Towards Regional Development by Higher Education Institutions

An Empirical Study of a University of Applied Sciences

Rauno Pirinen
RAUNO PIRINEN

TOWARDS REGIONAL DEVELOPMENT BY HIGHER EDUCATION INSTITUTIONS: AN EMPIRICAL STUDY OF A UNIVERSITY OF APPLIED SCIENCES

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Abstract

This thesis addresses the realisation of the regional development task of higher education in response to new regional and national challenges. This regional study investigates how the third task of regional development can be understood and was addressed at Laurea University of Applied Sciences (UAS). In this qualitative study as research continuum: action research is used in the investigation of an organisational-regional change, the integrated perspective of the design research is in the systemising of design and a multiple case study research is integrated for bringing an understanding of a research scope and in addition it can produce new knowledge for design and action. The unit of analysis was a case study and the analysis was undertaken using empirical, in-depth data collected between May 2001 and September 2012.

This study provides new and critical insights into the integration of regional development and regionally focused higher education within emergent value networks. In the centre of the study, there is the collectively developed integrative model at Laurea UAS, specifically, the student-centred integration of regional development, research and development (R&D) and higher education functions. Here, in this operative environment, close proximity with an integrated web of R&D activities and projects produces new knowledge. This investigation into the new “third task” of the regionally focused university focuses on the development of new knowledge from value networks and externalities, within which R&D activities steer the direction of new knowledge. This research uses an integrative model to examine the dynamic workings of an emerging networked innovative collaborative environment, consisting of UAS spin-offs and initiatives for knowledge-based economic development, and strategic alliances between the actors of the regional knowledge flows that are rapidly extending towards more global networking and interaction with international externalities.

Keywords: continuum of research, focused university, innovation system, regional development, regional study, third task

Tutkimuksessa toteutettu toimintatutkimus kohdistuu ammattikorkeakoulun muutoksen tutkimiseen, ensisijaisesti tutkitaan aluekehitystöä, toteuttamista ja siihen liittyviä muutoksia, vuorovaikutuksia ja toteutusmalleja. Tutkimukseen sisältyvän suunnittelututkimuksen näkökulma on suunnittelun systematisointi. Sen tavoite on tutkia, jotta voidaan kehittää, parantaa ja arvioida malleja, käsitteistöjä, luokituksia, metodologiaa, artefakteja ja palveluja. Tapaustutkimus tässä tutkimuksessa tuottaa syvällistä ymmärrystä tutkittavasta ilmiöstä sekä lisää tietämystä suunnittelun ja toteuttamisen tueksi.

Toteutettu integratiivinen toimintamalli yhdistää aluekehitystöitä sekä toiminnassa kehitettyä kansainvälistä arvovarastoa että alueelliset avainprofilit, strategiat ja innovaatiojärjestelmiä aktiiviteettii. Toteutuksen toimintalogiikka yhdistää strategioiden, visioiden, luovuuden ja ajattelun syklisen maailman kehittämispohjaiseen oppimiseen ammattikorkeakouluissa. Toiminnan alueellinen ja yhteiskunnallinen vaikutuvaus ilmenee palvelujen, teollisuuden ja korkeakoulun yhteistyössä ja vuorovaikutuksessa, erityisesti yhteisöllisen toimintatavan, oppimisen integrointumisen, turvallisuuden sekä osaamisen, palvelujen ja tuotteiden kehittämisen alueella. Samalla integratiivinen toiminta edistää alueen kehittämistä tuottaen tietovarantoa sekä kansainvälistä verkostoitumista ja osaamista yksilölle, työyhteisölle ja alueelle.

Asiakirjan mainitut tiedot:

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Oulu
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This research was started in late Spring 2001, when I was employed as a principal lecturer at Laurea University of Applied Sciences. The work introduced me to the research topic of “exploring regional studies” with respect to the integration of research and development and regional development in higher education. Now, looking back on the eleven years that have passed during my integrative work and study, I realise many people contributed to and stimulated my studies.

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Espoo, March 2013
Rauno Pirinen
List of original publications

This thesis critically examines the new regional development role of universities as demonstrated in the following collection of academic publications:


V Pirinen R (In press) Governance of an externally funded research and development: a multiple case study analysis. WSEAS Transactions on Advances in Engineering Education.

The first article was reviewed by the International Journal of Innovation and Regional Development, which is quality classified by the publication forum initiative of the universities in Finland. The second paper, presented at the AMCIS 2009 (Americas Conference on Information Systems), was peer-reviewed and includes a double-blind system. The proceedings of the AMCIS 2009 are archived in the AIS Electronic Library (AISeL). The third article, presented in the International Multi-Conference on Engineering and Technological Innovation, was peer-reviewed and it involved a double-blind review system. The fourth paper takes the form of an article published in the Creative Education Journal, which is peer-reviewed and has a quality control process. The fifth study is reviewed in the WSEAS Transactions on Advances in Engineering Education, which is also quality classified by the publication forum initiative of the universities in Finland.
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1 Introduction

1.1 Background and research environment

This thesis is positioned in the field of Industrial Engineering and Management at the University of Oulu. In this study, the primary research encompasses management sciences, service and product design and development, the integration of activities of research and development (R&D) and higher education as regional study. The agreement for the research of this regional development task related thesis was underwritten at Laurea University of Applied Sciences in Espoo, March 2002. The data collection for the research commenced in May 2001 and was completed in September 2012, when statistics for 2011 were complete at Laurea. The research agreement was based on the increasing needs of R&D and integration of regional collaboration and activating of study units in the Espoo and Helsinki metropolitan area between universities of applied sciences (UAS) as well as numerous other knowledge producers and higher education institutions. These included business organisations, new and medium size firms, entrepreneurs, universities and other R&D institutions (Regional Development Strategy 2002, Huttula 2001, Finnish Act 351/2003).

In this study, the integration of R&D and education in a UAS with an R&D network are investigated from the perspective of regional development. Here, interactions of industry and service, government and academia, the triple helix are based on the collaboration of R&D actors (Etzkowitz & Leydesdorff 1998). These vertical ties and collaborations are expected to function and create regional sustainability, different types of value, and welfare and safety with achieved collaborative atmospheres as trusted “co-creations” in expanding R&D. The collaboration includes management activities, regionally integrated strategies in higher education, services for supporting new inventions and innovations and sharing regional R&D within industrial-service, value networks and European level research programmes (Goddard & Chatterton 1999, Goddard et al. 2000). The empirical focus of this study is in the growing importance of the integration of regional and national R&D and higher education (Lampinen 2003, Harmaakorpi 2004, Kautonen 2006, Teräs 2008). Here, the collaborative R&D activities combine multiple methods, knowledge from multiple sources and a multidisciplinary approach and “co-create” it with other actors for novel and benefiting competences and capabilities, which relate to authentic R&D projects,
clusters, innovation systems, industry, region and society. In the middle of this focus, there are collective and regional R&D activities and regional focused R&D profiles with international networked R&D actors (Regional Development Strategy 2002, Huttula 2001, Rauhala 2008, Tarkkanen 2009).

The challenges regarding regional R&D in higher education have changed rapidly in the ten years between 2001 and 2012. From the perspective of this study, it has been as government policy for UASs to respond to these challenges. In this research environment, knowledge-based workplaces in both the economy and in society create an expanding and rapidly changing professional labour market for which higher education is expected to provide competent and capable graduates (cf. Salminen & Ali-Yrkkö 2010). The Finnish Act (351/2003) by the Parliament of Finland sets three tasks for UASs: (1) education, (2) research and development, and (3) regional development. The regulation by Finnish Act (351/2003: Section 2) decrees that together universities and UASs form the higher education system as a dual model in Finland.

In the environment of this study, UASs offer and develop adult and master’s level education, which is ordered to maintain and increase workplace and regional profiled R&D competences. It is the responsibility of UASs to provide higher education that is focused first on skills requiring professional expertise based on the requirements of the labour market and its development, second, on scientific research and on artistic principles, to support the professional development of individuals, and to carry out applied R&D in service of the development of UAS education, the labour market, and regional development, taking into account the social structures of the region in question (351/2003: Section 4).

As a consequence of the regional development task, the role of UASs is to collaborate with trade and industry representatives and other employers, particularly in their own regions, as well as with Finnish and foreign higher education institutions and other educational establishments as a prerequisite of partnership. Here, the perspective of higher education is based on the demands of the employment market and its development; consequently, the UASs and employer representatives need to work together to develop of collective R&D communities and useful externalities (Pirinen 2008). Research conducted by regional development based on the demands for development of the employment market can be used in the workplace to generate new competence and regional capability, which means an ability to do something. This might include, for example, regional capabilities to increase the productivity of the region and development by using a research-oriented approach and support for student

This study uses the Oxford Dictionary of English (ODE 2005) as its base glossary. Statistics Finland (Statistic Finland 2012) provides the definition of the most fundamental term of the study, “R&D”, which is understood as systematic activity directed towards acquiring more information and using the information for finding new applications; the criterion of the term “R&D” is that the goal of the activity is something novel and new. In this study, the terms “research environment” and “operative environment” refer to the metropolitan area of Espoo and Helsinki. “Regional development” circumstances are regarded as those in which a particular activity, action or event happens or a combination of circumstances, variables, and conditions that affect an event, activity or action at a known moment (Corbin & Strauss 2008, ODE 2005). In this study, the term “regional development” is used in an experimental context, regarding an environment where UAS education would improve the kind of expertise that influences student advancement in their work life and creates the requisite conditions for a successful employment market. The rationale is that during their studies, students become experts in network flows and in the development processes of new capabilities. This allows connecting various cultures of expertise to the development processes, such as collaboration in R&D, which includes (1) individual development, (2) community development and (3) regional development. This, in turn, means that students can bridge the unique workplace competence in their own development. In this research, the term “learner” refers to a student, teacher or participant who enriches their own competence through collaborative R&D work, by sharing expertise and learning from others, where collaboration and integrated regional development are used (Pirinen 2009d). The term “student” is used to indicate an individual registered as a student in the database of the Ministry of Education and Culture (AMKOTA).

The term “communities of expertise” represents internal, external, national and international externalities and networks, which help learners build their own communities of work, expertise (Voorhees 2001, Hakkarainen et al. 2004, Teräis 2008) and emergent value networks (Todorova & Durisin 2007, Pirinen 2008, Pirinen et al. 2009, Tarkkanen 2009). Hence, competent graduates would have comprehensive expertise and capabilities in various disciplines (Virtanen 2002, Sölvell 2009). This implies a social and constructivist worldview comprising the gathering and processing information, reflecting on one’s own experiences,
sharing knowledge with others and continuously developing one’s own work and R&D methods, such as learners’ sustainable and lifelong development (Lehtinen & Palonen 1999, Tynjälä 1999, Ruohotie 2000, Poikela 2001, Salter & Martin 2001, Howells 2005, Jensen et al. 2007). Here, knowledge refers to understanding the complexity of the environment in order to identify the influences behind various phenomena. Engineering and management refers to not only managing contents, building applications and services, but it also connects the understanding of processes, action logic and practices by which information and knowledge are produced (Regional Development Strategy 2002). In this study, the term “collaboration” addresses the realisation of the authentic and regional R&D that is collectively joined to regional and national R&D (Pedagogical Strategy 2007, Pirinen 2008). Students are consequently in the middle of the regionally integrated R&D process, which conducts regional profiles, capabilities and abilities by bridging unique knowledge and competences in practice (Gulati & Singh 1999, Salter & Martin 2001).

In this study, the unit of analysis is a “realised sample of evidence of R&D”, which is used as a case study in higher education where the emphasis is on regional development with authentic and integrated R&D. The sample of evidence can be either qualitative or quantitative. The same unit of analysis as “display” or “sample of evidence” is used in parts of the analyses in three journal articles (Pirinen 2012a, 2012b, V); two conference articles (Pirinen 2009a, 2009b); and seven FINHEEC (Finnish Higher Education Evaluation Council) evaluation transactions (archived as KKA 8:2001, KKA 12:2003, KKA 13:2006, KKA 1:2009, KKA 1:2010, KKA 18:2010, KKA 7:2012). Respectively, the editors of these archives are referenced as follows: the (KKA 8:2001) is edited and referenced by Huttula (2001); the (KKA 12:2003) is edited and referenced by Impiö et al. (2003); the (KKA 13:2006) is edited and referenced by Käyhkö et al. (2006); the (KKA 1:2010) is edited and referenced by Auvinen et al. (2010); the (KKA 18:2010) is edited and referenced by Lampelo et al. (2010); and the (KKA 7:2012) is referenced by Maassen et al. (2012).

1.2 Objectives and scopes

The scope of study is concentrated on the strategic objectives and regional setting, integration of regional development, R&D activities and education at Laurea in the Espoo and Helsinki metropolitan region between them and Laurea and other producers of services, competence, knowledge and R&D actors. In this study, the
The research context and scope are focused on the integrative model, where the term “collaborative” means acting in an interoperable and “co-creative” way with other actors. The selected perspective of the study is limited to a UAS context as representing one sample and case study of the Finnish higher education system. The operative environment of the study is Laurea University of Applied Sciences and its related R&D network. The perspective of the study consists of the empirical student-centred R&D execution in master’s, bachelor’s and degree education in the programs of information systems (n = 489 students in 2011), security management (n = 340) and services (n = 920).

1.2.1 Rationale for the study

The rationale for the study includes the integration of higher education and regional development. Then, it also relates the change towards integration of higher education and regional R&D. The scope was that region oriented R&D in higher education would more rapidly (1) “co-create”, (2) improve, (3) produce testing of new knowledge, understanding, methods, artefacts and services and (4) increase the advantages of student-user-centred R&D with multiple multidisciplinary methods in the actualisations of study units. In this regional setting the authentic and collaborative method of R&D based education appears. It strives studies from its initial stage to competence development in the complexity of the real world and development of profiles and R&D integration in the region (Alvarez & Barney 2007, Amaral & Magalhaes 2002, Abowd 1999). From the context of this study, this method of R&D integration was considered a new transition from classical implementation of study units to the enactment of authentic and regionally oriented R&D in every day studies and education. This critical assumption included that learners should utilise better traditional “isolated sets of information” in a regional R&D context. Collaborative regional R&D objectives, scopes and profiles would guide learners to modern and creativity-oriented R&D. In addition, the action would achieve an improvement of proactive regional capabilities and mobilisation of knowledge reserves (Eraut 1994, Lytyinen & Probey 1999, Voorhees 2001, Karjalainen 2003, Regional Development Strategy 2002, 2005).

Because they required not only meeting the demands of the employment sector, but also training the organisation, employees and learners of the future, as well as promoting international interactions and improvements of regional development and mobilisation, the objectives and scope of the study were
challenging (Pedagogical Strategy 2002, Pirinen 2008). In consideration of the objectives and difficulty of this study, one perspective was that a purposeful use of new information requires that knowledge and information be assimilated into a sufficiently novel and broad context; for example, be activated and mobilised in networks and clusters, so that information and knowledge are not just repeated but also understood, revised and given value. Although integrating the regional development task appears challenging, it both enriches and contributes to higher education. It would additionally improve mobilisation of reserves, and proofing and improvements of R&D bindings in regional R&D amalgamation.

A consideration of an alternative scenario was that if the tasks of regional development and R&D are implemented using isolated and dedicated units in UASs, then influences on the students are challenging. Here, information knowledge hubs are only small units, which cooperate in the field of R&D and regional development. The reasoning in this situation was that in everyday practice, even in situations in which organisational and regional development is valued, the core processes are isolated rather than collective. Indeed, organisations often minimise the effects of development by establishing special dedicated units that are isolated from core processes. These dedicated units are often created to oversee organisational development, quality assurance, methodology design, risk assessment and other valuable learning activities. These isolated departments then act as reserves of competences that are rarely accessed (Lyytinen & Probey 1999, Nonaka & Takeuchi 1995, Fränti & Pirinen 2005). Hence, the assumption was that if a large number of developers of both work places and students of higher education can be trusted and mobilised to further regional R&D, then more “co-created” regional results and impacts would be achieved. Regardless of these practical arguments, the alternative is a rival implementation model, frequently called the “separation model”, which has been used for realisation of the three statutory tasks in many Finnish UASs between 2001 and 2011 (AMKOTA 2011). In this context, the term “impact” refers to marked effects and influences such as R&D related activities having clear effects on the regional-national capabilities, abilities, business and welfare.

