruments' (such as the establishment of a new SHOK in the public sector). Is there any room for knowledge - this question will at least arise when we are unable to rely on knowledge or when it fails to support our short-term approach to scheduling and thinking and instead challenges and questions our activities.

Or are the problems localised in the more general infrastructures of the governance of the cluster's RDI and expertise (institutions, structures, ICT, etc.) in the same way as in its own sets of tools, thinking and operating culture?

At the start of the introductory chapter, it is stated that the publication has as its general basis the broadening of the field of 'public responsibility', in which the aim is to ensure better use of new knowledge and expertise in the KiRa cluster. Judging from the presentations, one can also ask whether we actually have a clear picture of the relationship between the internal and external responsibilities of the KiRa cluster when attempts are made to build bridges between knowledge and expertise and uses of them. Who is responsible for building bridges between challenges, opportunities and responsibilities or between the silos connected with the above and resulting from the current governance model? Providing answers to these questions would require a more in-depth and a more open-minded examination of the relationship between expert information, expertise and KiRa operating practices before we move to examine structural models and organisational charts. Is this anybody's responsibility at the moment? In the future the sustainable expansion of 'public responsibility' can probably not be founded on more regulations, procedures, funding, knowledge, expertise or other individual requirement factors, and for this reason, there is also a need to highlight entirely new dimensions and issues:

Who will ensure that searching for new operating models, and new knowledge and expertise would cut through activities in a more broad-

based manner and would not be limited to guidelines and dealing with appropriations? Who will convince players in the KiRa cluster that the new knowledge and expertise and the innovative operating model will produce sustainable and relative benefits? Who will build bridges between them and the current operating approaches and norms of the players in the KiRa cluster? Who will simplify general and often complicated solutions produced by RDI so that they can be used by the players in their everyday work? Can the players involved in the KiRa cluster and its governance test new solutions and, on the basis of this, assess the added value generated by the use of RDI? Who are responsible for the above matters?[18] Is there any broad-based player and governance model in sight that would bring together different players in the wide field of operations of the KiRa cluster and would create coordinates for interaction and problem solving by the central and local government, labour market organisations, RDI organisations, companies and other branches?[19]

The authors pose questions rather than provide answers. Could they actually do anything else? Judging from the presentations, there would be plenty of demand for a steering or governance policy providing clear answers to these questions.

The presentations should be seen as an entity. In this entity, attention is given to both the RDI-related market failures of the KiRa cluster and the government failures affecting the cluster's RDI. Except for Kokkala, all speakers focus on the macro environment of the KiRa cluster.

Applying the terminology of political research, different authors produce social analysis by merging social, economic, political and institutional analysis so that the impact of the Finnish KiRa cluster on any policy reforms and their end results can be traced. The second dominant feature in the presentations is the examination of change drivers. There is

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[18] *Of the above mentioned issues as requirements for spread of innovations, see Alasoini 2007. From the perspective of governance, cf. Mäntysalo & Roininen (ed.) 2009, 76–85.*

[19] *From the perspective of the governance of knowledge, the monitoring system of the urban structure (YKR) (Mäntysalo et al. 2008, 36–39) with its many development needs (mt. p. 40) offers promising development prospects. The development project for land use, housing construction and transport infrastructure (MAL), which is jointly pursued by large urban sub-regions and the central government, and the INKA (innovative cities) development programme are examples of operational development projects currently under way. The operations of the Housing Finance and Development Centre of Finland, which comes under the Ministry of the Environment are in the process of undergoing an external evaluation.*

less attention to power analysis, the third macro-level section, which often appears in analyses. However, the authors extensively discuss the challenges and problems of the KiRa cluster in the demand for and supply of RDI and in the interaction between them.

2 Future challenges and opportunities of the KiRa sector

Mari Hjelt

2.1 The KiRa sector, the mainstay of our prosperity, is facing numerous changes.

The role of the KiRa sector[20] in the Finnish economy cannot be disputed and it is of cross-cutting nature. The recent ROTI report describing the state of our built environment lists a large number of facts describing its importance[21]. For example, it is estimated in the report that built environment accounts for 74 per cent of Finland's total national wealth. It accounts for 40 per cent of all energy consumption, while the development and maintenance of the built environment provide direct and indirect employment for 500,000 people in Finland. Built environment also has a major impact on our well-being and health. Here in the North, people spend about 90 per cent of their time indoors.

Because of the central role of the sector, all major changes affecting the KiRa sector are important to us, while at the same time there are no development trends or megatrends that would be unconnected with the KiRa sector. In global terms, major future drivers include population growth, migration to cities and an increasing consumption, which results from a rising standard of living. Urbanisation also creates problems. As cities grow, transport problems become more severe, housing becomes more expensive (which leads to wider income gaps), cities take over areas that are now in natural state and such issues as water and waste management must be solved. In Finland, the problems are not serious but the problems in global megalopolises are of mega size.

The fact that the growth in consumption is exceeding the earth's capacity means that there is a shortage of many resources (materials and energy). Climate change is progressing and will bring many inevitable changes and surprises that will affect many areas of our life. In

[20] *Defining the KiRa sector is difficult and in this presentation it is loosely defined as the built infrastructure and activities that are directly and indirectly connected with it.*

[21] *Finnish Association of Civil Engineers RIL (2013): Rakennetun omaisuuden tila (State of Finland's built environment) 2013. ROTI report . Helsinki 2013.*

catastrophe scenarios, the Western world will see its prosperity collapse, the world is torn by wars caused by a shortage of natural resources and we will return to protectionist local economy in which everybody relies on their own resources. Even if these scenarios did not become reality, it is clear that as globalisation and the digital internet economy are advancing, global interdependence will grow, which means that developments elsewhere will also have a quicker and stronger impact on Finland.

The KiRa sector has traditionally been treated as a 'low technology' branch and in the future, too, it will involve a great deal of activity based on expertise that is thousands of years old. As other sectors, KiRa is also linked with the development of different technology areas and in them changes can be substantial and occur in leaps. Many of the technology issues and development paths connected with the energy economy are closely related to the KiRa sector. National infrastructures are increasingly dependent on electricity supply and local power failures may have a major impact. It is estimated that as a result of the climate change, extreme weather phenomena (storms, floods) will become more common, which will severely test the functioning of the energy system intended to ensure electricity supply. At the same time, rapid development of the solar power technology combined with other local-level energy production may open up opportunities for making buildings self-sufficient in energy and radically reduce our dependency on joint electricity distribution systems. Might it be possible to have a situation where all surfaces of the built environment would directly generate solar energy?

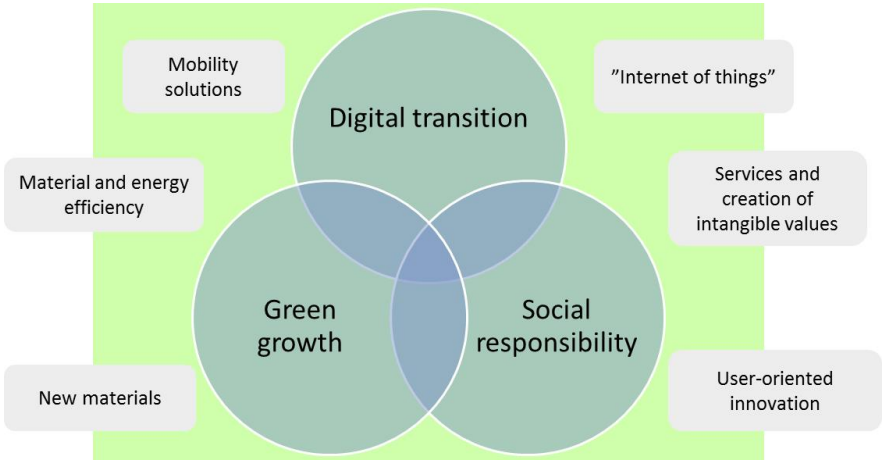

CHART 2. Future opportunities in the KiRa sector.

Future problems and challenges are also opportunities. Producing solutions requires RDI and the solutions will create a potential for new business and they will also generate well-being for humans and the environment in Finland and elsewhere. Sectors with future potential include the ongoing transition into digital economy, green growth and trends concerning social responsibility, which are all connected with each other. Chart 2 illustrates the connections between the problems, challenges and opportunities.

One important change that will continue to affect everyday life and many sectors in the coming decades is the growth of the ICT sector, which has already achieved the leap from hardware towards digital services and the integration of 'intelligence' into equipment and physical infrastructure. It has been estimated that the mobile internet, automation of information work (replacing work that until now has required human inputs with automation, such as legal services), 'internet of things' (linking different devices and the physical infrastructure with the Internet and communication between them) and cloud services are technology areas with the greatest economic growth potential in the coming decades[22]. It should be noted that most of the potential involves the creation of intangible values and that the role of services is growing. As the central infrastructure platform, the KiRa cluster is amidst changes. Examples of this include the new mobility solutions and the reorganisation of the digital everyday life, which puts pressures on our social structures and will make it possible to keep all parts of sparsely populated countries (like Finland) inhabited.

In the future, many resources will be in short supply. Green growth can be defined as 'low-carbon and resource-efficient economic growth based on safeguarding the functional capacity of ecosystems and promoting well-being and social justice.'[23] In a broader sense, green growth means consideration of different dimensions of sustainable development and the ensuring of the functioning of ecosystems in all activities. The KiRa cluster as a whole plays a central role in the energy and material balance of the national economy. The demands for sustainability apply to all players of the KiRa sector and all their activities in Finland and other countries. Demands for higher energy efficiency are an example of this.

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[22] *McKinsey Global Institute, Disruptive technologies: Advances that will transform life business and global economy, May 2013.*

[23] *Consortium for natural resources and environmental research (LYNET) (2013). Opportunities for green growth. Prime Minister's Office Reports 4/2013. Helsinki: Prime Minister's Office.*

Broad-based social responsibility, in which focus is not only on environmental issues but also on the success factors of the future, is a requirement for future prosperity. The vision is that companies operating responsibly on more than one level would also be more competitive than other enterprises. If the competition for experts (such as RDI staff) becomes tougher, many companies will have to rely on responsibility as a central factor for attracting personnel. As the national infrastructure platform, the KiRa sector covers a broad range of stakeholders and activities, in which consideration must be given to different aspects of social responsibility for the duration of the life cycle of the built infrastructure. From the perspective of society, it is important to pay attention to such issues as the shadow economy, occupational safety and health and the use of foreign labour, in the case of which the development paths may lead to many different directions. Cooperation between different social partners may acquire new forms and open up new opportunities as civil society players become more active and move to virtual environments. From the perspective of RDI, it is significant that in the KiRa sector, RDI is increasingly connected with user-oriented innovation, in which both the customers and end users play a major role as participants in joint activities. This will open up new opportunities, which the KiRa sector can seize in new ways.

2.2 Are RDI activities in the KiRa sector trouble-free?

The central role of the KiRa sector in society cannot be disputed. It offers a wide range of opportunities for new activities that also have positive impacts on all of us. Are RDI activities free of problems? Unfortunately not. There are many special features in the sector that have an impact on RDI inputs. For example, the KiRa sector relies heavily on the domestic market. Operating on a small market limits growth and does not provide an incentive for RDI activities. Naturally, there are big differences between companies operating in the sector in this respect. For example, companies providing technological part-solutions for Finnish and foreign customers invest in RDI in a larger scale than construction or real estate management companies. The KiRa sector is also very sensitive to economic fluctuations, which prevents long-term RDI investments.

The most important factor affecting RDI in the KiRa branch is, however, the fact that the public sector plays an exceptionally important role in it. The public sector is a major customer in the branch. The

decisions on investments in our built environment are made at national, regional and local level. As a customer, the public sector sets out requirements for companies in the sector, which means that in this manner it also steers their innovation activities. If the customer does not demand new and innovative solutions and the competition is solely founded on price, there are no market-based incentives for RDI inputs. The public sector has a broad range of different instruments for creating domestic markets and for providing incentives for innovation.

The state also plays a central role as a regulator of the KiRa sector. Compared with ICT companies, companies in the KiRa sector are significantly more dependent on regulation and regulatory changes and long-term planning in the public sector. Development of the built environment in Finland is largely steered with long-term planning. Governance during the life cycle of buildings and real estate involves a great deal of regulation, the purpose of which is to ensure human health and safety. There is increasing attention to environmental, material and energy aspects in the KiRa sector and these are also steered by means of regulation. Most of this is based on the development of regulation at EU level.

2.3 Governance of chemical risks in the KiRa sector as a practical example

Governance of chemical risks in the KiRa sector is discussed in the following chapter as an example of the complexities and challenges of the branch. Under the Finnish Chemicals Act, a chemical means 'a chemical element and its compounds in the natural state or obtained by any manufacturing process (substances) or mixture composed of two or more substances (preparations)'. Some of these chemicals are harmful or extremely harmful to humans or to the environment. However, there is not always clear understanding of whether a chemical is harmful, how it is harmful and how the risk can be managed. Nowadays, there are major uncertainties concerning such materials as nanomaterials.

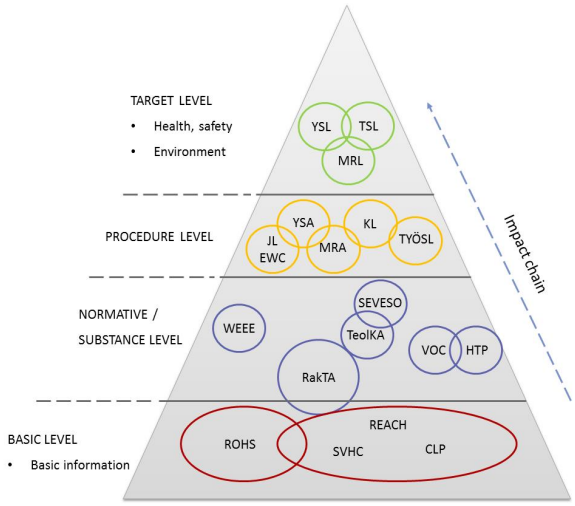
In buildings, chemicals are used during both construction and the use of premises. Moreover, during the demolition, safe final storage of the materials must also be ensured. Over the years, new chemicals have been introduced even though there has been little understanding about their harmfulness. The best known of these substances is asbestos, which was subsequently found out to be extremely harmful and a cause of health problems and deaths. Eliminating the health hazard has been very costly.

Management of chemical risks requires both extensive knowledge about the harmfulness of chemicals and their behaviour indoors and the way in which they behave in combination with other substances. For these reasons, the manufacturing, sales and use of chemicals is a highly regulated sector.

In Finland, the Toxic Substances Decree, a major piece of legislation in the field of chemical safety was introduced in 1946. It contains a provision under which 'toxic substances must be handled with utmost care so that none of the substance falls or leaks at the handling location and in this way causes danger or harm to humans, animals or objects'. Since then, there has been a vast growth in the number of chemicals and the amount of chemicals used in different areas of society. At the start of the 21st century, the number of different chemicals and their use was up to 100 times higher than in the 1950s. It is estimated that at the moment there are about 100,000 different chemicals used by industries on a regular basis. There are about 50,000 defined construction products used in buildings and some of them also contain chemicals or other substances harmful to humans or the environment. It is estimated that about 50 per cent of all hazardous waste is generated by the KiRa sector. The field of players responsible for the governance of chemicals risks is diverse. The value chain of the KiRa sector from the manufacturers of construction products to retail trade and builders is naturally responsible for the safety of its products. Likewise, chemical risks must also be taken into account in the activities taking place during the use of buildings. This is the responsibility of real estate management and, ultimately, the property owners.

The public sector plays a major role as a customer, owner and user and is in a position to influence the activities of the sector by laying out requirements. Creating the regulatory framework and laying out requirements are the most important roles of the public sector in the governance of chemicals risks. After the introduction of the Toxic Substances Decree, the regulatory framework has expanded in the same pace with the progress of the 'chemicalisation' of society. The current 'regulatory pyramid' is outlined in Chart 2. The aim of the uppermost level is to ensure human health and safety and environmental well-being. These fundamental aims are laid down in the Environmental Protection Act, Occupational Safety and Health Act and the Land Use and Building Act. Procedures and norms are steered by means of a complex regulatory framework, which is based on a jointly agreed production of an information base, for example in the manner laid down in the REACH Regulation. Different players must be familiar with all details of the requirements laid down in the regulations. In addition to developing

regulation, the state is also responsible for supervising adherence to the regulation.



YSL	Environmental Protection Act
MRL	Land Use and Building Act
TSL	Occupational Safety and Health Act
JL	Waste Act / EWC = European Waste Catalogue
YSA	Environmental Protection Decree
MRA	Land Use and Building Decree
KL	Chemicals Act (to be updated and integrated into REACH; HE 38/2013)
TYÖSL	Occupational Safety and Health Act 738/2002
WEEE	Waste electrical and electronic equipment directive (producer responsibility)
RakTA	Construction products regulation (links with REACH)
TeolKA	Industrial chemicals decree; updated: 855/2012 (incl. storage; links with SEVESO)
SEVESO	Directive on the control of major-accident hazards
VOC	Volatile organic compounds + use
HTP	Concentrations known to be harmful (usually in the air of the workspace)
REACH	Regulation on registration, evaluation, authorisation and restriction of chemicals
SVHC	Substances of very high concern (contained in REACH)
CLP	Regulation on classification, labelling and packaging
ROHS	Restriction of the use of certain hazardous substances in electrical and electronics industry

CHART 3. Regulatory framework for chemicals governance in the KiRa sector[24].

The complex process of governing chemical and other risks is in many ways connected with the RDI activities of the KiRa sector. Naturally, for companies and business, the essential factor is that RDI continuously produces new and better chemicals and other solutions. Research and product development also generate new problems that must be solved. One of the topical issues at the moment is the rapid development of nanomaterials, which are also used in buildings. How can the safety of the new products be ensured in an operating area where the time span of research on safety and harmful impacts is measured in decades? How is the precautionary principle applied in practice? A major challenge for the well-being of the environment and humans is that we should also understand and examine the combined effects of different chemicals and substances. As the number of chemicals is increasing, the number of potential compounds is unlimited. At the same time, there is no limit to the amount of resources required for examining the combined effects. How are the costs of basic research shared worldwide and between different players?

[24] *Petter Hemgård, Fenco Oy and Gaia Consulting Oy.*

There is plenty of research information and information on the use of chemicals and in many countries more information is required on the materials and chemicals used in buildings than in Finland. For example, under the Norwegian land use and building act, all materials and substances used in a building must be documented before the building is approved for use. These documentations and databases can be used throughout the building's life cycle. RDI is needed for developing new innovative and effective solutions for information collecting and, particularly for ensuring that the information can be used in risk management and in the prevention of problems. The public sector has an obligation to invest in the sharing and use of information on risks. Central issues concerning regulation and RDI are illustrated in Chart 4.

CHART 4. Governance of chemical risks and main RDI issues.

In the future, the efforts to ensure that the regulatory framework can keep pace with the field of chemicals and the increasing complexity of risk management will be a major issue for the public sector in the future. The fundamental aim is the manufacture and use of risk-free products. However, technological advances and RDI are continuously opening up new opportunities in a rapid pace. Regulation must ensure that risks to humans and the environment are manageable. However, at the same time, regulation should also support the introduction of new solutions and the creation of innovative demand. The aim is also to ensure that regulation is clear and lightweight. How can these aims be effectively reconciled with each other in the future?

2.4 Summary

The KiRa sector is, from the perspective of society at large and the national economy, an important entity, both globally and nationally. Changes in the future are in many ways connected with the sector and the changes will open up plenty of opportunities.

Even though RDI is important, there are many obstacles to it, particularly in the KiRa sector. One important feature of the branch is the central role of the public sector as a customer, as a party shaping the markets and as a regulator. The public sector is expected to possess an outstanding ability to act as a player providing incentives for RDI activities, as a player creating innovative markets and as a regulator ensuring the well-being of citizens and the environment.

Society must ensure minimisation of risks and provide different players with opportunities to manage different types of risk. The field of KiRa players is diverse and the players have extensive value networks. In such an environment, management of risks requires joint action, sharing of costs and consideration of extremely long time spans.

3 KiRa cluster: a challenge to or problem for the expertise and innovation system?

Matti Kokkala

The author discusses the special characteristics of the research and innovation activities in the real estate and construction sector from the perspective of a research organisation. The presentation is also based on the experiences that the author has accumulated during his many years of work in the interface between the public and private sectors.

3.1 KiRa cluster - does it exist?

Technological advances, particularly in the field of energy and information technologies have led to a situation where the boundaries between traditional industrial clusters have become blurred. Thus, instead of the term real estate and construction cluster, there is often talk of built environment, in which enterprises and other operators providing information technology, energy generation and distribution services or end user services are also included in the joint operating ecosystem. However, when the cluster concept is used, it is also acceptable to talk about a real estate and construction cluster, in which case it means the players that take part in the design, construction or maintenance of buildings and the physical infrastructure in the public and private sectors.

Unfortunately not even official statistics recognise the real estate and construction cluster as a single sector. When describing R&D activity (or passivity), people often erroneously use information on the construction industry as the only figures describing the real estate and construction cluster.

3.2 KiRa cluster and innovation

In capital intensive industries, it is typical that the main players in a sector act as integrators and that in their innovation activities they focus on process and business model innovations. At the same time, technological

product innovations are often made by subcontractors (such as manufacturers of materials and machinery). Thus, a major part of the technological innovations in the real estate and construction sector comes from the construction products and building technology industries. During the past 20–30 years, the markets for construction products have become much more international. Substantial sections of the Finnish construction products industry have also become part of international groups. For this reason, it is natural that Finnish-based product innovation has declined.

It is also typical of the real estate and construction sector that the end product is not created by a single player. In fact, innovations usually require a large number of players (a value chain or a value network). From the perspective of individual companies, a good innovation may actually be harmful in overall terms. This is because the changes introduced by one player also cause significant harm to a large number of other players.

In many cases, major innovations created by one company are therefore only justified if the innovator wields sufficient power in the value network. The power may be based on such factors as economic inputs and the customer power resulting from responsibility or technological superiority, in other words on a situation where there is practically no competition. In the KiRa cluster, there are rarely any such leader enterprises that with their own inputs can motivate other companies in the value network to join a collective development effort. If the company is one of the dozens of players in a value network, the safest thing is to focus on minor improvements.

In most cases, companies are motivated in their innovation activities by the chance to significantly boost business through renewal or by a fear that competition would otherwise reduce turnover. As the sector's biggest players, too, focus on the domestic market, such growth is not in sight in the real estate and construction sector. On stagnant markets, companies are rarely in a position to post substantial profit margins even if they have innovations offering major advantages.

As a major investor and customer, the public sector also plays an important business role in the KiRa cluster. Nevertheless, there are various legal provisions applying to the public sector in this respect. For example, innovation subsidies may not be channelled to public sector players in the same way as to private companies. Thus, the rules governing the KiRa markets are different from those used in the sectors where business is solely a matter between companies.

3.3 Why do companies innovate?

The fundamental motive for companies to innovate is always the increasing of future returns or the prevention of a decline in returns. Investments in R&D are like any other investments.

There are substantial differences between the return expectations of different companies. The larger the requirement for return on investment, the sooner are the profits expected to be realised. For example, if the interest rate is over 20 per cent, returns generated more than a decade later are no longer of any interest. In the other extreme is a state where a growth rate of 2–3 per cent would already be quite a good achievement. With such interest rates, aiming for returns 15 years later would still be justified. Examples of this are basic education and basic research. Even though inputs in them are well-justified from the perspective of social development, it is difficult to find any market-based players willing to invest in them.