In 2001, I selected the integration of higher education from the perspective of regional development, as the main scope, interest and objective of this thesis and regional research study. This thesis addresses requirements that, in order to react to the regional and national challenges, UASs need new perspectives in (1) understanding, (2) designs and (3) student-centred R&D on the integration of their regional development tasks.
1.2.2 Research questions

The study includes one main research question, which was additionally focused by five expanded and iterative research questions in five studies in which the research questions of each study produced more detailed insight into the main research question. In addressing the research questions of the five studies, I have drawn continuously deepening iterative and heuristic standpoints to the research: (1) integration of regional development to education, (2) integration of R&D to education, and (3) investigation of the changes in realisation of study units and education in everyday practice and the context of study, where (4) a unit of analysis is a sample of evidence as a case study. In this research, the main research question was to gain a deeper understanding and design of the structures, characteristics, factors and actualisations of regional development and R&D in the context of a UAS.

The main research question is: How can the regional development function be understood, designed and actualised in a UAS?

As a root of continuum to all five studies, the main research question was primarily based on a strategically selected method of including regional development and R&D orientations into higher education. The scope of the first study, which included two action research cycles, addresses the analysis of a collaborative means of thinking about organisational change, and utilising the two FINHEEC evaluations of new implementation logic of regionally integrated R&D based education and regional R&D collaboration. The foundations of the study are derived from FINHEEC evaluations, samples of regional-global integrations and collaboration in R&D activities in a UAS. The first study represents the most macro-level heuristic analysis of realisations from the perspective of understanding and design. The research question of the first study was:

How was the regional development task actualised at Laurea UAS from the perspective of the FINHEEC evaluations, which were conducted between 2001 and 2008?

In the second study, the research focused on collaborative R&D environments, integration models and research methodologies in which an integrative model was the basis of the development-based and regional R&D collaboration. The second research question is:
How can the regional development be understood, designed and actualised in a UAS from the perspectives of integrative research and development framework?

In the third study, the integration of regional development, R&D and higher education all take place in a collective R&D process in which the region matters for competences and shared capabilities. In this regionally focused study, there are also larger influencing geographical units, which are at the least of equal, if not more concern. Here, the region as the primary focus of the study incorporates arguments of external flows as externalities, international pipelines and the globalisation of knowledge. The third research question under examination is:

How can regional development be understood and designed in a UAS from the perspective of effective integration and globalisation models?

The research in the fourth study was focused on improving quality in integrative R&D, including perspectives such as interaction, continuum of research, extended analysis of results, impacts and utility, and the quality of the enactment of study units that work as an interoperational spine for the R&D-framework of collaboration and “co-creative” activities between R&D programmes, clusters, innovation systems and the UAS. The research question of the fourth study is:

How can regional development be understood, designed and actualised at Laurea UAS from the perspective of quality assurance?

Finally, the fifth area of study was on governance, as governance of student-centred and collaborative R&D, which includes development and research participants in a sustainable, cooperative and student-centred manner and shares the regional-national R&D, its funding, capabilities, interests, and agenda. The fifth research question is:

How can the regional development be understood, designed and actualised in a UAS from the perspective of the governance of externally funded R&D projects?

1.3 Research approach

In my work as an instructor, students of a UAS are integrated in R&D, such as in participating in externally funded R&D projects and regional development where the increasing role of creativity takes place, and a focus is on the students’ own
thoughts and imagination-creations relations, which leads to development where creativeness is seen as an emphasized ability in a professional context. In this study, “creation” refers to a thing that has been made or invented (ODE 2005); the learner’s creations would then include almost everything created that can be demonstrated and assessed (cf. Ritsilä et al. 2008). This form of “creativity” appears often in educational interactions within activities for producing something essentially new through imaginative ability or skill, whether as a new service, a new artefact as solution, new knowledge, method or construct. In this study, the term “artefact” is based on and used as an instance of an object made by a human being. The term “construct” is understood as a concept describing relations among phenomena, something that exists at an abstract level and ontology but is difficult to define in formal terms; for example, in this context, the term “creativeness” is a construct (Hevner & Chatterjee 2010, ODE 2005).

1.3.1 Integrative model

In the “integrative model”, learners are encouraged to develop their own ideas and train in competences to become developers and researchers at a regional level. These learning transactions then enable learners to contribute to their collective understanding and regional capabilities (Harmaakorpi 2004). Consequently, in this study, the term “learner” includes a union of students and professional R&D actors as well as actors of a cluster and regional innovation system. The term “collaborative” pertains to the perspective of the integration of regional development, R&D and education as the integrative model. The “integrative model” relates to the shared activities within regional development, regional clusters and innovation systems (Porter 1990, Swann 1998, Cooke & Morgan 1998, Maskell & Malmberg 1999, Doloreux 2002, Asheim & Coenen 2005), which is related to both organisational development (Argyris & Schön 1996, Engeström 2001) and the development of personnel as learners of the future. It promotes international interactions and externalities into the collaborative R&D community as integrative environments, living labs and pipeline structures (Ballon et al. 2005, Ståhlbröst 2008, Teräs 2008). It refers to the development activities as producing a sustainably running driver for the integration of R&D with various types of R&D transactions (Pirinen 2008).
1.3.2 Roles and actors

In this study, “My role is that of researcher, while simultaneously working at Laurea as principal lecturer in the area of R&D within information systems and multidisciplinary research projects. The education and R&D with integrative environments are my main tasks, which form the basis of my work at Laurea. My research work was based on an agreement of the working time, which was decided on a yearly basis; the agreement of the researcher for this thesis was underwritten at Laurea in March 2002.”

In this study, the term “insider” refers to deep involvement and that an actor participates intensively in the development and decision making of related actions as described in a number of studies (Herr & Anderson 2005, Baskerville 1999, Coghlan 2003). Regardless of whether the researcher has any particular insider instance in the research continuum, the research framework with transparent quality system, performed case study research and data collection enables the possibility of exploration by different types of researcher roles as “insider”, “insiders with outsiders”, “outsiders with insiders” and “outsiders” (Herr & Anderson 2005, Baskerville & Myers 2004, Baskerville 1999, Stringer 2007).

Hitherto, between 2001 and 2012, students in master’s level programs in information systems at Laurea (n = 75) participated as research colleagues and as outsiders with insiders in research (Lau 1999, Coghlan & Brannick 2010) and regional development. The researcher participated in the students’ research efforts as a teacher and was in the role of responsible principal lecturer of the master program. The trust-based management and leadership power of the international and integrative research projects were collaboratively shared with students and management.

The management at Laurea includes the vice president and the heads of the departments of Laurea UAS, who were in the “insider positions and roles” in this research continuum of study, as well as the management who participated intensively in R&D management. This combined leadership and management form was based on a bottom-up, student-centric vision and relationship. It was additionally based on an orientation and management culture and philosophy, where the management focus was on variations of power, mutual trust and authority relations and in relationship management (Burr 1995, Gibbons et al. 2008).
The “outsiders” in this study were the evaluators of the FINHEEC, actors of the target and result negotiations in the Ministry of Education and Culture, the owners of Laurea, actors of participating clusters, regional actors, outside evaluators and visiting researchers, financiers, and visiting experts. The “outsiders” were involved cyclically in the action at Laurea; for example, through participation in evaluations, they performed review sessions for personnel, worked towards the development of regional aligned and shared strategy, the “co-creation” of agenda-based scopes to realisations and collectively gathered competences (cf. Avison et al. 1999, Avison 2002, Konu & Pekkarinen 2008).

In the outsiders’ evaluation processes, the researcher was involved in the preparation of proposals, applications, data collection, fact finding, decision making and interventions of audits (KKA 3:2005, KKA 2:2009, KKA 1:2010, KKA 18:2010). In the FINHEEC evaluations, the researcher participated in the “insiders with outsiders” role.

In the environment of this study, the term “co-creation” refers to an activity of mutual creation, such as student-centred and user-centred approaches in design (cf. Luojus 2010, Mattelmäki 2006). In our context of services, the term “co-creation” refers often to the customer-company interactions as mutual value creations (Keränen & Ojasalo 2011). Similarly, in our operational environment, the terms “co” and “centred” both refer to “participation of knowledge creation” and/or “consuming of knowledge”. Through these interactions, learners have an opportunity to take a part in the value creation of innovation system networks and become a “co-creator” of value (Pirinen 2009c, Keränen & Ojasalo 2011). The shared themes of collaborative R&D processes can be appreciated and increase commitment in an atmosphere where learners may increase their motivation, improve their capabilities and contribute their competitiveness within the shared value creating R&D processes (e.g. Tuomisto 2011).

1.3.3 Research methodology

This description of research methodology includes: (1) the viewpoints of scientific research from a philosophical perspective, (2) a methodological continuum and (3) the utilized research methods, including action research, information systems’ design research, and a case study analysis. The focus of the analysis is in the continuum of research methods: understanding (case studies), design, building, testing and definition of the structures and characteristics (design research) and as framework, integration of regional
development and higher education with investigation of related organisational and regional change (action research).

The various parts of study address the practices both of the researcher’s own organisation and as that of a researcher in collaboration with other insiders and outsiders (Stringer 2007, Her & Anderson 2005, Baskerville & Myers 2004, Lau 1999). Although the research data consists of quantitative data, which is primarily objective, the research objects were perceived subjectively in a collaborative framework. Therefore, this study represents the idealist view of ontology and follows the hermeneutic more than the positivist research tradition.

The study focuses on a novel phenomenon and research questions, which are extremely relevant for all UASs in Finland. According to Clark (1976), the main strength of the action research framework is that it combines discovery and implementation in one process. Thus, action research can effectively be used to combine practical action and science. According to Coghlan and Brannick (2010), action research involves a collaborative developing relationship between researcher and organisation, aimed at both conducting development interests and generating new knowledge. In this study, there are five empirical studies, and the unit of analysis is a “case”, which is used as “sample evidence” or “display”. The evidence of the study was drawn with obvious depth where the researcher was personally involved in the framework as an “insider” in the action research and more an “outsider” in the case studies and where the research was fully conducted in parallel with everyday actions. The experiences, sample of evidence and R&D related development processes are used as the main methods of the longitudinal evidence: thus, the research obviously represents the pragmatic continuum of epistemology (Dewey 1925, Popper 1979, Haack 1976, Markus et al. 2002, Baskerville & Myers 2004, Davison et al. 2004).

Here, the logic of thought pattern is addressed to the paradigm, epistemology and ontology. Kuhn (1996) maintains that, since in this study, the influencing paradigm is empiricism, which emphasises those aspects of scientific knowledge that are closely related to evidence, especially as discovered in experiments, the paradigms are used for the description of a scientific discipline in relation to time and, in an epistemological context, are used to refer to a thought pattern of a scientific discipline. According to Popper (2007), epistemology is a theory of knowledge that addresses the acquisition of knowledge. Here, philosophical questions may guidance such as how we know what we know and what are the core influencing theories in the integration of regional development, R&D and education. An objective or logical correspondence, the ontological perspective is
and appears in this study as forms of empirically tested things, activities and samples of evidence; for example, competences, value and novelty of what is learned, integration of theories, logical categories of being and their relations to the integrative method as phenomenon.

In this study, the case study research methods provide an understanding of a complex issue or object and can extend experience or add strength to what is already known through previous research. Case studies emphasise detailed contextual analysis of a limited number of events or conditions and their relationships. As described in the “outsider role”, the exception is when the relevant behaviour cannot be changed or manipulated by a researcher (Stake 1995, Eisenhardt 1998, George & Bennett 2005, Gerring 2007, Yin 2009). According to Yin, the case study inquiry relies on multiple sources of evidence with data that needs to converge through a triangulation approach. It benefits from the prior development of theoretical propositions to guide data collection and analysis. In this continuum of research, the term “triangulation” refers to the usage of multiple sources of evidence such as: (1) data sources, data triangulation; (2) among different evaluators, investigator triangulation; (3) perspectives of the same data set, theory triangulation and (4) methodological triangulation (Campbell & Fiske 1959, Robson 2002, George & Bennett 2005, Gerring 2007, Yin 2009).

In this R&D continuum, design research is considered to produce viable services and artefacts in the form of a construct, model, method, or instantiation (Hevner et al. 2004), and design science produces design science knowledge for the improvement of the activities of design and construction. Specifically, in this case, it produces the knowledge to implement the artefacts, services and methods (March & Smith 1995, Van Aken 2004).

Then, in the continuum as the research framework, action research is included to solve current practical problems while expanding scientific knowledge. As a continuum of the case study analysis, in which the researcher seeks to study but not change the organisational phenomena, the integration of action researcher and design research seeks to bring about organisational and regional change while simultaneously studying the process. It is strongly oriented toward collaboration and change and involves both researchers and subjects. In this continuum, action research is an iterative and continuous research process that capitalises on development by both researcher as a member of the expert community and other regional participants such as students, colleges, collaborators and management (Baskerville & Myers 2004, Baskerville & Wood-Harper 1998, Stringer 2007).
1.4 Research realisation and thesis structure


1.4.1 Focus of realisation

The study focuses on the regional development activities within R&D, concepts and models and collaboration with a regional innovation system. One viewpoint of study is to propose the possible models of R&D-based education, which can contribute towards integration of regional development and effort to producing as designs for improvements of R&D-based higher education, which in turn addresses the potential of the region in conjunction with its capabilities and development efforts within the regional-national innovation system. The second focus of research realisation is addressed in exploring how this new method of R&D and regional integration can be completed in higher education. The third perspective is to outline a screen for the future, as for “The UAS of The Future”, which is built on empirical studies. Therefore, the thesis can elaborate on theoretical and educational approaches that explicate imagination, “co-design” and “co-create” support in collective development and further the constructs of shared R&D activities (cf. Konu & Pekkarinen 2008, Ritsilä et al. 2008).

While the title of the study is “Towards regional development by Higher Education Institutions”, the study is limited to the general domain of higher education in which empirical and tested evidence are primarily drawn from the information systems, security management and services degree programs at Laurea UAS between 2001 and 2012. In this study, the term “empirical research”, refers to inductive knowledge based on observed and measured phenomena and the derived knowledge and evidence coming from sample case. This is in comparison to that which is drawn deductively from theory or belief (Robson 2002).
1.4.2 Data collection

The seven categories (numbered and detailed below) of research data were collected between May 2001 and September 2012. Managing the data and presenting it for analysis was verified by the researcher. In order to facilitate the data processing, all data was organised into the seven data categories based on practical activities and action. Primarily in the form of collected cases of the body being studied, the collected data was adaptable and it enabled reflection on the part of the researcher and it provided a lens into everyday and practical activities. Data analyses were performed continuously throughout the course of the five studies. Reflective reading and preliminary analysis of the research data had already commenced when the research data was collected and transferred to the directory and searched for analysis.

Because of the cyclic research method, and the fact that the research data was continuously being enriched, the research data was analysed while new data was in the process of being collected. While this obviously enriched the research data, preliminary interpretations of the data were conducted in the next phase of the study. Preliminary interpretations of the research data guided the continuous data collection process. Based on the analyses, the following reflection activities were designed to bring focus onto the phenomena of interest to the research. From the enriched and analysed data, the researcher selected samples to the study, which would then be used as parallel data in the next reflection activity. The data from a theme was represented as a model or higher-level concept which can be transformed into a database structure, as in the use of the entity type, which can be implemented as a table in a database (Miles & Huberman 1994, Strauss & Corbin 1994, Chen 1976, Ullman & Widom 2002).

The analysis phase of the study included seven categories of collected research data as numbered and detailed below:

1. management data: which describes Laurea’s strategy-based data: the collected data is in form of: documents, strategies, applications, visions, legislation, indicators, scoreboards, research documents, summaries of follow-up data, comparison data, presentations and implementation plans
2. evaluation data by FINHEEC: which includes applications and results of regional development evaluations, the collected data is on form of the archives by FINHEEC, related applications and presentations
3. data of development days and seminars: these data files are collected by calendar year and by current development themes and then placed in the themed directory. In this view, the term “data displays” refers to the second element in Miles and Huberman’s (1994) model of qualitative data analysis, where the data display goes a step beyond data reduction to provide an organised, compressed assembly of information that permits conclusion drawing.

4. the AMKOTA database: which is mostly quantitative and common to all Finnish UASs, this data category was often used for follow-up and evaluation purposes in this study.

5. feedback data from students which includes: study unit feedback per every study units; early phase feedback per every incoming students; graduation feedback per every student; job placement and internship feedback per every student, in addition, this category includes also the selected research and development publication by personnel and students.

6. evaluation reports and references by outsiders: the evaluation data addresses mainly to the recommendations for improvements and quality; this collected data is in form of publications and reports.

7. data of externally funded R&D projects.

The data collection is cumulative; categories were systematically collected and used for analysis in all five studies between 2001 and 2012. Because RIESCA (October 2007 to March 2010) was our first externally funded R&D project, the data from the externally funded R&D project was involved since 2007 (appendix). The announcement delay of data in AMKOTA is approximately half a year. For reference, the analysed data and numbers of data entities used by studies are described in Table 1.
Table 1. Studies and analysed data.

<table>
<thead>
<tr>
<th>Study</th>
<th>Analysed data</th>
</tr>
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<tbody>
<tr>
<td>I</td>
<td>Action research data collection between May 2001 and December 2008 included: Management Data: Eurostat, World Economic Outlook, and European Scoreboard (n = 3). Development days (n = 56); involved teachers (n = 41); folders (n = 102) and files (n = 469). KKA 8:2001 (Huttula 2001), KKA 12:2003 (Impiö et al. 2003) and KKA 13:2006 (Käyhkö et al. 2006), which included (n = 27) evaluators; references (n = 28); collaborators (n = 10); involved students (n = 1120); master's level students (n = 56); integrated R&amp;D projects (n = 2) SATERISK and FLOODWARE. Integrative environments (n = 4) BarLaurea; REDLabs; Datacom-Lab and Start-ups-incubator at Laurea.</td>
</tr>
<tr>
<td>II</td>
<td>Data for design of integrative framework between May 2001 and April 2009. Development days (n = 81); involved teachers (n = 41); folders (n = 136) and files (n = 671); KKA 12:2003 (Impiö et al. 2003) and KKA 13:2006 (Käyhkö et al. 2006) including evaluators (n = 17); article references (n = 31) and literature review (n = 24).</td>
</tr>
<tr>
<td>III</td>
<td>Data for the design of integrative environments between May 2001 and April 2009. Integrative environments (n = 4) BarLaurea, REDLabs, Datacom-Lab and Laurea Living Labs. Regional Development Strategy 2002, 2005; R&amp;D Strategy 2004; Pedagogic Strategy 2002, 2007; and European Scoreboard 2007. Data for design between May 2001 and April 2009; development days (n = 81); teachers (n = 41); folders (n = 136) and files (n = 671); KKA 12:2003 (Impiö et al. 2003) and KKA 13:2006 (Käyhkö et al. 2006), which included (n = 17) evaluators and article references (n = 31).</td>
</tr>
<tr>
<td>IV</td>
<td>Development days and seminars on the quality assurance system in 2008 included development days (n = 3), teachers (n = 48) and files (n = 26). Development days and seminars on the quality assurance system in 2009 included development days (n = 17), teachers (n = 52), and files (n = 155). Development days and seminars on the quality assurance system in 2010 included development days (n = 4), teachers (n = 54) and files (n = 53); KKA 13:2006 (Käyhkö et al. 2006), KKA 1:2010 (Auvinen et al. 2010) and KKA 18:2010 (Lampelo et al. 2010), which included evaluators (n = 16); article references (n = 37) and literature review (n = 26).</td>
</tr>
<tr>
<td>V</td>
<td>Data for governance and management: data of funded R&amp;D projects (n = 11) as cross-cases (appendix); management data (n = 89) files, which include strategies, drafts of visions, legislation, papers of regional focus, scoreboards and indicators; data of development days and reviews, (n = 420) files, which include data displays, evaluations, reviews, learning diaries, development proposals and reports; data of FINHEEC evaluations regarding the regional development and R&amp;D, (n = 4) evaluation reports; and feedback data from students, (n = 164) reports from the INKA system, which is the information system for feedback from students during different phases and areas of study. KKA 1:2010 (Auvinen et al. 2010), KKA 7:2012 (Maassen et al. 2012), which included evaluators (n = 12) and article references (n = 30).</td>
</tr>
</tbody>
</table>
1.4.3 Data analysis

In addressing the research questions for understanding, designing and integrating regional development in higher education, between 2001 and 2012, the basic qualitative data analysis was continuously involved in organising, accounting for and explaining the collected data. Conclusions were drawn from the data in terms of: situation, themes, categories, entities, relations and regularities (Patton 1990, Miles & Huberman 1994, Robson 2002, Corbin & Strauss 2008). In this data analysis, both qualitative and quantitative data were included (Yin 2009). The unit of analysis was as one selected sample of evidence used as a case study.

In the first phase of the analysis, the quantitative data was interpreted through qualitative terms in reduction, display and drawing cycles of analysis (Miles & Huberman 1994, Stringer 2007). In this study, the qualitative data analysis by Miles and Huberman (1994) was expanded with the second phase of analysis, which can include one, two or all three expanded phases of analysis. Such expansions include: (1) analysis of information systems; (2) analysis of service designs; and (3) analysis of management models in management science. It is noteworthy that each of these three expanded phases can overlap each other and the subsequent second phases are not mutually exclusive; all of them can be used together or separately for facilitation of utility according to the first phase of the qualitative data analysis (Miles & Huberman 1994).

First expansion: the system analysis, which was used as a furthered cycle of qualitative analysis for creating, building, testing and normalisation of data structures, objects, models, artefacts and information-intensive services, was implemented by the theoretical core of (Chen 1976, March & Smith 1995, Nunamaker et al. 1991, Hevner et al. 2004, Nunamaker 2010). Previous studies by Shostack (1982), Mager (2004), Mattelmäki (2006) and Luojus (2010) provided the foundation for the analysis of service science and service design of the second expansion. The earliest contributions of service design to the perspective of marketing and management disciplines are connected to the Shostack (1982) article, “How to Design a Service”, which describes the integrated design of material components, namely products and immaterial component services. A design process can be documented and codified using a “service blueprint” to map the sequence of events in a service and its essential functions in an objective and explicit manner. Effective service marketing requires the recognition of the complex combination of products and services that make up a simple service (Shostack 1982, Mager 2004). In the third expansion, a
significant amount of the literature in management science can be related to the furthering of quantitative and qualitative analysis for utility creation (Porter 1998, Etzkowitz & Leydesdorff 2000, Nowotny et al. 2002).

The studies included both qualitative and quantitative data, where the quantitative data was interpreted in an analysis through qualitative terms in reduction, display and drawing cycles of analysis (Miles & Huberman 1994, Stringer 2007, Lindgren et al. 2004). The information system analysis was then integrated as a furthered cycle of qualitative analysis for utility as building, testing and normalisation of data structures, objects and artefacts (Chen 1976, Ullman & Widom 2002). Consequently, parts of the analysis include continuums from quality to analysis and utility. The data collection included the seven directory structures, as Table 1 described, for the analysis phase; this cumulative data collection was used separately in each of the five studies. Therefore, the investigated data in each study represented one perspective from the whole data collection set, which includes qualitative, quantitative and longitudinal data (views of AMKOTA). In this case, the “longitudinal study” refers to the method of data gathering in which the process is repeated on several occasions over a period of time, repeating the same methodology each time. The practical and theoretical contributions of each study were drawn from the perspective of the data, and the selection of data samples was related to the theme and questions of each study. The expected outcomes of the expanded analysis include such things as new or improved knowledge, artefacts, services, designs, management models, classifications, methodologies, descriptions of “action logic”, structures of data management systems, user interfaces, information systems and structures of data.

1.4.4 Thesis structure

The study structure comprises five chapters followed by the five original research publications. This introduction continues by presenting the theoretical foundation of the study in Chapter 2. The main qualities and principles are explored through the theories, concept and systems of the empirical studies. Chapter 3 follows with an evaluation of the contributions of the five empirical studies. Chapter 4 describes the long-term theoretical and practical implications of the study, the quality perspectives of the research and the recommendations for future research. Finally, Chapter 5 presents the concluding remarks of this study.
1.5 Related studies and summary of research approach

Regarding the integration of “clusters” and higher education in the regional development context, Teräsvirta (2008) states that additional case studies concentrating on only one or some of the key categories of cluster actors, would provide yet another viewpoint to further sharpen the picture on various types of regional clusters, especially such research as regional science-based clusters and concentrations of clusters and higher education (Teräsvirta 2008, Doloreux & Parto 2005). In this study, the empirical integration of higher education and R&D based regional concentrations were furthered.

Clark (2008) suggests that higher education should take more of an entrepreneurial and focused outlook, evolve a set of overarching beliefs that guide and rationalise the structural change that provide a stronger capability, and build a central steering capability to make larger choices that help focus the institution. Hence, it was recognised in this study that a research continuum to understanding, building, improving and testing key regional profiles and the investigation of focused higher education as phenomenon was required (cf. Lester 2005, Ritsilä et al. 2008, Salter & Martin 2001, Koski 2006, Konu & Pekkarinen 2008).

Kautonen (2006) maintains that most of the regional related research approaches are either at a system or cluster level, and only a few aspects refer to an actual firm or to R&D project level samples and analysis. Although this type of future research is needed for comparability, future research is also required in more explicit and empirical level conceptualisations. As a reference from Kautonen, it is especially important to develop a sound theoretical conceptualisation of creativity embracing both artefact based manufacturing and service innovations. In this study, the focus was in services and artefact related R&D and the integration of higher education and its study units.

Ståhlbröst (2008) maintains that more research is needed in the living lab approach to increase the collected knowledge about this concept; research for development of tools to support distributed user involvement is also needed. Ståhlbröst emphasised a shift in the degrees of user involvement going from design for and with users towards “design by users” (Luojus 2010, Mattelmäki 2006). In this study, student- and user-centred approaches are focused in “co-design” and “co-creation” processes as environments in the transition to life. In summary of the research approach, the key entities and descriptions with the most influenced methodological literature are included in Table 2.
### Table 2. Summary of research approach.

<table>
<thead>
<tr>
<th>Entity</th>
<th>Description of approach</th>
</tr>
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<tbody>
<tr>
<td>Paradigm</td>
<td>The influencing paradigm of study is empiricism, which emphasises those aspects of scientific knowledge that are closely related to evidence, especially as discovered in experiments (Kuhn 1996, Popper 2009).</td>
</tr>
<tr>
<td>Epistemology</td>
<td>The experiences, sample of evidence and R&amp;D related development processes were used as the main method of longitudinal evidence; thus, the research represents the pragmatic continuum of epistemology (Dewey 1916, Popper 1979, Haack 1976, Markus et al. 2002).</td>
</tr>
<tr>
<td>Ontology</td>
<td>Although the research data consists of quantitative data that is primarily objective, the research objects were being perceived subjectively in a collaborative framework. Therefore, this study represents the idealist view of ontology and follows the hermeneutic tradition more than the positivist research tradition (Stringer 2007, Her &amp; Anderson 2005, Lau 1999).</td>
</tr>
<tr>
<td>Unit of analysis</td>
<td>The unit of analysis is a sample of evidence as a case study of R&amp;D in higher education where the emphasis is on the regional development with authentic and integrated R&amp;D. The sample of evidence can be qualitative or quantitative, and the same unit of analysis as “display” or “sample of evidence” is used in all analysed parts in this study and the related evaluations by outsiders.</td>
</tr>
<tr>
<td>Form of analysis</td>
<td>The qualitative data analysis was continuously involved in organising, accounting for and explaining the collected data, and making sense of data in terms of situation, themes, categories, entities, relations and regularities. The investigated data in each study represents the one view from the whole data collection set; which includes qualitative, quantitative and longitudinal data. The information system analysis was used as an additional cycle of qualitative analysis for utility as building, testing and normalisation of data structures, objects, databases and artefacts (Patton 1990, Miles &amp; Huberman 1994, Denzin &amp; Lincoln 2005, Robson 2002, Locke et al. 2007, Corbin &amp; Strauss 2008, Chen 1976, Ullman &amp; Widom 2002).</td>
</tr>
<tr>
<td>Approach to new concepts and theory</td>
<td>Inductive design-stream from the empirical data, here, the “inductive reasoning” refers to the process of drawing a generalised conclusion from a particular instance, a process of moving from specific observations or displays to generalisation, models, systems and theory (Patton 1990, Miles &amp; Huberman 1994, Eisenhardt 1998, Robson 2002, Yin 2009).</td>
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</table>
2 Theoretical foundation

The theoretical foundation of this study includes a scale of the most influential literature used between 2001 and 2012 in the empirical and collective development of the integrative model at Laurea and its operative network. The studies were used as functional and theoretical guidance to an extent as required for understanding, developing, improving and testing the integration of regional development tasks, student-centred R&D, and scoping profiles into R&D-based higher education in a UAS context.

2.1 Integrative model

In this sub-chapter, after the preface examines Dewey’s learning by doing and inquiry, the binding of influenced theories of the study is in the constructivist approach, the path-dependent approach, the evolution theory of economic changes and the activity theory. While the constructivist approach provides the educational foundation for this study, the path-dependent approach is mentioned frequently in the discussion of regional development and the activity theory is presented for a conceptual framework for dissemination.

2.1.1 Learning by doing and inquiry

According to Democracy and Education (Dewey 1916: 33): “Education is not an affair of telling and being told, but an active and constructive process…. Its enactment into practice requires that the school environment be equipped with agencies for doing, with tools and physical materials, to an extent rarely attained…. It requires that methods of instruction and administration be modified to allow and to secure direct and continuous occupations with things…. Not that the use of language as an educational resource should lessen; but that its use should be more vital and fruitful by having its normal connection with shared activities.”

Dewey’s definition of inquiry is as follows: “Inquiry is the controlled or directed transformation of an indeterminate situation into one that is so determinate in its constituent distinctions and relations as to convert the elements of the original situation into a unified whole” (Dewey 1938: 104).

Dewey stated that the teacher should: “participate within that learning process, the teacher role should not be one to stand at the front of the room doling
out bits of information to be absorbed by passive students, instead, the teacher’s role should be that of facilitator and guide”. Therefore, the teacher becomes a “partner in the learning process, guiding students to independently discover meaning within the subject area” (Dewey 1897: 231).


2.1.2 Constructivist approach

In the context of both an integrative model and this study, a constructivist approach, which is based on cognitive psychology, was used extensively in this study since early 2001 (cf. Fränti & Pirinen 2005, Pirinen 2008, 2009a, 2009b). According to the constructivist educational perspective, knowledge is not transported to individuals; instead, it is constructed by the individuals themselves or “co-created” by participants (Burr 1995, Helakorpi & Olkinuora 1997, Tynjälä 1999, Lehtinen & Palonen 1999, Rauste-von Wright et al. 2003). Hence, in this study, the terms “constructivism” and/or “constructionism” as they relate to educational approaches, refer to reality being constructed by individuals or collectively. A “social reality” is constructed by those who participate in it and is frequently referred to as “social constructionism” (Burr 1995: 1–5). In the constructivist approach, individuals generate knowledge and meaning from an interaction between their experiences and their ideas. The learning process is experiential through real life experience to construct and improve understanding and knowledge (Burr 1995, Helakorpi & Olkinuora 1997, Lehtinen & Palonen 1999, Tynjälä 1999). In this collective process, individuals interpret their observations on the basis of previous knowledge and experience, and thus continuously build a worldview by providing experiences with meaning through interpretation (Tynjälä 1999). Individual observations and knowledge
constructions are based on earlier experiences and knowledge (Vygotsky 1978, Leontev 1978, Engeström 2001). From this perspective, the reflection on one’s own starting points may lead to regenerative outcomes and comprehensive learning (Kolb 1984). This type of experiential learning emphasises the individual, while in service tasks, R&D teams, and in this the nature of community, is another vital element of learning (Kolb 1983, 1984, Kolb & Kolb 2005).