Innovation is always connected with risks (uncertainty concerning the benefits generated by the investments). The greater the uncertainty, the higher the expectations for returns as otherwise the returns would be below expectations.

Thus, the task of RDI subsidies granted by the public sector is to allow a) the lengthening of the benefit time span or b) participation in the sharing of risks, in which case a company would not need to shoulder the entire risk even if the project failed. This helps to promote long-term, moderate and sustainable growth in society and industries.

3.4 Challenges of current RDI funding

In Finland, there are two main public providers of funding for research, development and innovation: Academy of Finland and Tekes. During the past ten years, their activities have become increasingly differentiated. In its choices, the Academy of Finland emphasises scientific quality and gives little consideration to social or industrial relevance. At the same time, Tekes is increasingly focusing on boosting business activities aiming at international growth or radical changes in Finnish industries. When measured with high-quality scientific publications or the number of patents and spin-off enterprises, research in the KiRa cluster is basically in a weak position compared with RDI activities in other sectors. The principles applied by the Academy of Finland and Tekes are, however,

fully justified as Finland's scientific research and industries would not otherwise be successful in international competition.

However, between these financing principles there is an area for which it is difficult to find funding in Finland. From the perspective of society at large, major problems arise in situations where industries and companies are themselves responsible for the activities but the time spans are so long that the necessary RDI investments will not materialise if the rules of the market economy are observed. In the KiRa cluster these include the well-known mould problems or the decay of the physical infrastructure. As the problems will only surface several decades later, there are no market-economy mechanisms that would provide companies with incentives to invest in the elimination of them. At the same time, however, the public sector is not able to solve the problems on its own, without a major involvement of companies.

In a report commissioned by Housing Minister Vapaavuori[25], I proposed that a strategic centre for science, technology and innovation (SHOK) should be established in the public sector. In my view, we need a funding organisation that would incorporate the funding of research for the major social problems affecting the built environment. In this organisation, the public sector (ministries, cities and towns) would provide most of the financing though companies would have a minority stake. Thus, unlike in the existing SHOKs, which have been established on the basis of innovation policy, the decision-making power would be in the hands of the public sector. In my view, there is still a need for such public-private partnership.

3.5 Challenges of innovation in the KiRa cluster from the perspective of those doing research

Because of weak research traditions and the width of the field, those doing research have to deal with special challenges.

As the sector is not research-oriented, there are no traditions concerning the publication of findings either. A large number of useful research results are published on forums. However, these presentations are not

[25] *Kokkala, Matti. Seven development proposals - Public research on housing, construction and use of land in Finland. Reports of the Ministry of Environment 10/2010, 57.*

always documented and even if they are, they can no longer be traced after a few years. This means that in retrospect, the findings are not published at all.

Typically, research is carried out with one thesis at a time and no funding can be found for more advanced research in the same field. This will easily lead to a situation where a same problem surfaces every few years. Researchers do a great deal of re-search, in which they examine a topic that has already been studied.

Research in the real estate and construction sector would also require up-to-date equipment and premises allowing experiments to be conducted. However, when proportioned to research volumes, such equipment and premises are so expensive that in Finland no investments have been made in major construction technology research equipment for years (or even decades).

More competitive tendering in research funding is also often seen as a way of improving the quality of research. However, competition only works when there are markets for research (more than one customer and more than one supplier). If there is only one customer, the loser may disappear from the market, which means that as a result, the number of research bodies will decrease further. It also often happens in a competitive situation that the resources spent on making tenders are as large as the resources spent on conducting the research. In fact, the best researchers are often assigned to preparing research plans, whereas the research itself is the responsibility of younger and less experienced staff. Thus, competition should be seen more as international competition and internal domestic competition generating unnecessary overheads should be avoided.

3.6 Summary

RDI in the KiRa cluster is in a continuous competitive situation with similar activities in other sectors. Commonly used indicators do not, however, direct the research into solving major social problems that are of long-term nature but in the opposite direction.

Innovation as a term means that the research results are also used in the practical operations of companies or the public sector. It should be remembered that the practical application of the results is ultimately the responsibility of the users. This means that the situation cannot be solved solely by developing the activities of those doing the research. Companies and the public sector must also have experts that are able to process the

research findings into information that can benefit their own organisations.

4 Impact of RDI on the real estate and construction cluster, particularly from the perspective of regulation

Lauri Tarasti

The impact of RDI on the real estate and construction cluster can be examined from many different angles. I have been more or less closely involved in the preparation of numerous amendments to the Land Use and Building Act during the past ten years and in the writing of at least 1,000 sections in different laws. For this reason, I will concentrate on the impact of RDI from the perspective of the regulation of the real estate and construction cluster. As I am a lawyer, I am not very familiar with construction-related research.

Initiating a law drafting process is usually based on empirical observations or information on deficiencies in society, or willingness to develop specific areas of society or prevent unwanted development. The Government Programme and any revisions to it have become the main basis for law drafting. However, this does not prevent other ways of initiating a law-drafting process, particularly in minor issues. A large number of legislative initiatives also originate in the Parliament. Even though outside initiatives are rarely successful, lobbying is of course permitted.

When the law drafting process has been started by a ministry's public servants, in a committee or in a working group, the first task is to acquire a sufficient knowledge base of the area concerned. Research results, earlier reports, examples of solutions from other countries and existing proposals or options are collected. If there is time, additional reports or research may also be commissioned. Experts and parties with a stake in the law drafting process are consulted.

At this stage, RDI is in a central position. The question is mostly of RDI that has already been carried out because nowadays the deadlines for law drafting are unreasonably tight. Thus, it is not possible to commission new research. The most that can be done is to prepare reports on the current situation. Politics have become a process with a short time span.

The information generated by RDI is discussed during the law drafting process. The main question is whether the information obtained is applied

to practice in an effective manner. Can RDI offer innovative solutions? How much weight is given to the reliability of the research? As RDI rarely produces only one result, it must be decided which of the many possible aspects are given priority.

At this stage, the assessment of the RDI becomes the responsibility of political decision-makers. What kind of a legislative proposal will be prepared? Will the main emphasis be on the results of RDI or will the choice between values be made independently of them? Will the political decision be based on a society-based view of the solutions or must we rely on the results of the RDI? In most cases they are mixed, at least to some extent. At the same time, the relationship between the RDI and the choice of values is also weighed.

This is also how the impact of the RDI on the regulation concerning the real estate and construction cluster is weighed and in the following, I will give some examples of it.

4.1 Building regulations

In construction there is a great deal of regulation on many levels: in the Land Use and Building Act, the Land Use and Building Decree, the Finnish Building Code, municipal building ordinances, special legislation and increasingly also in the provisions of the European Union.

Under section 13 of the Land Use and Building Act, the Ministry of the Environment will issue technical and corresponding general regulations and instructions supplementing this Act, which are published in the Finnish Building Code. As choices between values at political level are mostly made in the Land Use and Building Act, one would assume that RDI would be particularly important in issues concerning building regulations. In most cases, the assumption is correct. Building regulations are founded on research-based information when such information is available. However, in such situations, too, it may become necessary to conduct above-mentioned assessments of RDI activities.

Snow load capacity requirements for roofs are undoubtedly based on readily accepted research findings. When new information about such matters as new materials or structural solutions becomes available, it can be incorporated in the building regulations as they are updated.

Fire safety regulations are also based on research findings on such matters as the combustibility of different materials. Trusting experts, the Ministry of the Environment approved strict fire safety regulations in the 1980s. At the time I was serving as the ministry's permanent secretary.

However, neither the minister nor I had any chance to question the experts' assessments. Except for the building of detached and row houses, the regulations meant the end of all wooden construction in Finland, a major supplier of wood products. In addition to carrying out RDI activities, it would have been necessary to make choices between values at political level. Since then, fire safety regulations have, independently of RDI activities of those days, been substantially modified and we know that wooden construction is now moving into high gear. Finland's biggest wooden residential area (with wooden blocks of flats) is being planned in the Vuores district of Tampere.

Provisions on the obligation to build civil defence shelters in new buildings are laid down in section 71 of the Rescue Act, while section 72 of the same act contains provisions on the construction of shelters in connection with alteration and repair work. Even though there is little doubt that the Government decree on the size and structure of civil defence shelters and the Ministry of the Interior decrees on technical details of civil defence shelters referred to in the Rescue Act are based on RDI, the obligation itself cannot, against the background of today's military technology, be justified by research and it is simply a choice of values made at political level. No wonder then that there is currently a lively debate on its usefulness.

4.2 European Union norms

The chances of RDI carried out in Finland to influence the drafting of EU legislation in Brussels are limited but not insignificant. Well and thoroughly researched information always gets a response. However, Finnish construction-related RDI is usually focused on Finland, which means that it carries little weight in Brussels.

Therefore, RDI is all the more important when Finland takes a position on projects under consideration in the EU. A good example of this is the directive on sulphur emissions from ships, the consequences of which came as a surprise to Finland. They had not been studied carefully enough in advance and as there were not enough facts available, the opinions on them had to be based on the choice of values at political level. Such information would probably have influenced the choice of values. As we know, the directive became very expensive for Finland.

Even though RDI is important to Finland so that it can formulate and present its well-justified opinions before the adoption of EU decrees and regulations, it is also important to examine what would be the best way for

Finland to implement the decrees and regulations that it has already adopted. In this process, RDI could play an important role as almost always there are options and room for manoeuvre in the implementation of EU norms.

As is the case with other provisions, the number of construction-related regulations in the EU is on the increase. The norms concerning the harmonisation of requirements concerning construction products, the first of which were introduced in 1989, are important in this respect. The regulation (EU) No 305/2011 of the European Parliament and of the Council laying down harmonised conditions for the marketing of construction products is currently in effect. Harmonisation takes place through the CE-labelling of European construction products. In Finland the provisions on this are contained in the Ministry of the Environment decree on the approval of construction products (1245/2003).

The active role of the EU in the combating of climate change has resulted in norms aimed at improving the energy efficiency of buildings. In Finland and elsewhere in the EU, buildings account for about 40 per cent of all energy consumption and carbon dioxide emissions. In 2010, the EU adopted a new directive on the energy efficiency of buildings. Under the directive, new buildings must be all but zero-energy buildings by the end of 2020 and there must be minimum energy-efficiency requirements for renovation at national level. In Finland, this led to the tightening of the Building Code at the start of 2010 and again in 2012. Moreover, in early 2013 the Ministry of the Environment issued a decree on the improving of energy efficiency in repairs and modifications, while the Act on Energy Certificates for Buildings (50/2013) was updated.

The ability of Finland to incorporate the changes required by the EU in its building regulations and in other areas greatly depends on RDI. It requires that Finnish parties responsible for RDI are informed about projects concerning construction-related norms being drafted in Brussels at an early stage and that the parties take appropriate measures.

4.3 Energy issues

Energy issues have become a central matter in construction. They are essential in the combating of climate change. In research under way in different parts of the world, efforts are being made to find new innovations and new energy sources and to create cleaner energy for the energy markets. Solar energy, wind power, bioenergy, wave power, shale oil and many other innovations are in a state of rapid change. Their

advantages and disadvantages are being intensively studied so that the right solutions can be found.

The solutions are moving from supranational level to lower levels. The objectives approved by the EU are divided between the Member States. As regards renewable energy production, Finland must generate 38 per cent of its energy with renewable resources by the year 2020. As a result, Finland has introduced a feed-in tariff for producers of renewable energy (Act on Production Subsidy for Electricity produced from Renewable Energy Sources; 1396/2010), which guarantees the profitability of such projects. The feed-in tariff applies to wind power plants, bio gas power plants, wood chip power plants and wood-burning power plants. In wind power, the aim is to achieve a ten-fold increase (to 3,750 MW), which would mean between 1,000 and 1,200 new wind power plants. The Finnish legislation lays down substantial research and reporting requirements for builders of wind power, particularly in the assessment of environmental impacts.