In this study, the constructivist approach takes place in a learning by developing (LbD) culture, which has been collectively developed, at Laurea UAS, since 2003. The roots of LbD lie in the collective and authentic design of learning, where an individual learns along with the community; in doing so, new competencies and capabilities are built by both individual and community efforts. The LbD model enables the testing of different learning and R&D related theories; it conducts the development of new theories as “sound kernel theories” (Gregor & Jones 2007, Gregor 2002). Here, testable theories or testable propositions are almost identical to hypothesis in R&D activities. Influentially, the LbD model represents a management, work and learning philosophy “in resonance” with Humboldt’s model (Lampinen 2003). The model emphasises collaboration with the employment sector to learn about the authentic developments and real problems encountered in the workplace. These collaborative facilities are addressed in integrative R&D environments; in doing so, the model is used in activities that systematically seek answers and utility to authentic R&D scopes whose solutions require new knowledge (cf. Lampinen 2003, Hakkarainen et al. 2004, Paavola et al. 2004, Peters et al. 2009). The core of the LbD model is formed by object-oriented work, which means that learning focuses on genuine development. Consequently, learning has a clear objective and takes place through the process of generating new competencies.

Between 2002 and 2004, there were many constructive aspects in the theoretical binding of the study and framework of the investigative model and LbD. Helakorpi and Olkinuora (1997) found that effective work in a development team requires creation and invention. Lehtinen and Palonen (1999) studied expertise from the perspective of high-level competence. Using Scardamalia and Bereiter’s (1999) statement that true experts differ from experienced people as a starting point, Tynjälä (1999) investigated the requirements for expertise. Raustevon Wright et al. (2003) noted that the general transference and applicability of knowledge and skills to practical situations is challenging; and Hakkarainen et al. (2004) state that inquiry learning refers to a process that systematically searches for a solution to a problem that cannot be solved using existing knowledge.
In the integrative model, regional development integrates with authentic targets within the regional innovation systems, R&D and the world of work; learning is subsequently achieved through activity and experience in these interventions. The integrative R&D process can also include rather a more dedicated research question or ready-made or fixed “problems” than resilience nature of “scopes”, then the LbD as well as the next close constructive model, the problem-based learning (PBL) can be facilitated to a student-centred pedagogy. Here, in a problem-based setting, students learn about a subject in the context of complex, multifaceted and realistic problems. In this problem-based view, students are working in groups and recognising what they already know about the problem, what they need to know, and how and where to access new information that may lead to the resolution of the problem (Barrows & Tamblyn 1980, Poikela 2001, Poikela & Poikela 2010).

The aspects of theoretical views, which influenced the integrative model after 2004, include facilitation of learning processes that underlie the creation of expertise and knowledge in the internalisation process (Vygotsky 1978); creation of new forms of a competence community (Tuomi 1999); community of expertise and inquiry learning (Hakkarainen et al. 2004); new types of communities of practice and expansive settings (Tuomi 1999, Engeström 2001); integrative components (Scardamalia & Bereiter 1999, Star & Griesemer 1989, Kolb 1984, Lewin 1942, 1946, 1947, Dewey 1938, Nonaka & Takeuchi 1995, March & Smith 1995); influences of constructive learning theories and “co-creations” (Tynjälä 1999, Lehtinen & Palonen 1999); binding and testing of different learning and R&D theories and development of new theories as sound kernel theories in the core of the LbD-model (Gregor & Jones 2007, Gregor 2002); and balancing evolutionary and constructive forces in clusters (Sölvell 2009, Uotila 2008, Teräs 2008).

2.1.3 Path-dependent approach

The evolution theory of economic change, addressed on Nelson and Winter (1982), was considered in the study context of regional development. Here, the focus is on the path-dependent nature of competence, development and curriculum (Pirinen 2009d). The assumption is that the learning takes place in an innovation process, which is rooted in a genuine economic structure and its regional context, which includes strong elements of path dependency and thematic nature (Fränti & Pirinen 2005, Pirinen 2008, 2009d, Study V). Regional
integration and regional development are not progressed in isolation, in this study, they rarely depend on situation, geography, historic or cultural bindings (Fränti & Pirinen 2005). The operative environment of study, which was as a socially constructed system, was embedded in its historic context and involved in continuous R&D. Here, for purposes of this study, the assumption of path-dependent nature can be described as: “what we can do in our own way is related to where we are and then where we have been” (Nelson & Winter 1982, Reichert 2006, Johansson & Ylinenpää 2012, Rickne et al. 2012, Study V).

In this study, the excepted resonance of the path-dependent approach appears in such forms as: (1) body of knowledge, (2) professional expertise, (3) collective experience and (4) the level of trust, which can be vital to the integrative model (Pirinen et al. 2009, Pirinen & Rajamäki 2010, Rajamäki et al. 2012). The selection of theory review is based on the early assumption that realisation of regional development, R&D and education is far from a linear process; instead, it is a result of a dynamic R&D process that involves interactions between several actors and things that no single actor, such as Laurea, can achieve or manage alone (Pirinen 2009a). This development includes a high level of uncertainty, unexpected events and rival implementation models, such as a “separation” model in which only dedicated units are involved in R&D and regional development in higher education and UASs. The path dependency seems also included similarities with social constructionism (Burr 1995, Nelson & Winter 1982), where historical and culturally specific knowledge is described in process that: “The attention of social constructionism is turned to a historical study of emergence of current forms of psychological and social life, and to social practice by which they are created..., a focus of social constructionism is on interactions and social practices..., a focus is on process” (Burr 1995: 6–7).

### 2.1.4 Activity theory

As a conceptual framework, activity theory offers a general perspective on human activity, providing the resources of studying human interactions with artefacts, within an environment, culture and historic context. Activity theory focuses on an activity that cannot be analysed outside the context in which it occurs, and promotes studies that are objective, naturalistic and ecological. Activity theory attempts to explain cultural and social practices in a real world context by relating them to the cultural and historic context in which the activity takes place. In activity theory, the human mind emerges, exists and is understood within the

Engeström (2001) outlines the evolution of activity theory in terms of three different generations of research: (1) activity theory, which draws on Vygotsky’s (1978) conception of mediation in which the stimulus and response formulation is exceeded by a mediated act; (2) activity theory as influenced by Leontev (1978), focused on the relationship of mediation with the other components of an activity system, in this, Engeström (1999) advocates the study of tools or artefacts as integral and inseparable components of human functioning; and (3) activity theory, which includes dialogues, multiple perspectives and networks of interacting within activity systems, adopting joint activity or practice.

The third description has similarities to learning by expanding (Engeström 1987, 2001), which is largely avoided in organisational learning, since it assumes that learning starts as “grasp” or input, which relates to a change in social practice. The expansive model by Engeström’s (2001) integrates a distributed cognition and presents an analysis of a meeting where the different participants drive the different stages. The beginning of Engeström’s (2001) learning cycle can be related to Dewey, as in the first step, a problem emerges that requires a solution. In the next step, the problem is analysed. Based on the created understanding of a problem, a solution is produced, its characteristics are studied and a solution is implemented (Tuomi 1999, Engeström 1987, 2001). Consolidating the new practice, the reflection on the process is the step between implementation to experimental action in way of learning cycle as a “social process” that develops new forms of activity and practice (Engeström 2001, Tuomi 1999). In this study, the view of activity theory is referenced in (Fränti & Pirinen 2005, Pirinen 2008, Pirinen et al. 2009).

### 2.2 Integrative concepts

In this part, the review includes the most addressed concept and modes of integration of regional development, R&D and education. The concept of the focused university by Clark; the triple helix by Etzkowitz, an open innovation mode by Chesbrough; and the two governance modes by Gibbons are included. In this study, the perspective of integrative concepts are mostly involved in (Fränti & Pirinen 2005, Pirinen 2008, Pirinen et al. 2009, Pirinen & Rajamäki 2010, Rajamäki et al. 2012).
2.2.1 Concept of focused university

According to Clark (2007: 129), “The concept of the focused university, points to a type of organisational character that growing classes of universities will need for sustainable development.” In this setting, “Universities can become robust as they develop problem-solving capabilities built around a flexible focus.” However, to do so, “They must become uncommonly mindful of their character and logical development.” This means, “facing complexity and uncertainty”. In addition, they will have to “assert themselves in new ways at the environment-university interface” and universities are simultaneously “dominated as ever by educational values rooted in activities of research, teaching and study”.

According to the focused university, the key profiles in Laurea’s strategy (2010) were developed as a UAS, which specialises in service innovations and whose specific task is to foster the competitiveness and regional development of the Helsinki metropolitan area. The role of Laurea was focused for regional networked expertise and being as learning organisation cf. path (Fränti & Pirinen 2005, Study V). Its strategy for 2010–2015 includes the following: (1) development of service innovations and value networks, (2) internationally acknowledged and productive research, development, and innovation activity as learning by developing, (3) an operating model that promotes the development of working life by integrating learning and R&D.

2.2.2 Trust-based triple helix

The strong theoretical inspiration in the integration of the regional development task had discourse with the triple helix at Laurea (Etzkowitz 1998, Etzkowitz & Leydesdorff 1998). Here, both actively and collaboratively, the triple helix model was addressed in relation to the study of social conditions of knowledge production. According to Etzkowitz and Leydesdorff (1998), the triple helix emphases are usually on the innovations produced through the interactions and communications among academia, industry and government and on the social mechanisms of selection, variation and retention responsible for their evolution as sectors. The objective of the creation of the triple helix was to identify an environment consisting of university spin-offs, innovativeness, trilateral initiatives for knowledge-based economic development, and strategic agreements between the triple helix actors (Etzkowitz 2003, 2008, Etzkowitz & Leydesdorff 2000).
Different versions of triple helix models were considered in terms of their structures and functions and abilities to promote or obstruct innovations in themselves, as a product of their coordination, or to improve development capabilities in the region (Pirinen et al. 2009). From this perspective, Laurea’s strategy centred its own role as that of a developing part of the triple helix in the Helsinki metropolitan region. It was therefore positioned to serve the future needs of both the regional and global development. According to Etzkowitz and Leydesdorff (1998), a spiral model of innovation is required to capture the evolution of multiple linkages of different stages of capitalisation of knowledge and to the effects which academic-industrial collaboration changes the role of the university. Etzkowitz and Leydesdorff (1998) note that there are four dimensions of development of the triple helix model: (1) the international transformation in each of the helices; (2) the influence of a helix upon another; (3) the creation of a new overlay of institutional structures from the integration among the three helices; and (4) a recursive effect of these entities, both on the spirals from which they emerged and on the larger society. With the triple helix model, the overlay of communications and expectations at the network level guides the reconstruction of institutional arrangements (Etzkowitz & Leydesdorff 1998, 2000, Etzkowitz et al. 2000, Etzkowitz 2003).

2.2.3 An open innovation mode

In this study, the term “open innovation mode” relates to the dissemination process, which creates externalities and a “thematic learning” between individuals, organisations, cities, regions and international relations (cf. Chesbrough 2003). In the activating of study units, the similar continuum goes through a syllabus, curriculum, R&D theme, R&D profile, R&D agenda and an innovation system. In this, as an open innovation mode, integrative R&D is a collective process for achieving of knowledge, facilitating externalities, and providing the possibility to extend the ability to use and transform such knowledge, which are key assets in a selected R&D scope. Here, the open innovation mode is for the facilitation of positive externalities, creating benefits for a wider set of actors. It requires an active learning process, where such necessity for interaction and learning between actors has long been disseminated by agenda or scopes on innovation system, clusters, industrial districts, service producers and education (Chesbrough 2003). In this study, the open innovation mode also refers to the exploration of knowledge reserves in such terms as science, methodology, technology, markets, etc.
services and dissemination. It refers to the mobility of people moving in and out of units of academia and enterprises and a knowledge transfer, which is made possible; different organisations may well share their own knowledge and ability reserves with others, in this way, they can achieve a larger whole and increase their own knowledge reserves (Laage-Hellman et al. 2012, Study V, Pirinen et al. 2009, Fränti & Pirinen 2005).

Schumpeter (1939) lists five possible meanings of the term “innovation”, including (1) new goods, (2) new processes, (3) new markets, (4) new sources of supply of new materials, and (5) new organisational status. Tichy (1998) maintains that “innovation is as organisational capability which includes: scientific; technological; socioeconomic and even cultural aspects”. Geffen and Judd (2004) advocate that, “the successes of commercialisation and commercialised advantages are major determinant of innovation”.

The most appropriate for this study is definition by Galanakis (2006), which proposes a broader definition to the term innovation, “the creation of new products; processes; knowledge or services by using new or existing scientific or technological knowledge, which provides a degree of novelty either to: the developer; the industrial sector; the nation or the world; or to succeed in the market place”.

In this study, the term “innovation” takes place, for the most part, in a regional context as the desired result. In the integrative model, the focus is on development and learning for improving regional innovation capabilities and often the results of learning transactions are as the learner’s own or collective creations, which, in turn, may be related to the new regionally or internationally impacting future innovations.

2.2.4 The two governance modes

Although the combined form of leadership and management at Laurea was based on a bottom-up, student-centric vision and relationship, in the timeframe of this study, it was also based on an orientation, management culture and philosophy in which the management focus was on variations of power, mutual trust and authority relations as well as relationship management (Gibbons et al. 2008). Here, Gibbons et al. (2008) advocate two related management approaches: the disciplinary “mode-1” and the intellectual “mode-2”. Gibbon’s mode-1 is based on a disciplinary setting where the creativity of an individual is the driving
force of development and is operated through disciplinary structures of identifying and improving the management and its collective perspective. Gibbon’s mode-1 includes control aspects as the consensual figure of the scientific community. Gibbon’s mode-2 is rather the “intellectual quality setting” for management and leadership, which means here that the creativity is collective as a group ”co-creativity” phenomenon with the individual’s contribution. In mode-2, the management and “steering” are exercised as a socially extended process, which accommodates a variety of interests in a process.

Gibbons et al. (2008) state that these two systems may coexist in the recent and future implementations of the knowledge creation processes: Mode-1 represents the ideas, methods, values and norms that have grown up to control the diffusion of the Newtonian model of science to more and more fields of enquiry and ensure its compliance with what is considered sound scientific practice; Mode-2 represents knowledge production as carried out in the context of application and marked by its “transdisciplinarity; heterogeneity; organisational heterarchy and transience; social accountability and reflexivity; and quality control, which emphasises context- and user-dependence; the results from the parallel expansion of knowledge” (Gibbons et al. 2008: 4–6). In this, the term “transdisciplinarity” refers to a research strategy that crosses many disciplinary boundaries to create a holistic approach. In this context, the term “heterogeneity” refers to the composition of dissimilar parts of an environment.

In this study, from the perspective of a new production of knowledge, the view of governance adopted is derived from the Gibbons mode-2 (Gibbons et al. 2008) and the study on knowledge creation (Nonaka & Takeuchi 1995, Paavola et al. 2004). The study of thematic element as forum, proposed by (Pirinen et al. 2009), bridges the strategic R&D agenda, regional profiles and learning scopes to the syllabus-curriculum-regional-national-international interactions and key regional profiles (cf. Pirinen et al. 2009, Teräs 2008, Harmaakorpi 2004). Here, a utility resides beside these activities; the bottom-up management is the force of a sustainable development driver; it is enabling “scopes” and “agility” in the education processes, so that the ecosystems of different stakeholders can develop new creative ideas (Gibbons et al. 2008, Rajamäki et al. 2012).

In this study, the terms “results” and “impacts” aims to marked effects and things such as R&D related activities having clear effects on the regional-national capabilities, abilities, business and welfare: confer, the evaluation model of (Ritsilä et al. 2008) and the “concept of proofing” by (Nunamaker 2010).
2.3 **Integrative systems**

In this part, the review includes the most influenced structures and models as innovation system, clusters, externalities and integrative environment descriptions such as living labs (Study IV, V, Pirinen et al. 2009, Pirinen 2008, Fränti & Pirinen 2005).