The energy regulations of buildings have been tightened on several occasions in order to cut carbon dioxide emissions. As I already mentioned, the aim is to achieve zero-energy housing construction. Finland's first zero-energy blocks of flats have recently been constructed in Kuopio and Järvenpää. However, it will take many years before the energy regulations will have any impact. Because of the protection enjoyed by private property, owners can only be required to make changes in existing building stock in connection with renovations. New construction only accounts for about one per cent of the total Finnish housing stock.

Measurements of the carbon dioxide balance have started in many places. The purpose of the measurements is to show which activities only produce positive impacts concerning the carbon dioxide balance. During my tenure as the chairman of the Finnish Association of Landscape Industries, there were already studies on whether the construction of parks and green space results in a positive carbon dioxide balance. We all know that trees and other vegetation bind carbon dioxide. However, when we calculate the carbon dioxide emissions arising from the construction of green space, mowing of lawn, etc. the results may be different from what one would imagine in the first place. More such research can be expected in the future. The same applies to construction and the studying of the carbon footprint left by construction.

As a result of the oil crisis of the 1970s, the regulations concerning the sealing of buildings were tightened. Naturally, the aim was to save energy. However, current mould and moisture problems are partially a result of these measures. This could have been prevented with RDI.

However, as crises often lead to demands for quick action, there is no time to wait for the results of thorough RDI. Thus, the decisions are made and building regulations issued on the basis of the information available at the time, even if the information is known to be inadequate.

In construction-related energy issues RDI has always played an important role and this will also be the case in the future. As the examination will have to be widened to cover the entire life cycle of buildings, which is between 50 and 100 years, a great deal is required of the RDI activities. We must be able to present solutions that take into account today's needs but also the needs of the entire life cycle of buildings. This should also be seen in the regulation of construction.

4.4 Quality of construction

Especially during the past few years, the quality of construction has, as a result of construction faults and failures, become a topic of public discussion. I have often said that one cannot expect high quality if, as a result of competitive tendering, the cheapest architect, the cheapest designers, the cheapest principal contractor and the cheapest subcontractors are selected for the building project. In competitive tendering, quality should be the main criterion. This is because the price often becomes the crucial factor even if quality is the number one requirement. It is impossible to assess quality in a future project. However, the price can be exactly defined in euros.

As most of the construction is carried out by private operators, one would assume that there is RDI in the private sector aimed at ensuring that the quality of construction can be improved. This is also the case. However, the construction sector has only limited chances to play an RDI role. Competitive tendering and legislation on public procurement have led to such a price competition that it is impossible to win contracts with RDI that may only bring results in 2–10 years. Very few companies are able to wait that long.

A good example of research in the private sector is RYM Oy, a research company jointly owned by the Finnish construction branch, which has recently started operations. It is an RDI company with 43 partners: 37 companies and six research institutes. Its first research programmes have a time span of 3–6 years and they are jointly carried out by the companies involved. The Confederation of Finnish Construction Industries RT has its own Laatupolku (quality path) programme, while large construction companies are carrying out applied research. The Academy of Finland is

funding private construction research, while Tekes and Sitra are providing financing for applied research projects. A number of foundations are also supporting construction research.

The Building Information Foundation and the Building Information Ltd owned by it keep the RT building information file, which serves as a major quality manual in the construction sector. It is a key source of practical construction information in many areas and has a substantial impact on the quality of construction.

However, RDI in the construction sector is mainly the responsibility of the public sector (in practice the central government). Higher education institutions, universities of applied sciences, VTT and many sectoral research institutions of the state in the administrative sectors of different ministries play a central role in RDI. They can conduct long-term research and they do not need to link their funding with everyday business activities. Furthermore, they can also support private research in different projects.

In other respects, too, the public sector plays an exceptionally important role, or actually a multiple of roles, in construction: It is a customer, regulator, creator of markets and also a player in education, training and research.

Regulating the quality of construction is a difficult task insofar as quality is a regulatory matter. Plenty of examples of this have been given above. In specific matters, it is possible to set out quality requirements in such areas as construction products. However, the end result of construction is a sum of so many factors that it has proved impossible to ensure quality through standards.

4.5 Finally

Above, I have examined the RDI influencing regulation in the construction sector and the choice of values as alternatives: Either we adhere to the results and proposals generated by RDI or choose between values (political choices). These options are often treated as disputes between experts and politicians in which the role of experts has been highlighted and political activities belittled. However, choices of values made at political level are the main content of democracy. For my own part, when preparing a report on wind power in 2012, I noticed that if the decision on the construction of wind power plants was left to the experts, none would be built. When I added up the expert opinions on regional control, air traffic, road and rail traffic, aesthetic impacts, noise, bird

migration routes, peace at summer cottages, etc., there would not have been any space left for wind power plants.

Such exaggeration is, however, unnecessary as RDI and choices of values at political level are usually interactive. Research findings and innovations have an impact on the choice of values and are often used to justify them. At the same time, choices of values steer RDI towards innovation and examination of choices between values.

When no research findings are available we have to make choices that in the minor building regulation issues are unlikely to be considered choices between values but merely solutions dictated by practical considerations or costs.

Political choices are choices between values. As RDI in the construction sector is the responsibility of the central government and ultimately, when decisions on the state budget and the budgets of individual ministries are made, of the Parliament, directing RDI through state action would be possible and this is also how it is done in a small scale even though there would not be any interference in the freedom of research. In the development of RDI in the construction sector, it is important to decide where the definitions are made, in what areas is the research done and how is RDI and RDI funding allocated. At the moment, this definition work is dispersed over a wide area.

Often the difficulty is to determine which issues are important in construction in the future and require a solution. In this area, the choices of values of RDI and decision-makers should closely interact, as has been stated on several occasions above.

If there had been enough research on construction materials, formaldehyde and asbestos problems could have been identified and materials containing them could have been avoided. The resulting cost savings would have been substantial. Perhaps we can learn something from this. At the moment, there is research under way on the impacts of construction materials on the greenhouse gas emissions of buildings.

If the mould and moisture problems had been identified in advance, a great deal of attention would have been paid to them and efforts would have been made to prevent them. However, the damage has been done and eliminating the problem will be very expensive. According to some estimates, the repairs will cost about 1.4 billion euros.

Ageing of the population should be taken into account in all planning and construction. New solutions are needed in many areas. Even though they now generate costs, they will bring savings at a later date. A good example of this are the government grants for building lifts and for eliminating barriers to mobility. In the 2013 state budget, these total 22

million euros. They are needed because in the past, lifts and barrier-free construction were not considered essential.

These examples show how much consideration can and should be given to RDI in construction and regulation of construction.

5 How should and can the Government's steering policy and steering instruments be developed? Wicked problems of KiRa steering as an example

Olli-Pekka Heinonen

5.1 Wicked problems

In English there is useful idiomatic phrase 'wicked problems'. According to Wikipedia, it is a phrase that was originally used in social planning for describing a problem that is difficult or impossible to solve because of incomplete, contradictory and changing requirements. The term 'wicked' is used to denote resistance to resolution, rather than evil. Because of complex interdependencies, the efforts to solve one aspect of a wicked problem may reveal or create new problems.

The concept 'wicked problems' has been occupying my mind as in my current task I have been able to observe the challenges that the Finnish government has been dealing with during the past 12 months. The definition aptly describes the reforms of Finland's social and health care and municipal services: Any solutions are shaped by the definition of the problem, there is no clear beginning or end for the problem and the solutions are unique rather than universal. Neither are they right or wrong but, depending on the perspective, they can be considered better or worse. The Talvivaara problem last autumn was impossible to manage or solve from the perspective of a single sector. At its height, there were 20 different authorities and seven different ministries working on the matter even though none of them had the competence to produce a workable overall solution to the problem. A third example is from the level of an individual. The problems of a socially excluded young person cannot be solved through the action of social, labour, youth, education, housing or health authorities as the solution requires the understanding of the overall life situation of the individual concerned.

There are also wicked problems in the real estate and construction sector. There is no clear-cut solution to the shortage of reasonably priced housing in the Helsinki region or the mould problem as the two matters

seem have got stuck in a web of different players and perspectives, which will only become more complicated when you try to free yourself.

David Snowden has developed a four-domain model to structure the impact of different operating environments on decision-making and organisation. The most familiar field is the 'known' environment where things happen in a logical and linear manner, causal relations are clear and the truth is known. Best practices are part of this approach as they have already been invented and now we only need to discover them and start using them. The 'known' world is based on hierarchical top-down division of labour where everybody is responsible for his own circle and should not interfere with the circles of others.

The second domain is the 'knowable' field where experts can, through continuous development and 'a bit better' thinking, find new solutions. The idea of a learning organisation belongs to this domain. In the 'knowable' field, experts should be given more power so that they would have more room to learn and develop new solutions.

The third domain is that of 'complex reality'. In that, the causal relations are no longer clear. Because of strong interdependencies, the flows coming from outside the organisations have a greater impact on the organisations that the organisations' own activities.

Because of a complex operating environment, management is a matter of creating operating prerequisites and cultures for self-steering units that must be able to react to changes quickly.

'Chaos' is the fourth domain. In this field, there is no time to know, learn or analyse. You can only act because otherwise you would not survive.

This theoretical frame of reference gives us a good basis for asking which of the domains best corresponds to the reality in which we live. If we have a common idea of where we are, our next challenge is to find an answer to the question 'Are our operating practices, cultures and organisational models in harmony with our operating environment?' The answers vary between organisations and situations and all four domains can become reality simultaneously in different parts of the same organisation.

Changes in the operating environment challenge the public administration and decision-makers in the same way as other players. Central to it is the growth in complexity and interdependencies, which also provides a closer link between public and private action and success. The financial crisis that started in the United States in 2007 and that has recently shaken such countries as Cyprus, and the interdependency between the financing sector and individual countries that it has demonstrated plus its manifold impacts are a good example of this.

Interdependencies mean more complexity. Causal relations are no longer as clear as before and good intentions may turn upside down along the way.

This development also challenges our traditional way of organising our central government into independent ministries and administrative sectors. Important and difficult issues of our society are no longer compartmentalised solely in accordance with the ministerial division but require continuous cooperation between a large number of branches, transfer of resources and governance of large entities. We often realise that we are solving horizontal problems with a vertical organisation. In such cases committing funding, personnel and performance targets strictly by administrative sector may become an obstacle to problem solving in a manner that such countries as Sweden have solved many years ago.

5.2 In change situations we need specific steering policies.

Steering instruments available to the public administration should also be examined. In Finland, there is a strong top-down steering culture, which has its origins in the sectorised 'known' operating environment. Normative and budget steering are the most important instruments of our steering system and their aim is to achieve changes in the behaviour of individuals and communities. When we face social problems, we instantly and without much thinking suggest new legislation. If we try to solve everything through new laws, the quality of legislation will inevitably suffer.

The most recent addition to our steering field is performance steering. It has resulted in target-oriented thinking and cost-awareness. However, in its current form, it strengthens sectoral and silo mentality and makes it more difficult to set horizontal targets. Developing performance steering in a manner that allows the setting of cross-administrative targets is therefore an important area for development in the steering policy.

Our steering policy toolbox is unfortunately little used. It is the task of the politicians to show the direction of social development. The public administration should use its expertise to demonstrate which methods and which forms are best suited for ensuring that we can also embark on that path.

In addition to normative steering, steering by means of resources and information, building of incentives, self-regulation mechanisms, operating practices of service design, evaluation and consultation steering,

crowdsourcing etc. are all among the instruments. One basis for the steering policy must be that the selection of the steering method provides an incentive for new innovations and the development of an innovative operating environment. The decision-making powers of the Parliament can also be ensured in the different steering models.

Central government steering in research, development and innovation are also being discussed. As business sectors and clusters (such as the KiRa cluster) are in a state of change one has to ask whether such entities as SHOK programmes prop up existing structures at the expense of creating new. The focusing of innovation funding on specific projects also raises the question whether public innovation funding aims to pick the winners. In the background there is the question whether it is reasonable to direct public innovation funding as specific enterprise subsidies or as more general funding supporting companies' operating and innovation basis and their innovation environment.

A complex environment full of interdependencies does not require that the steering instruments should be equally complicated, on the contrary. In such an environment, the effectiveness of steering is based on the understanding of the principle that less is more. We have many examples of cases where good intentions based on wrong steering instruments have led to harmful results that are opposite to what has been intended. For example, there is definitely good will behind every single regulation in the continuously expanding normative steering at local government level. Nevertheless, as a whole and when implemented sector by sector, the avalanche of norms makes it impossible to build resident-oriented and cost-effective service processes at municipal level. Thus, good will is not enough; we also need to know how to put the things into practice.

By making use of more broad-based steering instruments, we could avoid inflexibilities and support self-directed processes that function better in a complex environment characterised by interdependencies. Because of its traditions, legislation is also fairly sectoralised when one examines the division of matters in the law book. In the future, such documents as the Government Programme should state what kind of steering cultures should be used for developing Finland.

5.3 Introducing a new intelligent operating model in Finland

In my view, our operating practices and cultures are not in the position in which the world around us expects them to be. We are not sufficiently

adaptable to change and not prepared to use the opportunities created by change, surprises, shocks and uncertainty. Because of our inflexible structures we are unable to make full use of the strengths of Finnish culture and expertise. Finland has a skilled, professional and highly committed civil service whose intellectual resources are not fully used. It is the structures and the culture that are at fault, not the people. Those employed in the public administration deserve a better-managed organisational culture and workplace atmosphere. Finland needs a new intelligent way of doing things.

It is not a question of playing with boxes but a more in-depth change in the operating culture. The change in culture is the most difficult and the most time-consuming change process and for this reason, we should start without delay. The power of example is the main instrument for bringing about change at the level of individual supervisors, units and the nation as a whole. It is difficult to serve as an example to regional and local government and to the nation as a whole if one's own operating practices are out of date.

Strategic sensitivity in central government is also blunted by a large number of different projects. In projects, the aim is to solve problems by simulating a theoretically perfect solution. The good thing about projects is that they aim to take into account different perspectives and try to find sustainable solutions. The bad thing is that projects last long and when they are concluded the reality and challenges are often different from those at the start of the projects.

Piloting would allow us to learn and gather experiences more quickly and also to fail more quickly in a smaller scale. The process would also create tacit knowledge, which is essential for generating used-oriented innovations. The ability to scale up successful pilot projects into more general operating practices would be a demonstration of the kind of strategic sensitivity that is now expected of us.

Finns are one of the most highly educated people in the world and our research and innovation intensity is also top class. For this reason it is strange that we still rely on the top-down model and fail to make use of our expertise base by supporting bottom-up culture. In an expertise-intensive country like Finland, a change in perspective would probably bring significant benefits.

At the same time, we must make determined efforts to demolish silos and connect them with bridges, irrespective of whether the silos in question are in the public or private sectors, or in the public, private or academic worlds. Instead of trying to find mistakes and guilty parties, we should start improving things by testing and by learning from experiences. It means that we should accept failures and rejoice at successes. Learning

together with municipal residents, citizens and customers may create a pioneering spirit, an innovative operating culture and a more motivating living environment. An intelligent built environment is a good example of an objective that cannot be achieved using old practices but is within our reach if we adopt a new operating culture. In fact, from the perspective of the end result, changing the operating culture may be more important than specific strategies in the real estate and construction sector.

6 A more sustainable management of our real estate and built assets requires innovations in steering systems

Tuomas Pöysti

6.1 Buildings and structures are an important part of our national and public wealth.

People spend most of their lives in buildings and in the built environment. The state of the built environment is therefore of great importance for the quality of life and the health of the living environment. Buildings and structures are also an important part of Finland's national wealth and the general government balance sheet.

TABLE 1. Buildings and structures in the national economy and general government finances[26]

Net capital stock of buildings and structures (2011)	443 billion euros
Gross fixed capital formation (2011)	24.6 billion euros
Net capital stock of general government buildings and structures (2011)	85.2 billion euros
Value of buildings in local government financial statements (2012)	12.7 billion euros
Value of fixed structures in local government financial statements (2012)	8.7 billion euros
Value of fixed structures in final central government accounts (2012)	17.6 billion euros
Value of buildings and structures in the balance sheet of the state enterprise Senate Properties (2012)	3.2 billion euros

This means that as a group, the central government alone has buildings and structures worth about 21 billion euros in its balance sheets.

6.2 Repair backlog weakens long-term financial sustainability

Repair backlog means the amount of money that would be needed to put buildings and structures into a condition that is in accordance with the current needs and the required basic quality level. In the eyes of external auditors, performance auditors and fiscal policy auditors, the concept of repair backlog is vague and open to many interpretations. However, its basic content from the perspective of good asset management and accountability is important. The repair backlog describes the unrealised risks of asset value depreciation and future spending needs. Thus, it is connected with the issue of sustainable finances. Most construction sector

[26] *Sources: Official Statistics of Finland (OSF): National accounts, from: StatFin service of Statistcs Finland. Official Statistics of Finland (OSF): Finances and activities of municipalities and joint municipal boards, from: StatFin service of Statistics Finland. Final central government accounts for 2012 and financial statements of the state enterprise Senate Properties for 2012.*

experts are of the view that the repair backlog of Finland's building stock is between 30 and 50 billion euros.[27] There is also a great deal of repair backlog in public buildings and particularly in the buildings belonging to municipalities.

The report on moisture and mould problems in buildings, tendered and commissioned by the Parliamentary Audit Committee, examines the repair backlog from a different perspective.28 According to the report, moisture and mould problems cost about 450 million euros each year in health problems. According to an estimate compiled by the Audit Committee, building assets worth between 13 and 28.2 billion euros suffer from significant moisture and mould damage. Estimates of their nonrecurring repair costs vary between 1.2 and 14.5 billion euros.29 There are significant moisture and mould problems in public buildings, particularly in those owned by municipalities. According to the mould survey commissioned by the Audit Committee, between 12 and 18 per cent of schools and day care centres and between 20 and 26 per cent of care institutions suffer from serious moisture and mould damage. Moisture and mould problems are one reason for the repair backlog.

On the basis of the study, the Audit Committee arranged an extensive hearing of experts and, under section 90 of the Constitution of Finland, prepared a report containing significant supervision findings to the plenary session of the Parliament.[30] On the basis of the report, the Parliament adopted an opinion containing 13 different measures. In accordance with an established practice, the National Audit Office will monitor and assess the situation, with the aim of ensuring that the Government meets the reporting obligation set out in the Parliamentary opinion. In its performance audit, the National Audit Office will also, in the form of a case study, focus on issues concerning research, development, innovation, education and training in the real estate and construction sector, and knowledge and knowledge-based decision-making concerning them.

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[27] Rakennetun omaisuuden tila (State of Finland's built environment), ROTI 2013. Report of the Audit Committee 1/2013 vp. - M 5/2013, moisture and mould problems in buildings.

[28] Moisture and mould problems in buildings, Kari Reijula et al., publication of the Audit Committee 1/2012, Parliament 2012 (Mould report of the Audit Committee 2012).

[29] Report of the Audit Committee TrVM 1/2013 vp., moisture and mould problems in buildings.

[30] Report of the Audit Committee 1/2013 vp., moisture and mould problems in buildings.

In overall terms, the real estate and construction sector thus plays an important role in general government finances and in the Finnish economy as a whole. It is by no means surprising that the National Audit Office, the external professional body auditing central government finances and fiscal policy, takes an interest in the state of the real estate and construction sector, built environment and assets and their management.

6.3 Quality of construction and moisture and mould problems are a steering and health policy problem.

According to the report of the Audit Committee, moisture and mould problems in buildings are one of the most important environmental health problems of our time. This means that the quality of construction and maintenance of the built environment are not at satisfactory level. The problem is not solely of financial nature. It is an issue concerning fundamental rights, as laid down in section 19 of the Constitution of Finland on the obligation of the public authorities to promote the health of the population, and the environmental basic right laid down in section 20 of the Constitution, or more specifically the obligation of public authorities to ensure everybody the right to a healthy environment and an opportunity to influence the decisions concerning their own living environment.

The Government has also made efforts to influence matters concerning the renovation of buildings and moisture and mould problems by introducing steering measures. In 2008, the Government of Prime Minister Matti Vanhanen adopted a resolution on renovation. In 2010, the Government adopted a resolution on an action programme concerning the tackling of moisture and mould problems. However, the development measures have been inadequate. Government resolutions are a tool for Government-internal steering and policy planning rather than an external steering instrument used by the Government as the country's executive body. The role and effectiveness of the resolutions is not always as clear as could be expected of this steering instrument as a joint Government expression of its policies.

One reason for the moisture and mould problems is the fact that the steering of construction and real estate management has failed.[31] Thus, the Government can only efficiently implement the parliamentary opinion on the Audit Committee report TrVM 1/2013 vp. on moisture and mould problems if systematic efforts are also made to update the steering of the real estate and construction sector. The real estate and construction sector could thus act as a pilot for a new Government steering policy in which the aim is to adopt new thinking so that policy measures could play a more effective phenomenon-based role or solve current social problems as a whole.

6.4 The real estate and construction sector faces the wicked problems of the economy and public administration

Many of the fundamental problems, growing phenomena and development trends in Finnish society are also problems of the built environment and the real estate and construction sector. As a result of weak productivity growth and particularly the ageing of the population, there is a clear sustainability gap in the public sector, which requires urgent policy measures.[32] It significantly limits the room for manoeuvre in general government finances and thus also in public sector construction and renovation of buildings in the coming decades. Bringing the rise in costs under control, particularly in local government, will become an increasingly important economic policy aim.[33] The real estate and construction sector also has a role to play in the efforts to keep costs under control. Between December 2006 and December 2012, construction costs rose by 20.2 per cent. During the same period, the gross domestic product increased by 11.7 per cent. Hopefully, some of this growth is a result of improvements in the quality of construction, which would result in lower life-cycle costs.

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[31] *This is the conclusion of the Audit Committee on the success of steering. TrVM 1/2013 vp.*

[32] *Separate report of the National Audit Office to the Parliament K 2/2013 vp. interim fiscal policy audit report on the parliamentary term Ministry of Finance: Economic Survey, Spring 2013. VM 8a/2013.*

[33] *Separate report K 2/2013 vp. of the National Audit Office.*

For the public infrastructure, the financial situation means that in planning, construction and maintenance, care should be taken to ensure optimal costs of buildings and structures during their life cycle. As the old Finnish saying goes: If you are poor, do not choose the cheap option. At least, one should not choose poor quality and in this respect the procurement procedures in which the lowest contracting and subcontracting prices are the only or the main criterion create problems. At the same time, budgetary pressures in central government finances increase the risk of cuts in maintenance and the risk that in procurement prices, budget savings will be the main consideration and sustainable construction becomes less important.

Good real estate and premises solutions also make it easier to maximise productivity in work and other activities. This perspective also poses new challenges to the operational life cycle of buildings and the planning of the operational life cycle. For example in the improvement of the link between premises solutions and productivity in the construction of hospitals and the organisation of other health care premises in the public sector, there is clearly unused potential, which is topical now as it is also otherwise necessary to renovate and upgrade the building stock.

Ageing of the population also creates plenty of other needs and opportunities in the real estate and construction sector. According to the population projection of Statistics Finland, in the 2040s there will be more than 1.5 million people in Finland over the age of 65 and, even if uncertainties are taken into account, nearly 700,000 people over the age of 80. Towards the 2060s, the number of those over the age of 80 will reach 800,000, while at the same time the number of over 80-year olds living alone will also grow.[34] Ageing people need new types of services and a built environment allowing them to live independently as long as possible.