### 2.3.1 Innovation system

In related literature, the term “innovation system” addresses the research collaboration and development interactions with participating organisations and institutions, such as funding organisations, higher education institutions, research institutions and related international enterprises, national organisations and entrepreneurs. In this context, the term “innovation system” has been used to describe the integration of shared R&D activities. In the literature, the categories explaining innovation systems were based on spatial (national, regional) and sectorial innovation system’s characteristics: “national innovation systems” (Freeman 1987, Lundvall 1992, Nelson 1993); “regional innovation systems” (Cooke et al. 1997, Doloreux 2002); and “sectorial innovation systems” (Malerba 2002). Consequently, the borders of the innovation system have been analysed in terms of geography, sector and activity; actions of these related actors are additionally shaped by regulations, rules, norms and routines (Freeman 1987, Nelson 1993, Männistö 2002, Harmaakorpi 2004, Asheim & Gertler 2005, Kautonen 2006, Teräs 2008, Johansson & Ylinenpää 2012). The definition of “innovation system” encompasses two distinct meanings: (1) an “interrelated structure of institutional, cultural and actor-based condensations in an economic space that has specific industrial and innovative properties related to its environment with which it has exchange” (Laestadius & Rickne 2012: 18); and (2) the set of economic, political and institutional relationships occurring in a given geographical area, which generates a collective earning process leading to the rapid diffusion of knowledge and best practices (Bathelt et al. 2002, Teräs 2008).

#### National innovation system

In the context of this study, the integration of education, R&D of services and artefacts, and knowledge-intensive business and industry with activities of international externalities form the vision of the Finnish innovation system. The
concept of a national level innovation system often receives attention, because most public policies are designed and implemented at national level (Schienstock & Hämäläinen 2001, Harmaakorpi 2004, Kautonen 2006, Teräs 2008). The formulation of national science, technology and innovation policies has been assigned to a body of expertise, the Science and Technology Council (Harmaakorpi 2004). The foremost organisations responsible for science and technology policies are the Ministry of Education and Culture and the Ministry of Trade and Industry. The Ministry of Trade and Industry is in charge of matters pertaining to industrial and technology policies. The role of the VTT (Technical Research Centre of Finland), the TEKES (Finnish Funding Agency for Technology and Innovation) and Technology Policy Council is to contribute to the realisation of the strategy by means of science, technology and innovation polices and partially through education policy (Harmaakorpi 2004, Kautonen 2006, Uotila 2008, Ahola & Rautiainen 2009, Kuusisto 2011).

In this study, the most influential theoretical aspects, from the perspective of an national innovation system, were: studies to understand the differences in economic growth rates between industrialised countries (Freeman 1987); the creation of integrative learning and R&D environments, which arise from communication within the organisation, quality system and co-operation relationships (Lundvall 1992); an understanding of institutional economics (Nelson 1993); studies of innovation systems, which are analysed from the perspective of sectors, technological fields and products (Malerba 2002); regional studies, which investigate innovation systems from the perspective of geographical and spatial boundaries (Braczyk et al. 1998, Cooke et al. 2000, Cooke 2004, Asheim & Coenen 2005, Männistö 2002, Harmaakorpi 2004, Kautonen 2006, Teräs 2008); studies that contributed an understanding of the effects of international externalities in an innovation system (Bathelt et al. 2002, Teräs 2008).

Regional innovation system

system was understood by actors when it became obvious that some of the extent of innovation development was difficult to capture at the national level, even the exact difference between the regional and national innovation system was difficult to identify (Doloreux 2002, Doloreux & Parto 2005). Cooke (2004) identified a regional innovation system as consisting of the integration of knowledge generation and exploitation to other regional, national or global systems for commercialising new knowledge. In this, a regional innovation system is limited in terms of geographical existence, and the meaning of regional is related as “being nested territorially” (Cooke et al. 1997, Maskell 2001, Braczyk et al. 1998, Doloreux 2002, Cooke 2004). Doloreux and Parto (2005) maintain that the concept of a regional innovation system is understood as a set of participating public and private interests, official organisations and institutions, and relationships for conducting the generation and dissemination of new knowledge.

In Finland, the influences of the regional innovation system and regional innovation policy were sluggish until the 1990s. The development of the regional entities of the innovation system was particularly related to the development of the European Union, its regional and innovation policies and the reformation of the Finnish public sector. European integration and economic difficulties in the national economy increased the number of new possibilities for developing an innovation policy and system at the regional level (Harmaakorpi 2004, Kautonen 2006, Terävä 2008).

Andersson et al. (2004: 144) notes that the national-regional innovation systems and clusters are closely related. The fundamental distinction is that a cluster is regarded as an industry specific phenomenon and a “regional innovation system is a broader framework affecting the innovative capacity of firms in a variety of sectors”. They state, “The cluster concept is more delimited than the concept of innovation systems: an innovation system may contain several clusters, but a cluster is not a necessary forum in an innovation system.” Combining both structural and evolution issues, Tödtling and Tripl (2005: 1211–1212) analyse the probable challenges in regional innovation systems. They maintain that there are three main areas often ignored in regional innovation systems, as follows: (1) “peripheral regions may often face organisational narrowness, important regional innovation system prerequisites are under developed, there is a lack of dynamic clusters, often the difficulties in reaching of critical mass for a dynamic cluster; (2) old industrial regions often face too strong clustering as the regions are overspecialised and as a result, a realistic regional competitive advantage
and innovation capacity are underutilised; (3) metropolitan regions, regarded as centres of innovation, often face the problem of ‘fragmentation’, a lack of networks and novel learning are representing an innovation boundary, resulting in the development of new technologies and the formation of new firms are below strategies and expectations” (Tödtling & Trippl 2005, 2007).

Asheim and Gertler (2005) note that the basic forums of regional innovation systems include collaboration of organisations, institutions and relationships that cooperate in order to produce, disseminate and diffuse new and economic advances, novel knowledge and know-how (Lundvall 1992). In terms of this study, different organisations and institutions incorporate and share R&D functions with universities, other higher education institutions, public and private research institutes, corporations, organisations and enterprises. Therefore, the core of the innovation process is the collaborative R&D system, its resources, capabilities, abilities, competencies and organisational (Asheim & Gertler 2005, Asheim & Coenen 2005, Edquist 2005, Kautonen 2006, Gibbons et al. 2008, Teräs 2008, Rutten & Boekama 2007, 2009, 2012, Rutten et al. 2003).

Cooke (2007) et al. notes two types of regional innovation system: (1) the institutional regional innovation system; and (2) the entrepreneurial regional innovation system. First R&D driven and technology-focused, the institutional perspective is used more frequently in Europe. The second, entrepreneurial viewpoint is more familiar in the USA. It is a venture capital driven and market focused regional innovation system, which appeared as an issue on the research agenda of innovation studies. It has opened up a research area in which the scope of analysis has been broadened from artefacts to systems, and from individual firms to networks of organisations (Geels 2004, Uotila 2008, Harmaakorpi 2004, Teräs 2008). Cooke et al. (2007) follows with Tödtling and Trippl (2005) and Autio (1998) in his presentation of a regional innovation system. According to them, a “regional innovation system involves two instances, which are embedded in a regional socioeconomic and cultural setting: the knowledge application and exploitation entity, which comprises the companies, their clients, suppliers, competitors, and industrial co-operation partners; and the knowledge generation and diffusion entity, which consists of a union of institutions that are engaged in the production, dissemination and diffusion of knowledge, and skills, including mainly public research organisations, technology mediating organisations, and educational institutions” (Autio 1998: 34, Tödtling & Trippl 2005: 1214).

The concept of regional innovation system also has its challenges. Indeed, Doloreux and Parto (2005) dispute the regional innovation system concept has no
one and clear generally accepted definition. They argue that the diversity in regional innovation system types, means that there is a significant degree of definitional confusion and challenges related to empirical validation, making it difficult for researchers and policy makers to envisage what a regional innovation system, is or what it should be. Doloreux and Parto also maintain that the “region” has increasingly become a focus of economic policy, not only in Europe, but also elsewhere. In this, the term “region” has been applied in very different ways: sometimes it has meant a whole country, sometimes cities, small-scale industrial districts, and so on (Keenan & Uyarra 2002). Kautonen (2006) studied regional innovation systems from a company perspective. The results of his research emphasise the importance of a multilevel innovation environment rather than just a regional level innovation environment.

However, in this study, the primary focus in regional development is that a region has an interest, focus and purpose in the global economy, particularly in shaping its own economic attraction and development. In the timeframe of this study, between 2001 and 2012, the regions were believed to be “in an advantaged position” with respect to the design of policies that responded, and are dedicated, to the real needs of the public interests when compared to national policies (Keenan & Uyarra 2002, Harmaakorpi 2004, Kautonen 2006, Uotila 2008, Teräs 2008). In this study, the basic forums of regional innovation systems include the collaboration of organisations, institutions and relationships that cooperate in order to produce, disseminate and diffuse new and economical advances, novel knowledge, instances of methodology and know-why and know-how information.

### 2.3.2 Clusters

Marshall (1920) discussed “industrial districts” and the concentrations of specialised industries in particular localities. The term “industrial district” is defined as a “local system with an active co-presence of people and of primary industry consisting of small, independent firms specialised in the different phases of single production process” (cf. Teräs 2008: 23–24). This is understood as the “established framework for improved economic efficiencies of firms, which would cluster in order to benefit from positive externalities associated with their respective activities” (Teräs 2008: 23, cf. Becattini 2004, Becattini et al. 2003).

Porter (1990) proposed the diamond model to explain the industrial dynamic. The model consists of elements: (1) factors of production conditions as human and other resources; (2) demand conditions; (3) supportive industries; (4) firm
strategies and internal competitiveness, (5) government; and (6) random chance as unseen events. Porter (1990) states: the “intensity of interaction within the competitive diamond is improved if the cooperative firms are geographically localised or clustered”. Then Porter (1998) defined: “Clusters are geographic concentrations of interconnected companies and institutions in a particular field”, and continues that a “cluster allows each member of cluster to benefit as if it had greater scale or as if it had joint formally with other regardless without requiring sacrificing member’s own flexibility”. Porter concludes that clusters affect competition in three broad ways: (1) they increase the productivity of companies; (2) they drive the direction and pace of innovation; and (3) they stimulate the formation of new business. Porter (1998) studies clusters as the phenomenon of territorial and regional concentrations. His studies have focused the importance of local concentrations of learning, and how social interactions based on cultural and spatial closeness enable and facilitate trust, discussion and innovative activities in regional systems and interacting actors (Maskell & Malmberg 1999, Asheim & Coenen 2006, Asheim & Gertler 2005, Teräs & Ylinenpää 2012).

Swann (1998: 52) states the risks and disadvantages to participants of a cluster: a cluster may become overcrowded; “an increased number of competitors would reduce sales per-firm; prices; profits per-firm; growth on the demand side per-firm; increased competition on the supply chain”, for example, the cost of labour, property or resource. Kuah (2002: 221) notes that “co-location itself does not imply clustering if benefits such as innovation, productivity, and growth or competitiveness cannot be proved, described or shown”. Hendry and Brown (2006) state that clustering itself does not improve performance when comparisons are made with companies that are not clustered. A number of authors (Hendry et al. 2000, Harmaakorpi 2004, Teräs 2008, Rickne et al. 2012) have discovered the rationales, risks and possible disadvantages for the geographic concentration of industries in regional clusters.

According to Harmaakorpi (2004), the possible competitive advantages are based on the business potential of the actors within a regional development platform, such as the firms, technology centres, expertise centres, research centres and education organisations. Harmaakorpi advocates that contributing to the defined regional development its platform must be separately perceived and defined each time and the aim is to describe the potential to future regional clusters (Rickne et al. 2012). Wolfe and Gertler (2004: 1081) state that: “Clusters can be seen as nested within and impacted by other spatial scales of analysis including regional and national innovation systems as well as global relationship
Therefore, it is more appropriate to talk about localised public-private networks, which may have a sectorial, technological or thematic nature in Europe than of cluster in a strict and general sense (Bellini 2002).

Jensen et al. (2007) investigated cluster analysis, in relation to innovation performance. According to them, two modes can improve knowledge creation and innovation in regional and clustered economies. The modes are: (1) science, technology and innovation, which is based on the production and use of codified scientific and technical knowledge (science mode); and (2) doing, using and interacting, which is based on an experience-based mode of learning and doing, such as Dewey’s “learning by doing”. The tension between the “science” and “doing” modes corresponds to a need to join and combine approaches to regional and national regional innovation systems and focus on the role of shared R&D to produce explicit and codified knowledge with which focusing on the learning by doing from informal interactions within and between organisations resulting in competence-building and advances generation.

Teräs (2008: 145) states that the “role of external linkages has clearly increased in the regional science-based clusters”, which is “emphasising the external or global pipelines, so the view presents an illustration of internal and external linkages of the regional science-based cluster” (Bathelt et al. 2002: 15). Teräs (2008: 145) continues that the “external information flows with partners from the outside are implemented by global pipelines”, which include aspects such as interpretive schemes, scopes, shared values, attitudes, information flow and social spirit. In the literature of the relation between regional clusters and regional innovation systems, it is noteworthy that particularly in the literature on clusters; clusters are regarded as nested within innovation systems (Wolfe & Gertler 2004). However, there are differences in the comprehensiveness of the regional cluster concept, from a narrow definition, such as “firms only”, to broader definitions of firms, research organisations, governmental organisations, financial institutions and educational institutions for collaboration (Sölvell et al. 2003, Sölvell 2009).

The research literature compares the structure of clusters where the evolution of regional clusters is seen as relatively cyclic, dynamic and path-dependent. Porter (1998) states that the evolution of cluster structure is related to the self-enforcing cycles, which promote the growth of regional clusters. However, Porter noted that clusters could drop their competitiveness due to external or internal forces. Porter’s viewpoint was in accepting a life-cycle perspective of cluster evolution, which can be described in four stages: (1) the early stage of growth; (2)
established clusters that have possibilities for future growth; (3) mature clusters, which are stable, but future growth is challenging; and (4) declining clusters (Teräs & Ylinenpää 2012, Teräs 2008). Some clusters in the declining stage are able to reinvent themselves and enter the development cycle again (Teräs 2008, Teräs & Ylinenpää 2012).

The focus of this study is on development and research transactions, which relate to improving the integration of regional development, its capability and creativity in co-operative manner and in measuring the impacts and results of the integrative R&D model (Sabel 1993, Steiner 1998, Maskell 2001, Sölvell 2009, Möller & Svahn 2009).

2.3.3 Externalities


According to Dewey (1916: 33), education is an active and constructive process: “its enactment into practice requires that the school environment be equipped with agencies for doing, with tools and physical materials, to an extent rarely attained”. According to Andersson et al. (2004: 14), “firms would cluster in order to benefit from positive externalities associated with their respective activities, in this framework, a link can be recognised between location by firms and global economic efficiency”. According to Maskell and Malmberg (1999), the resources available in a certain cluster comprise the region’s own resources and knowledge reserves as well as the ones available through import from externalities, such as other parts of the world. Therefore, “an actor in a region needs to make relationships with actors located outside its own boarders” (Maskell & Malmberg 1999: 173).

Hendry et al. (2000) studied optoelectronics clusters and noted that national and international associations, as externalities, are even more vital than localised ones, due to the highly differentiated nature of the end-user markets and the complexity of the technologies. Bathelt et al. (2002) refer to two kinds of
knowledge: global pipelines and local buzz: This “local buzz” arises from the “physical co-presence, facilitating the circulation of information in a local economy or community of expertise”. The term “pipelines” refers to “channels of communication used in distant interaction, between firms in network”. Bathelt et al. (2002: 21) state that a “well-developed system of pipelines connecting the local cluster to the rest of the world is beneficial for each individual firm due to knowledge sharing relations to actors outside the cluster.” In addition, the “more the cluster firms build up shared networks, the more new information about markets and technologies are driven into internal networks, increasing even the local buzz of the cluster”.

Rosenfeld (2002: 19) states, that a “continuous inflow of information into the cluster from research institutions, competitors, and customers around the world, provides the cluster with cutting edge ideas.” Social capital then “transfers that knowledge from firm to firm and from individual to individual”. Rosenfeld argues that clusters that focus exclusively on internal linkages cut themselves off from sources of new knowledge and technology. Keroack et al. (2004) states, the concept of clusters highlights the significance of inter-organisational linkages in the development of complementary capabilities and exchange of knowledge. In order to increase activity, the regional clusters not only need constructive local conditions but also free and substantial mobility of resources between the cluster and the world around it. Wolfe and Gertler (2004: 1079) argue that: complex technologies “require the support of refined organisational networks providing the key elements of the overall technology. Increasingly, the elements are situated across a wide array of locations”.