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[34] Official Statistics of Finland (OSF): Population projection [e-publication], ISSN = 1798-5137. Helsinki, Statistics Finland, http://tilastokeskus.fi/til/vaenn/index.html [referred 15.4.2013], population projection of Statistics Finland 2012. In collaboration with ETLA, the National Audit Office is conducting research on the sustainability of general government finances and as part of it, it is also studying the role of the reliability of population projections and likelihood of demographic trends in the assessment of the sustainability of general government finances. The research supports the fiscal policy audits of the National Audit Office and the task laid down for NAO under which it acts as an independent supervisor and evaluator of fiscal policy (independent fiscal institution). The ETLA - NAO study makes use of the stochastic population projection prepared by Juha Alho, a professor at the University of Helsinki, which is founded on the modelling of uncertainties. The stochastic evaluation is used as a basis for the assessments in this presentation.

Changes in the population structure also create other significant pressures in public construction and, more generally, in the real estate and construction sector. There are substantial differences between population trends in Finnish regions. The active population, immigrants and families with children are concentrated in a small number of growth regions and growth centres, whereas in many of the existing regions and municipalities, the population will become older and decline substantially. Growth centres need new housing for different needs and new public infrastructure. Correspondingly, some of the existing infrastructure is in the wrong places, while at the same time it is affected by the challenges of ageing and repair backlog.

In addition to being in a downturn, the Finnish economy is also facing a structural shock. Finnish companies have lost markets but the losses are not solely a result of weakening price competitiveness. Growth in total productivity is stagnant and there are plenty of signs that in the future, the growth will permanently remain at a lower level than in the past. Research, development and innovation (RDI) in Finland are concentrated in a small number of sectors and the number of companies engaged in RDI is too small. Moreover, RDI outputs are not equal to the inputs.

The real estate and construction sector is in itself important to the Finnish economy. The sector should and could improve its overall productivity. The sector has been sensitive to economic fluctuations. Based on value added, total productivity in construction increased by 3.6 per cent between 2000 and 2011, while output-based total productivity only increased by about 1.5 per cent during the same period. [35]Thus, in terms or productivity growth, the sector has not been among the top performers of the Finnish economy. With some exaggeration, it can be said that in innovation, too, the emphasis has been on the development of new materials and related technologies. Thus, the focus in RDI is on technological solutions. At the same time, according to the mould survey of the Audit Committee, as much as 41 per cent of all moisture and mould problems are the result of design faults. This means that in the real estate and construction sector there is a need for a broader and more in-depth innovation concept that tackles the quality and life cycle of the built environment more extensively. It seems that the sector needs more service innovations, strategic innovations and steering and management system innovations.

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[35] *Statistics: Productivity surveys [e-publication], Helsinki, Statistics Finland [referred 25.6.2013], http://tilastokeskus.fi/til/ttut/index.html.*

The major trends and problems in the real estate and construction sector also include improvements in energy efficiency and preparations for the impacts of climate change. Energy efficiency has run into conflict with long-term sustainability of buildings and the health requirements for built climate. Studies show that some of the measures promoting energy efficiency have actually created moisture and mould problems in buildings or made them worse.[36] Climate change is very likely to lead to an increase in extreme weather phenomena, which means that appropriate preparations should also be made. This will have - or it should have - a significant impact on construction, urban planning and municipal infrastructure solutions. For this reason, the decision by the Government to cut subsidies to water supply and flood protection as part of its spending limits for 2014–2017 will not, without compensating measures or the reallocation of resources (which was also set out in the spending limits decision), necessarily generate sustainable savings in general government finances in the long term. It seems that there is still room for clarification in the division of labour and resources between the Ministry of the Environment and the Ministry of Agriculture and Forestry and in the steering and financing of municipal infrastructure.

In the steering carried out by central and local government, the problem is that the currently used steering instruments and methods (steering systems) actually favour the use of solutions that are easy in the short term but that are partially impractical from the perspective of the economic, operational and thus also social life cycle of buildings and structures. Excessively tight budgets and timetables, failure to carry out repairs and systems that are too difficult to maintain produce results that in the long term are unsustainable from the perspective of finances, health and fundamental rights.

All the above problems and increasingly prominent phenomena in the real estate and construction sector, the sustainability gap in general

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[36] *Reijula et al. 2012, report of the Audit Committee 1/2012 vp, p. 16. Results of the Frame research project, see for example Tampere University of Technology, Department of Civil Engineering, structural engineering, research report 159, Ilmastonmuutoksen ja lämmöneristyksen lisäyksen vaikutukset vaipparakenteiden kosteusteknisessä toiminnassa ja rakennusten energiankulutuksessa, Tampere University of Technology, structural engineering 2012, and research report 160, Matalaenergia- ja passiivitalojen rakenteiden ja liitosten suunnittelu- ja toteutusohjeita, Tampere University of Technology 2012. Information on the results of the research project is also available at the website of the Confederation of Finnish Construction Industries at www.rakennusteollisuus.fi/frame [referred on 25 June 2013].*

government finances and the structural shock in the Finnish economy are examples of wicked problems. There are no easy solutions to them. In such cases, attempts to tackle specific problem areas may produce a whole set of new problems. A concrete example of this is the problematic impact of higher energy efficiency (as such a well-justified objective) on moisture and mould damage. Steering instruments available to a single administrative sector or a single steering instrument are not enough to have an optimal impact on a wicked problem.

In Finland, a major aim in the development of public administration has been to strengthen knowledge-based decision-making. According to relatively optimistic assessments, knowledge-based decision-making and policy preparation will also create prerequisites for innovation. The model of knowledge-based decision-making is, however, demanding, in fact too demanding for straightforward implementation. The problems are connected with the depth and speed of the changes in the operating environment, knowledge potential, overemphasis on target-oriented rationality instead of value-based rationality (in other words: leaving politics out of politics) and the nature of the expert information. The real estate and construction sector is a concrete example of this.

In knowledge-based decision-making, wicked problems require knowledge and vision across the boundaries of traditional expert professions. Good and well-meaning expert knowledge, too, is often limited and fragmented. In its report on moisture and mould problems, the Audit Committee highlights the conflicting views among microbiology and toxicology experts and, more generally, the limits to and shortcomings of knowledge in situations where decision-makers must be able to make long-term and broad-based decisions. In the history of construction, the same applies to recommendations concerning different materials and the side and combined effects of new materials in buildings.

Wicked problems incorporate all these contemporary problems of knowledge management. Elsewhere in this publication, Olli-Pekka Heinonen examines the role of different operating environments from the perspective of knowability and Government steering. He uses a classification of operating environments based on the well-known Cynefin model drawn up by D.J. Snowden. On the basis of research literature, operating environments can also be classified using other criteria. However, all models offer a largely similar picture of the nature of knowledge and rapid change. On practical level, decision-making concerning the real estate and construction sector faces a complex and in certain cases a relatively chaotic decision-making environment. Some of those studying public administration talk about a turbulent operating

environment in which expert information is fragmented into knowledge-based communities consisting of different professional sectors.

As provisions and, particularly, other steering instruments, different standards and expert recommendations derived from them are often based on fragmented information on specific matters the process may well result in steering and regulatory problems. Fragmentation of knowledge may also lead to surprises in the financing and implementation of concrete building projects.

As a result, there are occasional surprises in the funding and implementation of concrete building projects.

Turbulence and the complexity and intertwining of phenomena and issues in the development of the operating environment of the real estate and construction sector are increasing. This intertwining also creates system risks in which the accumulation of a large number of smaller risks may seriously paralyse the entire society or important functions of society.

Issuing of laws is continuing and increasing in the real estate and construction sector. It is very difficult to stop the flow of norms. In an increasingly internationalised society, legal regulation and standardisation are one of the most legitimate forms and instruments of steering. For this reason, there is more and more demand for legal regulation.

The current problems of the real estate and construction sector in the quality of construction and innovations and the problems that we are trying to solve raise the question of the role and opportunities of public steering. Central and local government influence the practices of the sector as regulatory bodies (legislation and other regulation), as implementors of legislation, as taxation authorities and providers of funding (economic steering), as market players using significant market power (market and procurement steering) and as advisors and producers of information (information steering). Putting the parliamentary opinion on moisture and mould problems into practice in an effective manner and reconciling construction and renovation needs with tight general government finances require a new type of steering and the adoption of a new steering policy by the Government. An important aim is to achieve a situation in which a perspective that is in accordance with the technological, economic and operational perspective of construction and the general picture that goes beyond the specific perspective of different professional groups provide a stronger basis for steering and social impact.

6.5 Central government steering and steering policy in the real estate and construction sector

Steering instruments and steering mean all those tools and procedures that central government can in its different roles as legislator, regulator, taxation authority, provider of funding and advise, the user of market forces and as the creator of information systems use to influence the practices in the sector. Steering policy means the policies on the use of different steering instruments laid out in the Government.

At the moment there is no overall Government steering policy even though efforts have been made during the two latest government terms to develop and systematise steering systems. The work has often been carried out with the help of extensive and thorough reports prepared by experts. The Government largely relies on the steering models that have evolved over the years. This approach does not create an optimal or even a good base for solving moisture and mould problems in buildings in the manner set out in the parliamentary opinion or for solving the more general wicked problems facing the Finnish economy, public administration or the real estate and construction cluster. We urgently need broad-based updating of steering thinking and steering policies and, consequently, updated steering systems and steering system innovations.

In addition to the Government, the practical aspects of steering policy are also defined by many other players some of which are more influential than the Government in the process. The European Union, international organisations and international standardisation bodies play an important steering role in areas concerning technology and health. The Parliamentary Audit Committee determines the explicitness of regulation and sets out the limits for the steering in the areas laid down in the legislation. This often happens in a manner that puts an emphasis on the requirements concerning the explicitness of the legislation and broadens its scope. The opinions of the Parliamentary Ombudsman and the Chancellor of Justice of the Government, the supreme guardians of law under the Constitution of Finland, and the audit opinions and recommendations issued by the National Audit Office the supreme external auditor of general government finances, play a similar role. The fact that a high proportion of the opinions and recommendations issued by the National Audit Office are also implemented also means that NAO must carefully examine the policies shaped as a result of its opinions, both as a whole and, if necessary, in a self-critical manner. The highest courts

of law also wield substantial influence over the manner in which steering instruments are used, while at the same time it is also the task of the European Court of Human Rights and the Court of Justice of the European Union to control the activities of legislators.

In a constitutional state based on fundamental rights, it is natural that the constitution and the basic principles of the rule of law set the limits and framework for steering. However, within the framework of the arguments concerning the rule of law, legislators and the government must also be able to use discretion. There are also good grounds for examining whether the role of the Constitutional Law Committee, which is leading to an increasingly explicit system of legal norms and based on the committee's previous interpretations, is appropriate and sufficiently forward-looking. A more dynamic approach to the interpretations of the requirements laid out in the Constitution and an independent constitutional court as the bulwark of the constitutional state might be a more appropriate way of dealing with the challenges of the future.

The steering instruments available to the state are different in terms of their impact and effectiveness. In a complex society, steering is always a combination of the use of different steering instruments. For this reason, in the steering policy laying out the basis for the central and local government steering in the construction and real estate sector, there should be a knowledge-based assessment on how different steering instruments are emphasised.

The strongest steering instruments available to the central and local government (1) are laws and other binding normative steering instruments. There are many legislative systems and different expert information and international recommendations in a broad range of sectors that are relevant to construction and real estate management. The most important of them are the Land Use and Building Act (132/1999), the Health Protection Act (763/1994) and the Rescue Act (379/2011). There are also many other provisions and steering and control systems based on them (such as education and day care legislation, occupational safety and health legislation and public procurement legislation) that have a major influence on public construction. Healthy and safety of buildings is a general requirement under the updated Land Use and Building Act, Health Protection Act and Rescue Act. The problem is that the responsibility for the health and safety of the buildings mainly rests with the developers. In such cases, the responsibility may not be optimally (or in any manner) directed at the parties that have the expertise and motivation to shoulder part of the risk. The system of norms is also extensive and it should be examined whether it forms a systematic and clear entity.

When laws are used as a steering instrument, more consideration should also be given to the fact that merely adding a piece of legislation into the electronic Statutes of Finland does not make it effective. Legal steering must always be accompanied by a well-justified and realistic idea of how to ensure adherence to the piece of legislation, how to provide information on the requirements laid out in it and how it influences the way in which individuals, companies in a sector, authorities and other players act. Supervision and steering of the implementation of laws do not always get the attention that they deserve and in concrete terms this can be seen in many areas of the real estate and construction sector.

In addition to laws, standardisation is also an effective instrument of normative steering. It could also be used as an effective normative instrument supplementing legislation. One of the obstacles to this is the fact that in the interpretations of the Constitution, it has been difficult to find a place for standards in the menu of national regulatory toolkits. Standardisation might well be able to play a stronger role in the entity of central and local government steering instruments.

(2) Information steering is a wide group of very different procedures, in which the central and local government produce and distribute information by, for example, preparing recommendations and manuals or by disseminating information on quality or prices. The aim is to influence the activities that are being steered. The problems of information steering have been discussed in public on many occasions in such documents as the annual reports and opinions of legality issued by the Chancellor of Justice, and the performance audits of the National Audit Office. Information steering is widely used. The problem is that, in practice, information steering is not allocated enough resources so that it could be used for tackling specific matters of great importance. A concrete example of this is the Government-initiated moisture and mould programme, in which efforts have been made to tackle a set of difficult and widespread phenomena with meagre resources. A requirement for effective information steering is that more attention is paid to how it is relayed and incorporated in the decision-making and practical work of the players concerned. The cognitive quality of the steering (the way in which it is reconciled with the rules of human decision-making and information processing in it), availability and accessibility of steering information and their understandability play a major role as a foundation for effective information steering.

For the future of information steering, there is also a need to critically examine the role played by education and training contents and professional practices in the requirements for information steering. According to the views based on the observations contained in the

performance and fiscal policy audits of the National Audit Office, information steering works well when it is used for steering and developing professional practices in specific expert sectors. When efforts are made to solve wicked problems, there is a need for cooperation across the boundaries of professional groups. A stronger basis for that should already be created in the basic training of different professions. The report 1/2013 of the Audit Committee on moisture and mould problems in buildings gives numerous examples of the need for a new type of multi-professional cooperation in the real estate and construction sector.

In construction projects and maintenance the customer is often in a difficult position. Thus, the other clear area of development in information steering is the organisation of advice and other information steering reaching different customer groups. The production of information and the needs of the information users in the sector do not often meet. The problems connected with the implementation of the waste water decree for sparsely populated areas were a concrete example of a situation where, at least initially, there was little objective expert information, steering or advice supporting the implementation of the requirements laid down by the authorities. There are similar problems with moisture surveys and energy certificates.

Central and local government have effective (3) economic steering instruments at their disposal. These are divided into (3a) tax-based incentives and (3b) different types of grant and subsidy arrangement. Housing and construction and activities connected with urban planning and municipal technology are fairly extensively covered by public sector subsidies, some of which are overlapping. In order to balance general government finances, the volume of the subsidies must be further reviewed during the next few years and already in the next government term. It is also clear that in general, different types of subsidy need to be cut.[37] There are grounds for making subsidies and central government aid in construction and housing more clearly conditional on good and healthy built environments and adherence to the required construction and maintenance principles. This would provide an incentive for construction and real estate management that is in accordance with the buildings' life cycle. When the sustainability and health of local government finances are reviewed, it would be advisable to consider the inclusion of the setting aside of funds for future renovation needs (proposed in the mould report of the Audit Committee) in the examination of the balancing of local

[37] *Separate report K 2/2013 vp. of the National Audit Office.*

government finances and to give more consideration to the accumulated depreciation differences and any underdepreciation.

(4) Competition and markets as such and (5) the activities of the civil society can serve as important steering instruments when society and the real estate and construction sector are being developed into the desired direction. With competition policy and other activities influencing the markets, the central and local government can indirectly influence the development of practices in different sectors. In competitive tendering, there are good grounds for making the management of costs during the operational and economic life cycle of the building as tendering criteria instead of using the procurement prices of individual subprojects. In addition to traditional tendering, procurement legislation also allows other procurement procedures that are often better suited for implementing innovative projects. The strategic procurement activities of the central and local government can also help to maintain the basis for healthy competition and well-functioning markets. However, in this respect many Finnish municipalities are too small to act on their own. In the continuation of the municipal reform and the reforms of municipal legislation, there is also a need to provide a better framework for procurement cooperation between municipalities, particularly in strategic procurement.

The Finnish Consumer Agency (now the Finnish Competition and Consumer Authority) has successfully cooperated with organisations in the sector in such areas as the development of practices in housing package sales. The Confederation of Finnish Construction Industries plays an important role in many development projects in the sector. The Finnish Association of Civil Engineers has an important role in the production of the ROTI report on the state of Finland's built environment. In the future, there is also a need to sharpen the efforts towards phenomenon-based effectiveness in which the central and local government actively cooperate with their partners in steering-related matters. Even though the meagre resources available to the authorities have often provided an incentive to this, there should also be cooperation on the basis of effectiveness. In addition to the sectoral organisations representing Finnish industries, there should also be other non-governmental organisations representing users that would support the maintenance and development of a pleasant built environment.

Information systems are one of the most effective steering instruments (6) in the current and, particularly, in the future digital network society and in its information management. Well-functioning information systems allow more intelligent and more optimal operating practices. Information systems also make it possible to influence the behaviour of humans in a

fascinating manner. As Professor Lawrence Lessig, an internationally renowned expert on information law, has said: 'Code is law'. Operating, ICT and information architecture can be considered as the 'constitution'. In pleasant living environments, energy efficiency and in many other activities, there are still many unused opportunities for the real estate and construction sector to optimise its practices by means of intelligent solutions and use the solutions for developing behaviour in the desired direction. Intelligent transport solutions will also change our idea of good urban planning in many areas.

Information systems and the support that they provide should therefore be clearly recognised as a well-functioning steering instrument. The development of information systems and using them in steering are one way of solving the issue of actively monitoring the functioning and maintenance of building technology systems and of activating the users. Information technology solutions may also offer new opportunities and ideas for arranging the documentation required for good real estate management. In the short run, one of the most important tasks is the safe and efficient introduction of the concept of open data in the data resources of the construction and real estate sector and to ensure that the process can be carried out as extensively as possible.

6.6 Finally

It is clear that extensive steering system innovations are also needed so that the parliamentary opinion on moisture and mould problems and the practical development needs in the construction sector laid out in the report of the Audit Committee can be implemented. We must move on from one-off measures into more effective overall governance and into a situation where the central and local government aim for phenomenon-based impacts. Otherwise, the mistakes made in connection with the Government resolution on renovation building and the moisture and mould programme (too little with insufficient resources) will be repeated. Development of steering in the real estate and construction sector could also serve as a good test laboratory for the development of the Government's steering policy.

One area for development in the production and use of information required in steering is quite obvious, even though it alone would not provide the solution. In cost calculation and the tendering of projects, systematic efforts should be made to calculate and optimise costs of the building over the entire life cycle. In construction and maintenance,

specific efforts should also be made to optimise costs throughout the life cycle of buildings and structures. In competitive tendering this perspective should be made into a central objective and a selection criterion. The legislation on public procurements would make this possible provided that there is enough readiness to use the option. It is also necessary to revise the economic steering systems so that they would support target-setting based on life-cycle costs. Despite criticism, the model applied by Senate Properties in central government real estate management, which is based on the management of commercial premises, provides a relatively workable framework and incentives for long-term real estate management and investments. In local government finances, there are also good grounds for updating steering systems and budgeting so that they would support long-term asset management.

It is also necessary to subject steering instruments to innovation testing, or to examine whether in the current situation, we should approach the problem differently and how the selected model or operating approach would support innovation. Particularly in public construction, because of the ability of the public sector to shoulder substantial risks, it could be possible to promote and test innovative solutions that in the long term could benefit the whole sector and all citizens and consumers.

7 Summary

Juha Kostiainen, YIT, Timo Oksanen, VTV

7.1 Challenges facing Finnish society as drivers for knowledge, expertise and renewal of the real estate and construction (KiRa) cluster

Finnish society is facing major challenges. Decades of economic growth and favourable population structure allowed Finland to build a Nordic welfare state with continuously expanding services and social safety networks. Now European economies are in trouble and prospects for growth are weak. Furthermore, Finland is ageing more rapidly than any other country in Europe, which creates pressures for structural reforms.

The concurrence of the structural shock and economic downturn is only one example of the wicked problems that we are facing. Other such issues include the impacts of climate change, the demand for higher energy efficiency, better competitiveness, more healthy competition and the reforms of municipal and social and health care services. Wicked problems are characterised by the fact that any solutions are shaped by the definition of the problem, there is no clear beginning or end for the problem and the solutions are not universal and may not always be right or wrong.

A useful comparison can be made between wicked problems and what are called tame problems, while a division can also be made between enduring problems and removable problems.[38] Both (and particularly the first-mentioned) help to illustrate wicked problems. Removable problems can be eliminated using targeted measures that are designed for specific circumstances. At the same time, enduring problems require theoretical background work and a definition of a specific policy, which is a prerequisite for tackling the problems so that the negative consequences of the conflicts resulting from the problems can be managed. In the management of both problems, research, development and innovation (RDI) plays a central role both in general and in the real estate and construction sector (KiRa) in particular. In both areas, there is a need for rational operating models. However, the content of rationality is different,

[38] *See Kekes 1987.*

depending on the problem, and also requires different operating orientations and governance tools.

7.2 Governing knowledge, expertise and renewal: governance of complexity, national wealth and different steering instruments

Development of the KiRa cluster and the steering of innovation in the KiRa cluster are good examples of complex challenges in which there are different interdependencies between factors and which are of great importance to the national economy. Among the identified sub-factors are the following: risks connected with new materials and design solutions; need for more compact urban structures; slow planning process; increasingly expensive housing in the Helsinki region; moisture and mould problems in buildings; discrepancy between demand for and supply of customer information; compartmentalisation of information in different professional sectors; individual technological innovations versus lack of conceptual and management innovations; and, in general, the large and complex role of the public administration (as customer, regulator, partner, provider of funding, planner, etc.). Considering the fact that the cluster accounts for more than 70 per cent of our national wealth, we are dealing with a wicked problem, which has a substantial economic impact.

There are many different parties using or influencing the use of the steering instruments of the KiRa cluster and, at least indirectly, its RDI activities. They include the EU, the Parliament, the Government, Parliamentary Ombudsman, Justice Chancellor, National Audit Office, Supreme Court, Supreme Administrative Court and municipalities. Steering is conducted through normative steering, information steering, economic steering and, naturally, thorough competition and markets. Information systems are also among the most effective steering instruments in an information society. Normative steering or, in a more general sense, regulation is a particularly effective steering instrument. In the case of the KiRa cluster, the relationship between RDI and regulation is interesting, particularly during the drafting stage.

7.3 Intertwining of different steering elements: knowledge and values in regulation as an example

In the drafting of laws, the basic aim is to make use of RDI. Basically the question is of the use of already available research because nowadays the timetables of law drafting are so tight that they leave little time for new research. At most it is possible to conduct a small number of reports. The essential thing is whether the research findings are put into effective use and whether the innovation has produced new solutions. The reliability of the information must also be weighed. As the law drafting process progresses, the decisions on the content of the proposal will be entrusted to political decision-makers, and in this connection it will also become clear how much emphasis will be placed on research information. Will the main emphasis be on the results of RDI or will the decision be between values? The obligation to build civil defence shelters and the fire safety regulations of the 1980s are interesting examples of the dominance of different perspectives. It is difficult to find research information supporting the view that they are necessary and in fact the decisions to construct them are largely based on the choice of values at political level. At the same time, fire safety regulations were updated on the basis of expert information and as a result, there was a substantial reduction in the use of wood as construction material. As such, it is not necessary to make such a clear distinction between the two approaches. One should rather conclude that RDI and the choice of values should be in adequate interaction so that the best results can be achieved.