Rosenfeld (2005: 12) continues, “Geographic boundaries of the cluster must be porous: the best thinking should be absorbed into the cluster and cluster firms should be well aware of benchmark practices and changing markets.” Tödtling and Trippl (2007) argue that informal relations are not exclusively local and that formal networks and pipelines are not predominantly global. According to Teräs (2008: 176), “regional science-based clusters are not isolated entities but are increasingly more connected to externalities, external environments and global markets than before although the local cluster activities and the social relation between the cluster actors are still relevant” (cf. Teräs & Ylinenpää 2012). Laage-Hellman et al. (2012) conclude that interactions with other actors are a key prerequisite for gaining access to critical resources needed in the innovation process, even though a regional interaction is significant to companies, such interaction sometimes takes a regional with a national or international nature.
In this study, the term “externalities” operated as a connecting interface between the global perspective and integration of study units. In this case, externalities were facilitated for R&D, in addition, the influencing foundation included such literature as absorptive capacity (Zahra & George 2002); who cooperates for innovation and why (Tether 2002); firms relations and networks (Wilkinson & Young 2002); local dynamics and global linkages (Wolfe & Gertler 2004); and R&D cooperation between firms and universities (Chatterton & Goddard 2000, Veugelers & Cassiman 2005, Ritsilä et al. 2008).

### 2.3.4 Integrative environments

In this study, the term “integrative environment” refers to the collective space and dynamic nature of facilities and reserves, which are purposed to the support and configuration of R&D interactions and networked expertise (Nonaka & Takeuchi 1995, Fränti & Pirinen 2005, Leminen et al. 2012). Here, the term “heterogeneity” refers to networking of dissimilar environments and R&D scopes in relation to research, education and development (RED) and a configuration of space and R&D scopes; hence, the students, participants, workplaces and communities of expertise are of a different kind and the research-learning-development environments, as required spaces, are different in every R&D project. Consequently, the purpose of an integrative environment is the mobilisation of an R&D agenda and region-education strategies, networking of value and knowledge creation, and saving achieved knowledge across different study units. In this study, the term “integrative environment” refers to a realisation of Gibbon’s mode-2 space in Gibbon’s mode-1 institution (Gibbons et al. 2008). Here, the “integrative environment” is primary R&D-based in service, science and technology in where activities are created through an collective R&D process. It can be similar to scientific R&D, but also often includes non-R&D activities, such as services, technology adaption, combining existing knowledge, changes in work and organisation and networking.

The literature in this area is diverse and includes: rethinking the concept of user involvement (Barki & Hartwick 1989); toward the learning region (Florida 1995, 2003, 2005, Rutten & Boekema 2012); an experiment with the instrumentation of a living educational environment (Abowd 1999); managing collaboration within networks and relationships (Batt & Purchase 2004); knowledge bases and regional innovation systems (Asheim & Coenen 2005); theories or entrepreneurial action (Alvarez & Barney 2007); economic policy.
from an evolutionary perspective (Boschma & Sotarauta 2007); regional dimensions of knowledge transfer (Bröker & Bindel 2007); and regional dynamics of the knowledge-based clusters (Lorenz & Lundvall 2006, Teräs & Ylinenpää 2012).

In environment of this study, the concept of “living-lab” was understood to be one instance of an integrative R&D environment, which can expand regional R&D and its research, agenda, scoping and creative activities as “transition into live function”. This means, that a “living lab” is established as a human-centric R&D environment in which services and systems are first understood, then “co-designed” and “co-created”, then evaluated in the users’ own living context, and finally the results and impacts of this forum of collaboration are disseminated to a global business. Ballon et al. (2005) described “living labs” as experimentation environments in which technology is given shape in real life contexts and in which users are considered “co-producers”. Consequently, appropriate here, the concept of living lab addresses an R&D methodology where inventions and innovations, such as services, products and application enhancements are “co-created” and validated in collaborative, multi-contextual, empirical real-world environments. Eriksson et al. (2006) refer to “living labs” as an R&D methodology whereby innovations, such as services, products, and application enhancements are created and validated in collaborative multi-contextual empirical real-world settings; here, living labs are a concept in which firms, public authorities and citizens work together to create prototypes and validate as well as test new services, businesses, markets and technologies in real-life contexts, such as cities, city regions, rural areas and collaborative virtual networks between public and private players (cf. Fränti & Pirinen 2005). Følstad (2008) analysed the three most common categories of living lab: (1) living labs to experience and experiment with ubiquitous computing; (2) living labs as open innovation platforms; and (3) living labs exposing testbed applications to the users. In this perspective, living labs share real everyday contexts of life, living stimulates R&D and authorities, and the public and citizens are participating in and contributing to the entire innovation process from very early in the course of action to the very end (Ståhlbröst 2008).

In the environment of study, the realisation of the “living lab” are including appropriate methodologies, to make a “living lab network” “co-creative”, supportive and socially shared. In the context of study, living labs are integrated and designed for constructions, such as new “co-created” services, new artefacts and improved methodology. For reference, Laurea Living Labs (appendix) is a
member of the European Network of Living Labs, which is a Europe-wide platform for providing user-driven innovation capabilities and services to enterprises, international corporations, public sector agencies, academic institutions and individual citizens. Laurea Living Labs is an approach to stimulating and accelerating industrial and societal innovation. It is also a means of connecting and empowering users to participate in research, development and innovation. The Laurea Living Labs partnerships has been related to the execution of hospitality management and information system studies since 2008 (Fränti & Pirinen 2005, Keränen & Ojasalo 2011, Leminen et al. 2012).

The latest aspects of regional studies, as current integrative views in an integrative environment, consider that the new undertakings are more service related than manufacturing based, and value “co-design” and “co-creation” would be based more on new knowledge and attractive professional growth (e.g. SATERISK and CoCo, described in appendix). This relatively new perspective regarding the incipient knowledge economy refers to a focus on interactions between individuals as units of analysis. In this case, not only are countries, regions, companies and universities adopting a global perspective, but also individuals (cf. Chatterton & Goddard 2000, Salter & Martin 2001, Goldstein & Renault 2004, Lester 2005, Koski 2006, Goddard & Puukka 2008, Konu & Pekkarinen 2008, Ritsilä et al. 2008; Peters et al. 2009, Rickne et al. 2012).

Goddard & Puukka (2008: 22) states, “Increasingly, higher education need to market their education and research services across the globe and provide the supporting infrastructure that will attract and retain the best researchers, teachers and academic leaders. At the same time, regions also need to attract knowledge-based inward investment, support local companies seeking to operate on the global stage, and attract the most creative people to the community and retain them.” Konu & Pekkarinen (2008: 115) continues, “Development needs have been mapped in each of the regions in collaboration with a wide range of public and private stakeholders. The higher education institutions are engaged in strategy development and implementation at the regional levels.”

In integrative environments, a new web-based media is frequently used in communication, and development itself is path dependent (e.g. spin-offs by RIESCA in appendix) and based on emerging global economies as well as attractive new focuses and profiles. For the design of a region’s role, as an administrative entity, the focus would be in developing regional governance capabilities, which refer to the ability of a region to concentrate the innovation strategies in an intensive effort involving the regional administration, business

2.4 Summary of theoretical approaches

Table 3 summarises the theoretical approaches of the study: the timescale of the influential literature is described for reference.

Table 3. Summary of the theoretical approaches of the study.

<table>
<thead>
<tr>
<th>Approach</th>
<th>Influence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constructivist approach</td>
<td>Knowledge is not transported to individuals, but it would be constructed by the individuals themselves or it would be “co-created” by participants; here, a social reality would be constructed by those who participate in it (Dewey 1897, Burr 1995, Helakorpi &amp; Olikuura 1997, Tynjälä 1999, Rauste-von Wright et al. 2003, Hakkarainen et al. 2004, Rutten &amp; Boekema 2012).</td>
</tr>
<tr>
<td>Path dependency</td>
<td>Integration and regional development, R&amp;D and higher education are not developed in isolation, but are rarely dependent on its situation, geography, historic and cultural bindings; here, the aspects of path-dependent nature can be described as follows: “what we can do in our own way is related to where we are and then where we have been” (Nelson &amp; Winter 1982, Reichert 2006, Arthur 2007, Johansson &amp; Ylinenpää 2012, Rickne et al. 2012).</td>
</tr>
<tr>
<td>Activity theory</td>
<td>Activity theory focuses on the notion that an activity cannot be analysed outside the context in which it occurs; it promotes objective, naturalistic and ecological studies. Activity theory attempts to explain cultural and social practices in a real world context, by relating them to the cultural and historic context in which the activity is taking place. In activity theory, the human mind emerges, exists and can be understood within the context of human interaction with the world; in this interaction, an activity itself is socially and culturally determined (Vygotsky 1978, Leontiev 1978, Kaptelinin &amp; Nardi 1997, 2006, Nonaka &amp; Takeuchi 1995, Issroff &amp; Scanlon 2002, Engeström 2001, 1987).</td>
</tr>
<tr>
<td>Focused university</td>
<td>The concept of the focused university points to a type of organisational character in which growing university classes are needed for sustainable development; universities can become robust as they develop capabilities built around a flexible and novel focus (Clark 2007, 2008).</td>
</tr>
<tr>
<td>Approach</td>
<td>Influence</td>
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<td>---------------------------</td>
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<tr>
<td>Triple helix (1998–2012)</td>
<td>Triple helix emphases are usually on the innovations produced through the dynamics of interactions and communications among academia, industry and government and on the social mechanisms of selection, variation and retention responsible for their evolution as sectors. In this study, the implementation of the triple helix was directed towards the realisation of an environment with innovativeness, consisting of university spin-offs, trilateral initiatives for knowledge-based economic development, and strategic alliances between the triple helix actors (Etzkowitz 1998, 2003, 2008, Etzkowitz &amp; Leydesdorff 1998, 2000, Teräs &amp; Ylinenpää 2012).</td>
</tr>
<tr>
<td>Gibbon’s modes (1994–2012)</td>
<td>Gibbon’s mode-1, as a management approach, is based on a disciplinary setting where the creativity of an individual is the driving force of development and is operated through disciplinary structures of identifying and improving the management and the collective perspective as the consensual figure of the scientific community. Gibbon’s mode-2 is the intellectual quality setting in management and leadership; here, the creativity is collective as a group “co-creativity” phenomenon with the individual’s contribution. In mode-2, the management and steering are exercised as a socially extended process, which accommodates a variety of interests in an realisation process (Gibbons et al. 2008).</td>
</tr>
<tr>
<td>Integrative environment (1995–2012)</td>
<td>In this study, the term “integrative environment” refers to the collective space and dynamic nature of facilities and resources, which are purposed to the support and configuration of R&amp;D interactions and networked expertise (Nonaka &amp; Takeuchi 1995, Frânt &amp; Pirinen 2005, Gibbons et al. 2008, Leminen et al. 2012). Here, the “integrative environment” is primary R&amp;D-based in service, science and applied technology in where activities are created through an collective R&amp;D process. It can be similar to scientific R&amp;D, but also often includes non-R&amp;D activities, such as services, technology adaption, combining existing knowledge, changes in work and organisation, and space for networking (e.g. Laurea Living Las in appendix). In this study, the term “integrative environment” would be worded, it refers to a realisation of Gibbon’s mode-2 space in traditional Gibbon’s mode-1 institution for “configuring knowledge resources” (Gibbons et al. 2008: 51).</td>
</tr>
</tbody>
</table>
3 Research contribution

This chapter presents the most significant research findings and the contribution of each of the five empirical studies in answering the research question: How can regional development function be understood, designed and actualised in a University of Applied Sciences (UAS)?

3.1 Realisation of the regional development task

The approach of this first empirical study included an integrative setting of the three statutory tasks by the Finnish Act of Parliament (351/2003): regional development, education, and research, in the context of a UAS. The first study, indicated that the UAS management was committed to the focus and support of creativity, innovations and to the bottom-up model, which was focused towards the motivation of participants and realisation. An integrative model for the fulfilment of the three tasks was identified and students were placed at the centre of the strategy. The regional targets of the strategy were created with other regional actors and the future perspective was taken into consideration. The assumption of integration was that regional development most likely enriched education and learning. The efforts of “co-creation” of new regional projects were based on strategy, and the projects was produced in line with strategy. Then, globalisation efforts and new externalities were connected to strategic plans in a balanced way, and new methods, models and educational targets were produced for the integration of regional R&D scopes and open innovations. The research question was: How was the regional development task actualised at Laurea UAS, from the perspective of the FINHEEC evaluations conducted between 2001 and 2008? This first study was referenced follows:


The first study presented the two action research cycles, which addressed the development of regional development strategies and processes in the Laurea UAS. The first action research cycle was between May 2001 and June 2003, and the second action research cycle was between August 2003 and December 2008. Both cycles included an outsider’s involvement, via the two FINHEEC evaluations,
which were focussed on the impacts on regional development. The overall aim of the realisation was the sustainable integration of the three statutory tasks of UASs.

In the integrative model, a knowledge society creates and shares knowledge for the well-being of its people by creating competences and education; an activity takes place by using a body of knowledge in action. In this first study, there were three main entities in the integrative environment: (1) the innovation system; (2) the value network; and (3) the target domain. This core relationships between these elements are illustrated in Figure 1, below.

Fig. 1. Integrative environment (I, published by permission of Inderscience).

In Figure 1, “networked expertise” refer to competences that arise from social interaction and knowledge sharing; action is embedded in the shared competence of communities and organised groups of experts and professionals. In this approach cognition and intelligent activity are not limited to an individual’s mental processes, but also rely on trust, interest and socio-culturally developed cognitive tools, methods, services and artefacts of a larger context (cf. Lave 1988, Bredo 1994). Early in the study, the role of higher education institutions was traditionally seen as producers of new scientific and practical knowledge and
technology. A new contribution was towards the repositioning of knowledge production and development of services and artefacts through the creation of study units within regional development and R&D. The change in integration of study units was taking place due to (1) cooperation in value networks; (2) “co-created” innovations; (3) offerings of lead innovations; and (4) especially the integration of regional development that has an impact on social and global improvements and knowledge diffusion. The study contributed (1) new forms of/and actualisations of study units; (2) models and relations of integration; and (3) methods of R&D collaboration, which were created to supply for the creation of innovation in services, safety, technology, economy and society. This setting has the following entities: the innovation system, the value network and its target domain, and relations: such as the interest, trust and results in Figure 1.

The study faced both challenges and opportunities due to the integration of networked expertise and the regional knowledge society. The study included the following new ideas and issues: (1) action primarily bridges competences in the first place and is a way of using knowledge in action; (2) external funding is needed to ensure the fulfilment of the three tasks; (3) competition is increasing for the recruitment of students and staff between higher education institutions and global actors; (4) higher education institutions have different emphases and profiles; (5) higher education institutions contribute to the innovation system; (6) higher education institutions keep “co-creation” and innovation processes alive at the regional, national and global levels; and (7) higher education institutions are incubators of entrepreneurial skills and value makers for new competences.

In this operating environment, both new and small firms, particularly knowledge-intensive ones, were considered important actors in the innovation system. In this domain, UASs were seen as first, significant producers of new applied knowledge and competences, and second as users of the latest findings and third as bodies of knowledge in action, which gives them a role within the “thematic centre” of the innovation system. Their thematic nature comes from their action in combining knowledge from several sources, such as lead innovation systems, or institutions such as strategic centres of excellence in science, technology and ICT innovations. In addition, cooperation ensures that a body of knowledge is “co-created” with other organisations to contribute to innovations in industry and society as a whole; for example, national strategic research agendas (SRA), concepts of living labs and R&D related collective environments.
The three related FINHEEC evaluations indicated that the regional role of UAS in the context of this study was considerably developed. The focus of education has shifted to regional R&D work, thereby achieving regional and societal influence. R&D was understood as a strategic partnership (Impiö et al. 2003). Analysis of the entrepreneur and enterprise perspective demonstrated that regional integration had become more common and brought together education, R&D and entrepreneurs, as well as an entire body of work (Käyhkö et al. 2006, Huttula 2001). In particular, the future tasks of this innovation policy correlated with the increasing participation of entrepreneurs and enterprises. As a consequence, new concepts such as SHOKs (ICT clusters of the Finnish Strategic Centres for Science, Technology and Innovation) were established, for connecting enterprises and higher education institutions more closely to R&D, and by attempting to make use of the research by using it to improve competitiveness at both an enterprise and a regional business level (Rauhala 2008).