7.4 An important and specialised core area of the cluster's RDI activities: RDI in companies

A major part of RDI in the KiRa cluster takes place in companies and is aimed at developing their business operations. It is repeatedly claimed in the public discussion that there is little development activity going on in the cluster. Even though there is undoubtedly some truth in this, the role of different players should also be examined. At first, it should, however, be remembered that the level of development activities in the cluster is often only described on the basis of construction information, which in itself is misleading.

In capital intensive industries, it is typical that the main players of the sector act as integrators, which focus on the innovation of processes and business models. At the same time, technological product innovations are often made by subcontractors (such as manufacturers of materials and equipment), which means that they also appear in different statistics. Most of the innovations in the KiRa cluster are made in the construction products and building technology companies whose markets have become more international during the past 20 to 30 years. Many Finnish companies have become subsidiaries of international companies, which has led to a reduction in domestic innovation.

7.5 The area between private and public sectors as a governance balance challenge: Would there be demand for a public-sector SHOK?

The relationship between universities and research institutions and the companies in the sector is also characterised by a certain degree of tension. In the view of the research institutions, the sector is unable to become sufficiently committed to long-term research, while the companies do not believe that they would get commercial benefits. The strategic centre for science, technology and innovation in built environment (RYM) is one attempt to solve this problem. A more general problem is that the nature of the knowledge base of the KiRa sector has not been identified. Biotechnology, development of pharmaceuticals, and some areas of ICT technology are based on what is called the analytical knowledge base, which is characterised by deductive processes, scientific and codified information, publications, patents, etc. At least to some extent, heavy engineering and construction are areas with a synthetic knowledge base characterised by tacit knowledge, inductive approach and the use of the empirical information produced by users and partners. This should also be taken into account in research. Producing information about possible future scenarios would be one specific research field.

Tekes and the Academy of Finland are the two main providers of funding for innovation activities in our country. In its choices, the Academy of Finland emphasises scientific quality and gives little consideration to social or industrial relevance. At the same time, Tekes is increasingly focusing on boosting business activities aiming at international growth or radical changes in Finnish industries. However,

between these financing principles there is an area for which it is difficult to find funding. There are major social problems in which not enough RDI inputs are devoted to finding solutions as financing is fragmented and the time span for the use of the solutions is too long from the companies' perspective. Such areas include mould problems and the decay of the physical infrastructure. According to the estimates of the Audit Committee, eliminating the mould problem would cost about 1.4 billion euros. These problems cannot be solved by the public administration alone. One way of tackling such 'middle-ground' challenges would be the establishment of a public-sector SHOK. When consideration is given to this, we should remember one of the main conclusions of the workshop referred to at the end of the introduction: Before considering instruments such as new RDI-related structural solutions in the KiRa cluster, we should examine whether the problems are primarily connected with the adequacy of currently available instruments or whether they are connected with our thinking and operating culture, a public governance framework that goes beyond the KiRa cluster or perhaps with all of the above. When examining this issue, we should expand our perspectives.

7.6 Paradigmatic change challenge of the governance model: turning producers into users and threats into opportunities

A central issue from the perspective of RDI in the KiRa sector is how the transition from production-oriented approach into user-oriented approach is made, or how the users can be involved in development work, whether it is the question of the development of urban areas, housing services, office premises or shopping centres. There are encouraging examples of this in other areas. The co-creation approach also needs to be supported by research though not so much by technological research.

From the perspective of development work, it should also be remembered that a demanding customer is often also a good provider of incentives. A good example of this are life-cycle projects in which the customer determines the service level and conditions while the operators are responsible for the investments and maintenance. Contracts extending over ten years (occasionally over 30 years) provide an incentive to durable and high-quality construction. The E-number for energy efficiency introduced last year also helps to boost innovations as it gives operators a free hand in the field of technical solutions. At the same time, detailed regulation only leads to price competition.

The second important change challenge, which can also be characterised as paradigmatic, involves the turning of the social challenges of the KiRa cluster into opportunities. From the perspective of society and the economy, the transition from a production-based, knowledge-based and technology-based approach to a user-oriented and customer-oriented approach must be accompanied by a transition from a problem-centred approach to an approach based on opportunities and solutions. RDI connected with the needs of the citizens, customers and users serves as the engine for the transitions. The scale of this change is of such magnitude that it also requires a new type of governance as an engine.

7.7 A new steering model for the KiRa cluster: Making KiRa cluster into a test platform?

The change in the Finnish society and the operating environment of the KiRa cluster described above will force us to re-examine decision-making and steering instruments in the public administration. Is the traditional top-down steering culture along sectoral lines adequate in a situation characterised by complexity and interdependencies? Does the Government actually decide on the steering policy or is it held captive by old structures? It is clear that there is a need to update the steering policy and the operating practices of the central government so that it can operate as a single organ. The new steering policy could be tested in the KiRa cluster. After all, it is in many ways affected by decisions by the central government (RDI policy, Land Use and Building Act), regional administration (ELY centres, regional land use planning) and local politicians (land use, land use planning, etc.).

7.8 Renewing RDI of the KiRa cluster: Providing the core of the test platform?

From the perspective of this publication, the most important sub-challenge of the reforming of the KiRa cluster's steering model involves the better management of the cluster's RDI activities. The role of RDI as a tool of the KiRa cluster, a tool for steering and governing the cluster and as a prerequisite for efficient and effective use of other steering instruments (demand, customers, norms) is rapidly becoming more important. This change poses a challenge to the traditional core features of the cluster's

steering and governance model (norms, supply on the markets, self-steering) by providing a new perspective without knowledge and innovations replacing other central steering elements (such as values, needs, demand and future challenges). In an optimal situation there is fruitful dialectics between them. In the worst situation, different steering elements are disconnected and there is no useful interaction between them. The articles in this publication provide examples of both even though there seems to be more material about the latter.

7.9 Should the public sector play a role in the renewal of RDI in the KiRa cluster?

One core issue in the successful renewal of the steering model involves the balancing of the above-mentioned steering and governance elements (values, knowledge, regulation, markets, etc.). Who should assume responsibility for that? The definition of the relationships between steering elements can be considered a core issue in the governance of the KiRa cluster (subject of this publication). One reason for this is that this choice also determines the core issues of the steering policy and a number of other more specific solutions.

The complex topic of the governance of RDI activities and expertise was discussed in the introductory chapter by examining the background to the requirement and basis for governance as follows: 'The fields of public activities and perhaps the fields of public responsibility directed at different processes in particular have expanded to cover increasingly differentiated tasks, which, as a result of the differentiation, require broader expertise. The entity of different procedures that aim to provide answers to these new challenges is commonly referred to as governance.' The publication describes phenomena of the governance of RDI activities in the KiRa cluster from different directions and consideration is given to elements and tools of governance and its operating environment.

According to a number of assessments, finding balance between different steering and governance elements requires what are called systemic innovations. Systemic innovations are characterised by the fact that the balance between steering and governance instruments can be found through gradual and mutual adjustment based on testing rather than through rapid and abrupt changes in individual governance elements. This seems to be particularly clear in the KiRa cluster. References have already been made above to the fact that knowledge cannot replace other steering instruments as in many cases it actually supplements other

steering instruments and rationalises their use. However, due to various inflexibilities and path dependencies, the adjustment of steering and governance instruments also requires systematic steering and governance.

Based on the publication, the factors conditioning adjustment that are contained in the internal and external environment of the KiRa cluster are so strong that the central and local government should assume a great deal of responsibility in the sector. This would include opinions on such issues as the desirability of different target areas, priorities, time spans and uses of RDI activities. The articles show that market failures require different types of public-sector action in the KiRa cluster. Shortcomings in public-sector regulation and governance make it more difficult to eliminate market failures and require urgent examination, piloting and well-planned introduction of a new steering and governance model.

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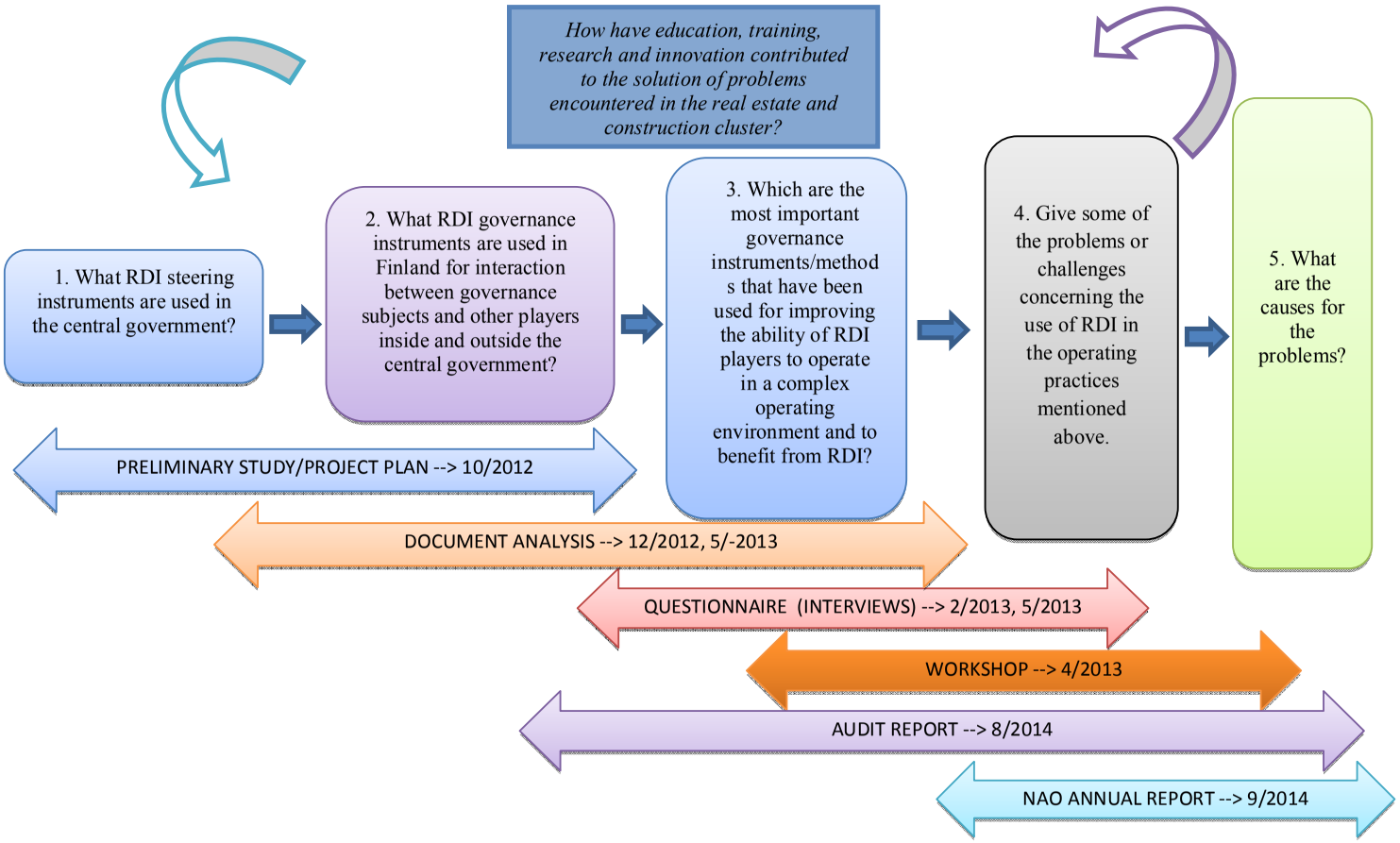
Annexes

Annex 1. Audit outline: questions to be asked, information collection and reporting tools, and timetable.



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