The study described the qualities of R&D based, activities which were related towards regional development and designing a new method of R&D based higher education teaching that can influence the potential of the region and its capabilities and development efforts within the regional-national innovation system. The study implied several types of co-operators, such as small size firms: (1) competitiveness and new forms of competences in the Helsinki metropolitan region; (2) cooperation with networks and innovation systems, for example, “focused university” (Clark 2008) and profiled R&D scopes, response to R&D themes and research agendas; (3) contributing opportunities for new economic activities, internationalisation services, R&D and support to “billets of commercialisation”; (4) cooperation in R&D projects; (5) support to emergent and growing enterprises; and (6) integration of students’ everyday activities with the development of the international employment sector, which was based on working towards solving genuine problems and enabling the transformation of knowledge and competences in the global domain.

From the perspective of the evaluation of results and impacts and the assessment, in this collaborative R&D setting, the research finding is that: “valuable output results at the beginning cannot be predicted beforehand”, and that, “innovation results can be evaluated incrementally in time of implementation of study unit but not formalised and valued in advance”. Consequently, this assessment and evaluation perspective refers to a synthesis in valuation processes regarding the respected interest and path dependency nature of newly created R&D processes (Pirinen 2008, Ritsilä et al. 2008).
3.2 Development of research continuum

In the first action research study, while fostering sustainable regional development in the context of a UAS, the model was created as an integrative method of education and research. In this second design research study, a more detailed methodological view of the integrative model was addressed, namely: How can the regional development be understood, designed and implemented in a UAS, from the perspectives of integrative research and development frameworks?

This second referenced study was as follows:


The main contribution of this second study was the identification of the integrative research framework in the information system, safety and service domains in a UAS context. The study described the R&D framework, which comprises R&D research methods for increased understanding, and for building, improving and testing information intensive services and artefacts, which were both relevant to a regional-national R&D agenda and relevant to focused and strategically oriented R&D profiles. The research rationale lies in findings relating to the integration of regional development, innovation systems, clusters and activities of higher education emerge value, expertise networking and valuable relations. Following from this, it was possible to understand a single R&D intervention as part of a larger collaborative network of R&D interventions and international transformations, collocation and scalability.

In this study, the R&D interventions were performed in a manner that integrates students and networks of R&D actors; therefore, such interventions should take place within integrative environments, such as living labs, that allow for dissemination and internationalisation, and in which knowledge transformation is both used and focused upon. The integrative R&D model: builds bridges between technologies, applications and services; enables research results to be transformed into products, services; and creates economic success between forums, such as living labs, regional innovation systems and business that is more global. In this study, it was implied that innovation alliances should be made between various stakeholders, particularly in science, business and politics.

In the integrative R&D model, vertical cooperation, namely between lead innovations, is geared toward certain services, applications and branches that
benefit from specifically coordinated support contributions from technological areas (Research for Innovations 2007). In collaboration, simultaneous with service platforms, technological alliances that further technological objectives are jointly created by science and business. Since the realisation of study units includes different types of future sense (proactive), cooperation, “co-design”, “co-creation”, reflection and research activities, Laurea’s role in this “lead innovation complex” was focused upon service innovations and the production of professional competences that were integrative and centred on students working with other participants in externally funded R&D projects.

In this integrative R&D model, the term “co-creation” as an activity of “mutual creation” pertains to an R&D collaboration, in which learners and customers should be seen as “co-creators” of emergent value and information rather than as passive recipients of learned knowledge, goods and services. For this new transformation, the integrative model focuses on “co-created” knowledge and “co-designed” products and services by encouraging the development of competitive “value co-creation” in fields of service, safety and product development (Keränen & Ojasalo 2011, Pirinen 2008, Fränti & Pirinen 2005).

The one contribution of the second study was the creation of a linear R&D framework and design for cyclic innovation activities that have a research, action and quality perspective. The system was a kind of “work system” (Alter 2008) within an innovation system framework and a liberation process for innovative activities, rather than a fully automated process for innovation generation. The aspect of this second study, where reflection was concerned, was in the collective interpretation of related forums (elements). There were several reasons for presenting a clearer design and specification of the forums of the integrative approach and ontology. The first was the confusion with regard to practical management. Here, a completely different type of management is required for different actions in the integrative approach (leadership/management for path and situation). The second reason was that commercially beneficial innovation is almost impossible without radical intervention (Pirinen 2008). The third reason was the fact that we live in a time of globalisation and this means that our future business will focus more on proactive creativity and innovation (Fränti & Pirinen 2005). The fourth reason was that good quality is imperative and requires different types of action in order to be achieved; for example, it takes creativity and innovation into account and research itself includes relevance, validity and rigor. Achieving of the total quality management is more reliant on
productive/linear processes than cyclic forum. The fifth reason was that the activities of innovation orientation require different types of action and flexibility.

Based on these reasons, a more detailed definition was needed to differentiate between and clarify different action types (action type = forum = element). Consequently, the four forums were incrementally revised in the continuum of this second study: (1) cyclic, which supports creativity and innovation, this forum emphasises the importance of mental and physical creations and the aspect of freedom as part of the methods and philosophies used in action and design, for example, thinking and creativity; (2) thematic, which supports the “co-creation” and “co-design” of lead innovations, and the profiled scopes and structure of a body of knowledge, for example SATERISK in appendix: in where focused scope was “risks of satellites”, then the body of knowledge was “an union of achieved knowledge of the theme of risks of satellites and the respected actors”; (3) linear, which supports the implementation of research, as well as development and action processes, for example, actualisation of study units, production and practices; and (4) relevance, which supports validity and scientific rigorousness, as well as the quality and relevance of execution and quality assurance, for example, measures.

There were many key aspects in the theoretical framework of the investigative model, one of the most advanced was the information system framework (Hevner et al. 2004). In this, the second study addressed the paradigm shift from reactive education methods to a culture of proactive knowledge creation through “co-creative” and “co-instructive” research and development design. Here, the integrative approach links living labs and integrative R&D environments on a “thematic” level. The thematic design integrates citizens and their needs for care, education, a social entity, creativity and value in a participatory manner. This can be understood as being motivated by the knowledge of the participants, which allows them to focus on the service and use their self-motivation and freedom to achieve creativity and produce innovative products and services in integrative R&D environments. The proposition of this second study was a new expanded dimension to the information system framework (Hevner et al. 2004). Because it was needed in information system design in the context of living labs and integrative R&D environments, the proposal contributed more creativity, “co-design”, “co-creation” and user-centred support to the framework. Then, the study primarily explored and contributed to the new methods of R&D and regional integration which may take place in, and via, higher education. In this study, the integration of design and action research were used in the first, second and third study. Case study was the method in the
fourth and fifth studies. The integration of proactive approach, design research and action research methods, shown in Table 4, are derived from the second study.

**Table 4. Integration of research approaches (II, published by permission of AIS).**

<table>
<thead>
<tr>
<th>Proactive approach</th>
<th>Design research</th>
<th>Action research</th>
</tr>
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<tbody>
<tr>
<td>What it produces? R&amp;D scopes for innovations, lead innovations, trust bases, support to creativity and innovations in value networks.</td>
<td>Design research produces a viable artefact in the form of a construct, model, method, service or an instantiation.</td>
<td>What does it produce? Knowledge to guide the practice of modifications of the action.</td>
</tr>
<tr>
<td>What are its values? Social or economic activity and values prospects for individuals, value networks and innovation systems.</td>
<td>The object of design research is to develop technology-based solutions for important and relevant business problems.</td>
<td>The utility aspect of the future systems, modifies a given reality, or develops a new system or the action.</td>
</tr>
<tr>
<td>How executed? Using innovative and creative activities and freedom of methods. Transforms from problems to social scopes.</td>
<td>The utility, quality and efficacy of a design artefact must be demonstrated via well-executed evaluation plans.</td>
<td>How is it executed? Planning, action taking, evaluation, learning, diagnosis and reflection.</td>
</tr>
<tr>
<td>What effects and impacts? Educational improvements, research and development inspiration, regional societal and global results and impacts, extends a proactive R&amp;D-based culture.</td>
<td>Effective design research provides clear and verifiable contributions in the areas of the design of artefact, design foundations and design methodologies.</td>
<td>Implications of practice and contributions of the research in collaboration with researchers and participants of the action system.</td>
</tr>
<tr>
<td>Perspective? Innovation system. Regional and societal development. Proactive R&amp;D focusing and scoping in education within regional development.</td>
<td>Design as a search process: the search for an effective artefact requires utilising the available means to reach a desired end.</td>
<td>Action as participatory perspective: the researcher intervenes in the problem and research setting.</td>
</tr>
<tr>
<td>Nature of communication? Knowledge sharing and transformations. Integration of knowledge and people. Participation perspective.</td>
<td>Design research must be presented effectively to both technology-oriented and management-oriented audiences.</td>
<td>Knowledge is generated, used, tested and modified in the course of the action research project; audience for change.</td>
</tr>
</tbody>
</table>
3.3 Integrative environments

Like the previous two, the third study, lay with the research theme of integrative regional development in a UAS, and included: (1) experiences of creating integrative R&D environments; (2) aspects of operative environment and living labs; and (3) involvements of the externally funded R&D projects. The research question was: How can regional development be understood and designed in a UAS, from the perspective of effective integration and globalisation models? The included conference paper is referenced as follows:


The purpose of this third study was to create a new model combining the operative environment, logic of integration, and realisation practice for more effective globalisation in R&D. Therefore, it was obvious to design the research as the continuum of the first action research study. In the third study, the contribution included the description of the model and the experimental evaluation. This analysis was drawn from the research data collected between 2002 and 2009 at Laurea UAS in Espoo. The results were drawn from the perspective of a UAS with the Helsinki metropolitan area, including the globalisation perspective. The results of the study were based on collected best practices and empirical data derived from the context of Laura’s regional-international network. As to the continuum of research, the researcher performed “participatory and sustainable” action research, compiling several online databases and putting data collection procedures in place for the purposes of quality confirmation and R&D.

This third study demonstrated that higher education institutions could promote knowledge transfer through their international operations; this makes for a greater region in sense of knowledge transfer (cf. Saari 2009), which is a genuinely international and multicultural environment with strong functional links to the world’s top innovation regions and strategic alliances with the world’s top universities (e.g. Cambridge). According to the analyses of this study, students in higher education are satisfied with improvements of their own R&D competencies and the international value network gives them concrete prospects and possibilities for continuing their studies on a global scale. From a student
perspective, there are both strengths and challenges, as follows. Strengths: greater employment prospects, effective participation in authentic R&D projects, being at the centre of R&D work, highly experimental learning, raised aspirations, improved social skills, self-confidence, personal responsibility for results, contact with companies and organisations, and coaching rather than management through study events. Challenges: the system relies tremendously on group commitment, motivation and coaching; “self-learning” is demanding and takes significantly longer than traditional teaching. The study proposes a new model of an integrative R&D environment and logic of integration, as detailed in Figure 2 below.

![Integrative R&D Environment Diagram]

Fig. 2. Integrative R&D environment (III, published by permission of IIS).

According to the summarised feedback data from enterprises: this way of integration of education, R&D and regional development means cooperation with the employment sector to learn about the authentic developments and problems encountered at work. This feedback would address to the authentic interests, scopes and themes in the sphere of the forums of Figure 2; the method systematically seeks answers to problems whose solutions require new knowledge.
This addresses the authenticity of the R&D scopes and themes; the core of the integrative R&D model is formed by object-oriented work, which means that education focuses on genuine development of the working life. This feedback can be related to the forums, especially to the impacts and values; learning has a clear objective and takes place through the process of generating new competence. Still in terms of Figure 2, body of knowledge in action produces competence; improvements in social skills and self-confidence were outstanding, more future learning is needed for balancing the enthusiasm of a new developer and the managed goals of a production organisation.

According to FINHEEC evaluations (Impiö et al. 2003, Käyhkö et al. 2006):

“In general, UASs have huge potential and realistic possibilities to implement their regional development task and other authentic societal and global challenges. The paradigm shift of education methods towards knowledge creation through research, development and learning is growing; one challenge, however, involves changes in the institutional systems and roles and attitudes of the students, teachers and participants.”

The third study represented the furthered steps in investigating the prerequisites to creating integrative R&D environments: in this case, designing and establishing the relatively new concept of “living labs”. In this study, the concept of “living-lab” was understood as one instance of an integrative R&D environment, which can expand regional R&D and its agenda, scoping and activity as “transition into live”. In this study, “living lab” grosses a set of circumstances including appropriate methodologies, to make a living lab network “co-creative” and successful. In Figure 2, the integrative R&D environments and living labs were as integrated research, design, development, education and R&D environments for construction; for example, new services, new artefacts and improved methodology. Laurea Living Labs (LLL) is described for reference (Pirinen 2008, Leminen et al. 2012).

The integrative environment, Laurea Living Labs (LLL) is a member of the European Network of Living Labs (ENoLL). ENoLL has a Europe-wide platform for providing user-driven innovation capabilities and services to small and medium-sized enterprises, international corporations, public sector agencies, academic institutions and individual citizens. LLL is an approach to stimulating and accelerating industrial and societal innovation. This partnership has been related to the executions of hospitality management and information systems studies since 2008. It has advanced to the acceptance of funded R&D projects, for example, the ITEA2-DiYSE and ITEA2-GUARANTEE.
In Figure 2, as the main informants, actors such as students, teachers and participants, worked as equal researchers, learners, designers, instructors, knowledge creators and content producers with a scope of new, novel, and interoperative methods of learning, which were a part of the integrative model, with its incipient international activities and student-centred R&D. In this context, learning, development and research are student-driven; students use and apply research, and can recognise its value (Impiö et al. 2003, Käyhkö et al. 2006).

In this study, the terms “scope” and “research object” were first approached as the interface for the integration of R&D and education. In the context of this study, the term “scope” is much more flexible and abstract than the term “problem”; for example, as in transforming new ideas, new issues and objectives of R&D agenda to enactments of study units without readymade linear problem statements. The assumption was that the flexibility of the term “scope” could support more innovativeness than the term “problem”. However, since it can also be used for balancing in design of studies; for instance, challenges, management of cognitive load, measuring, modularising, and achieving a collective atmosphere and trust, activating motivation, and social interactions. Furthermore, the bordering and focusing of “profiled interests” also used the term “scope”. An interface between different activities, as with scope in the context of this study, has many disparate facets in the included literature (Star & Griesemer 1989).

One advance of this study was in finding that in an operative R&D environment, students and users have the most optimal opportunity to contribute to the developed service or system in the beginning, early phases of systems design, by actually setting the direction for the design rather than mainly responding to half-finished services or prototypes at the end of the study. Hence, focus in an integrative R&D environment is on student or user involvement to participate in the whole life cycle of R&D, from beginning to end. These cycles were described as forums (elements) in the second study (Pirinen 2009a) and here in Figure 2. In the third study, the first phase was most developed in including concept design and case studies for understanding and investigation of the needs of the service or artefact. This first phase is usually denoted as the requirements definition and as understanding, which is achieved by research findings of case studies (Tuomisto 2011, Luojus 2010, Mattelmäki 2006, Yin 2009, Benyon et al. 2005).
3.4 Perspective of quality assurance

The fourth study continues with the case study analysis that addresses the realisation of the regional development task from the perspective of quality assurance in a UAS. The analysis included systematic and empirical data collection and the evaluation of the quality system by the FINHEEC between 2002 and 2012. Here, the repositioning of innovation-driving industry and services, UAS, and government relations all take place to guarantee quality assurance. The focus of this fourth study was the reconsideration of the quality assurance system due to innovation networks, “co-created” innovations, the offerings of lead and open innovations and regional development that has an impact on national and global improvement. The research question was: How can regional development be understood, designed and actualised at Laurea UAS from the perspective of quality assurance? The article is referenced as follows:


The study followed on from the three earlier studies and then addressed the research from the perspective of quality. The continuum of this fourth case study was in extending the understanding that quality assurance, assessments and implementations can be vital for regional R&D, participant’s “co-creations”, creativity, and regional-international R&D collaboration. The main contributions of the study include: (1) understanding and design of quality execution and confirmation; (2) benefits of strategy-based R&D for realisations; (3) explaining quality related challenges; and (4) allowing more transparency to research by insiders and outsiders.

Several conclusions emerged in the analysis: (1) the advantages to ontology in cases where the key terms were bridged to empirical evidence; (2) the operational environment was investigated and presented from the perspective of quality and empirical evidence; (3) the theoretical binding was explained in viewpoints of past experience and quality; (4) the concept of quality was described in light of the integration of regional development and for improvements of future realisations of authentic R&D related study units in a UAS; (5) the concept of thematic curriculum for the integration of R&D and “regional-national interest”; and (6) the concept of evaluation design was
analysed, which can produce the environment for future improvements, such as new settings for measures of regional and national impacts.

The analysis was complementary to incremental theory building according to regional development theories such as the integration of the triple helix and “co-creation” theories, and support for “co-creativity” and open innovations in a higher education context. The utilized research form of case study was valuable in the early development cycles such as in developing an understanding of the logic of action as well as in the development of models to quality assurance system and analysis.

In the quality assurance process, the term “thematic” addresses the continuum of syllabus-curriculum-regional-national-international relations. The thematic region, thematic living-labs, novel R&D-activities, thematic curriculum and thematic realisations of study units have corresponding interests in the R&D agenda. Then, the “thematic” refers to student activities being related to a body of R&D themes for studies, which are important to regional, societal and innovation systems. Therefore, in this interoperative manner, research areas of the R&D agenda and a regional innovation system interact with the generation of new competences and regional capabilities in the realisations of UASs.

The logic and steps of the thematic implementations are described in Figure 3. The first step of realisation, after the “co-created” strategy, consists of traits and characteristics that constitutes the foundation for education and collaborative R&D and represents the natural form of individual student or groups of students, where further experiences can be “co-created”. Differences in personality and other characteristics explain why people follow different development paths, path dependent and situational learning continuums and experiences, and create different ideas, as well as acquire different levels and kinds of skills, abilities and knowledge; therefore, the different types of learning designs and syllabus would be implemented.

Broadly, defined to include work and participation in community affairs and innovation systems, the second step consists of skills, knowledge and competences, developed through R&D-based learning experiences. Here, scaffolding is a supporting process or structure for learning or training something that is already known; for example, training of competences, sharing of knowledge, model-based learning and training. The competences within different contexts require different bundles of skills and knowledge; demonstrations (e.g. prototypes and new service proposals) are the mid-range results of applying and proofing path related competences.
The integration of learning and collaborative R&D particularly challenges assessment. A student may have a genuine and “path related” workplace competence assessment setting in slightly different ways, depending on the context and path of competence, which requires that teachers to have a collective familiarity of the scope and competence for assessment. From the perspective of the integration of the quality assurance process and the education-learning process, the design of an R&D environment is described as two mutual circles of activities (as shown in Figure 3).

Fig. 3. Integrative R&D environment (IV, published by permission of CE).

The one advantage of a thematic curriculum is that the strategy of a UAS becomes an active part of integration when it creates and decides R&D profiles with other regional R&D actors; this is described at the top of the circle in Figure 3. The selection of R&D profile addresses what UAS can explore and improve in how it can react to internal and regional R&D demands. This setting improves: (1) an expanded R&D collaboration in the region; (2) extending the funding base on UAS; (3) scopes of selected regional R&D; and (4) an integrated trust and spirit of triple helix, “co-creation” activities and open innovations in the region.
In light of the evaluation steps and quality, there is no single easy method of determining construct validity in collaborative R&D activities as stated in literature by Patton (1990), Miles and Huberman (1994), Robson (2002) and Corbin and Strauss (2008). Here, construct validity refers to the correct operational measures for the theme being studied. The view of construct validity is both addressed and asked to the extent “does it measure what you think it measures?” (Robson 2002). The resultant estimations and measures, which are related to R&D and regional development, are primarily defined, maintained and “co-created” by the Ministry of Education and Culture and the network of UASs.

In this domain, AMKOTA is the statistical database containing the fundamental quantitative data of UAS activities. The statistics of completed credits are compiled by calendar year and by field of education. Completed credits are designated as/and earned with a passing grade in youth and adult education, leading to a bachelor’s degree and education leading to a master’s degree. The data of AMKOTA are requested directly from UASs and obtained from Statistic Finland. The Ministry of Education and Culture administers the AMKOTA database.

Here, the strength of the construct validity addresses the statistical nature of the analysed units, such as theses based on projects or R&D, the publication number produced, and the external funding of R&D (Salter & Martin 2001). In this analysis, the one identified weakness of construct validity lies in the estimation nature of used analysed units, such as the number of credits completed in R&D, which one is the criterion-based estimation in study units by teachers. The analysis of quality includes qualitative and quantitative data, in which the quantitative data is often interpreted through qualitative terms in reduction, display and drawing cycles (Miles & Huberman 1994, Stringer 2007).

The analysis of this study proposed significant implications for measuring impacts. The rationale for multiple methods (Nunamaker 2010) in multiple environments “over actors of a region” (Ritsilä et al. 2008) for measuring impacts was recognised because the impacts would exist in study unit, research environments, working life or regional-societal networks, during the time of actualisation of a study unit and/or long afterwards. Measuring the impacts can be useful from the perspectives of: (1) R&D by success; (2) R&D by feedback; and (3) learning by failure and Popper’s falsification.
3.5 Governance of externally funded R&D

The focus of this fifth multiple case study research is in governance of the activities that realises R&D and regional development, and share regional-national R&D capabilities, interests and R&D agenda in the R&D collaboration of higher education, regional innovation systems and integrative R&D environments. The study is an analysis of the eleven externally funded R&D projects at Laurea UAS between 2008 and 2012. By contributing to R&D in real-life situations, the investigated R&D projects develop academic knowledge, competences and regional capabilities for all networked participants. The research domain comprises the collaborative R&D networks, partnerships with higher education, and mutual interactions of industry, the service sector. The research question was: How can regional development be understood, designed and actualised in a UAS from the perspective of the governance of externally funded R&D projects? The fifth study is referenced as follows:

Pirinen R (In press) Governance of an externally funded research and development: A multiple case study analysis. WSEAS Transactions on Advances in Engineering Education.

This multiple case study completed the continuum of research, which connected the five earlier studies by the researcher, which were: (1) realisation of regional development (two action research cycles) between 2002 and 2008; (2) development of research continuum (design research of methodology) between 2003 and 2009; (3) design research study of integrative R&D environments such as “living labs” between 2005 and 2009; (4) enactment of quality (case study) between 2007 and 2012; and (5) governance of an externally funded R&D: a multiple case study between 2008 and 2012. The research theme focused on the integration of regional development, R&D and education in a UAS. The common unit of analysis was a sample of evidence as R&D projects in regional development and impacts.

The contributions of the study were in finding that participant interest and “co-creative” motivation were based on value and trust, such as the value gained from an R&D project and the value given to a collaborative R&D project. Consequently, the new proposal of this study was in the “steering forums”, which describe shared value relations, retentions and management aspects of participants between (1) academic (e.g. academy of Finland), (2) research, (3) empirical and (4) education domains. The contribution of the concept is in understanding and...
utilising the role of the various actors in the regional-international R&D stage. This steering and concentration of values is needed in the integration of (1) the research context; (2) the R&D agenda and scope; (3) the methodology; (4) regional capabilities and different R&D abilities and (5) education in collaborative R&D projects. Then, as an integrative system, funded R&D can promote a value that is achieved or “co-created” in an R&D project. This value can be expanded and utilised by participants or regional actors, and it can contribute education and regional development and impacts. The concept of steering forums is presented in Figure 4.

Fig. 4. Steering forums (V, published by permission of WSEAS).

The study investigated the mutual functions in the integrative model, which can be identified as purposes of steering from the macro- to the micro-level. The four recognised functions were (1) triggering, such as cyclic thinking, proactive ideas, R&D issues, R&D scopes and R&D agenda; (2) collecting, such as regional planning, regional R&D profiles, focused R&D themes, collaborative R&D, networking, joining of externalities, focused universities, collective research institutions and R&D concentrations; (3) driving, such as study units, R&D
processes and production; and (4) enabling, such as funding, proofing of quality and evidence of R&D. This functional continuum is illustrated in Figure 4.

With the associations of study, beginning from the most macro level, the integrated concept of steering and value concentration maintenances the view that the Finnish national innovation system is an extensive trust-based entity, which includes the producers and users of new information, knowledge and know-how, which also includes know-why and know-who information, and the various ways and culture in which they interact. As a role of “macro level steering”, a key task for science, technology and innovation policies was analysed to ensure the balanced development of an innovation system and the strengthening of cooperation within it. Here, this entity was understood in study as the most macro-level influences to the four functions in Figure 4 as facilitator of triggers, collectors, drivers and enablers for national R&D and steering forums.

On the right side of Figure 4 you find the operative, business and quality view which advances such as (1) implementation of R&D; (2) results and quality of spreads in business opportunities; (3) increased innovations and entrepreneurship by way R&D profiles; (4) innovation stimulation in early stages of higher education; (5) familiarity, relationships and knowledge bridges between actors in regional innovation systems; and (6) networking of R&D environments and living labs for already understood community-led and user-centred incipient innovations. Here, the theoretical basis resonates with the Gibbons’ disciplinary “mode-1” as the steering of drivers and enablers, which are management-based and situational (Gibbons et al. 2008).

The study continues with left hand side of Figure 4, where the integrative view comprises the strategy view. It focuses onto a sense of leadership, which was purposed to the facilitation of concentrated expertise and value to (1) enter new markets; (2) develop new products and services; (3) foster regional advantages; (4) “co-create” regional R&D profiles and strategies; (5) network critical mass for starting new business; and (6) flexibility of competitive response. The role of the regional innovation system is expected as triggers and collectors of R&D, which include regional R&D as the steering of inspiration and settings of networked R&D profiles, R&D agenda and R&D funding. The study assimilates the functions of trigger and drivers as the trust-based triple helix (Etzkowitz & Leydesdorff 1998, 2000, Etzkowitz 1998, 2003). In this viewpoint, academic (e.g. academy of Finland), research, education (e.g. UASs) and empiric parties (e.g. production industry, safety fields and service production) share trust and steering. In this case, described as the triggers and collectors, the Gibbons’
“mode-2” anticipates the “institutional flexibility” and trust (Gibbons et al. 2008: 153). At this point, the creativity is collective as a group “co-creativity” phenomenon with the individual’s contribution. In “mode-2” of steering, the management was seen as being exercised as a socially extended process, which accommodates a variety of regional interests in a process and situation.

Figure 4 was contributed as the concept of “steering forums”, in which the steering functions integrate shared values and interests, relations and R&D activities between (1) academic, (2) research, (3) empirical and (4) education domains. The (1) intellectual value; (2) value of new knowledge, such as the results of academic research; (3) value of competitiveness, such as the transformation of knowledge to innovations; and (4) business value, such as relevance to commercial purposes, are all concentrated in the steering forums. The term “steering forums” was thus identified in the study; it covers everything that is steering the integration of R&D and regional development, as insiders, outsiders, management, R&D externalities, situations, retentions, networks and systems.

In Figure 4, the study advances to reflection and feedback, which includes such perspectives as: (1) results and impacts to the domain; (2) improvements to the R&D agenda and scopes; (3) questions of methodology; (4) advances of regional capabilities; and (5) evaluation of focused education within collaborative R&D projects. Then, as a continuum to the integrative model, funded R&D can promote a value that is achieved or “co-created” in an R&D project. This value can be expanded and utilised by participants or actors; it can also contribute to education and regional development.

The analysis of study takes a longitudinal perspective alongside the R&D collaboration between higher education, industry, service sectors, and government and region and it additionally revises earlier studies. In this way, it is efficient to integrate action and values (Pirinen 2008, Keränen & Ojasalo 2011). The study also furthered a design of regional integration, as steering forums. The effort is in the development of regional steering capabilities, which refer to the ability of regions to integrate and intensively realise the innovation strategies of the regional administration, business community and innovation support (Rutten & Boekema 2012, Terävä & Ylilinna 2012, Laage-Hellman et al. 2012, Maassen et al. 2012, Rickne et al. 2012).
4 Discussion

The fourth chapter begins with a discussion of the most advanced methodological, theoretical and managerial implications of the five studies. Then, the interesting issue, latest vision towards an integrative model for future higher education which is led through the implications is revised. The second sub-chapter describes a furthered integrative model as designed for “The UAS for The Future”, in which higher education should be able to work within an interdisciplinary framework for regional-national competitiveness. Third, the audit of the five studies is discussed where consideration includes external validity, internal validity, construct validity and reliability. Finally, recommendations for future research are presented.

4.1 Implications of study

This section includes a description of the most forward-looking methodological, theoretical and managerial implications of the five studies and how they reveal the composed theoretical foundation. In this, the focus is on making sense of empirical data, methodological approaches and the aspects of outlined theoretical bindings (Baskerville & Myers 2004). The summaries are presented in Table 5 and Table 6 at the end of the related sub-chapters.

4.1.1 Methodological and theoretical implications

In this study, as a research method, action research was used in the linear and relevant parts of the integrated action, especially in the sustainable integrative process. According to McKay and Marshal (2001), the dual imperatives of action research are (1) the problem solving interest and (2) the research interest. Both were implemented inside the integrative model and quality assurance system that took place in everyday action at Laurea. Although the cyclic nature of the action in the triggering phase, action research can hold the main role for maintaining scientific rigorousness in the linear and relevant parts of the integrative process. Hence, only a few of the innovative creations as “promising innovation candidates” lead to the innovation–execution–internationalisation process (Taatila 2009). Nevertheless, in this case, it is implied that the methodology of the cyclic element would include more motivation-based, flexibility and freedom for purposes of R&D and proactivity.
According to Jensen et al. (2007), innovations can be generated without research or even relevant problems but they always involve “inspiration” and “perspiration” as (Taatila 2009) words. Here, inspiration means creativity, which is supported with cyclic activities and perspiration meaning development work and commitment to production, both of which are always required and present before an innovation can be introduced to a global market (Fränti & Pirinen 2005, Pirinen 2008, Taatila 2009). Then, the methodological implication is that the action research, used by the integrative model, is suitable for the linear and relevant parts of that process and it works well in tandem with a quality assurance system.

In this study, the methodological approach to an integrative R&D framework was addressed regarding design, development and evaluation of the artefacts and services. The proposal framework was as an expansion and derivation of a theory to guide the implementation process of R&D and practice in the UAS domain. Therefore, the framework included the broader view of continuum of research as theory, prototype and validation by experiments or field study, which were approached, in where: (1) case studies were facilitated for an increase in understanding, for example, the case studies and related proactive forecasts were used for achieving improved understanding for design and future sense; (2) design research for building, improving and testing of artefacts, services and methodology, and (3) action research for research of organisational-regional change and epistemological utility. Then, focusing on the multimethodological perspective of research, the results of the study are in line with those of Nunamaker (2010). According to Nunamaker, this is because no single research methodology should be regarded as the preeminent research paradigm and because no single research methodology is sufficient by itself. Consequently, the integrative R&D framework, proposed in the second study, has inferences as to where the focus of R&D outcomes and evaluation would be in the prediction of research impacts. As an example, by way of using the last-mile research (Nunamaker 2010), this includes three phases: (1) proof of concept, which has closeness to exploratory sciences; (2) proof of value, as the view in experimental sciences; and (3) proof of use, as an instance of applied sciences and engineering (Nunamaker et al. 1991, Nunamaker 2010).

From the perspective of results evaluation and assessment in realisations of study units, if the main scope of study unit is the improvement of creativity, interest and the use of creativity for innovations, then, according to the data of this study, it is implied that in cyclic action: valuable output results cannot be
predicted and defined well beforehand. Here, innovation results can be evaluated and its assessment done in time or in end, but results and impacts cannot be formalised and valued in advance. This obviously pragmatic perspective implies a synthesis of objectivity, subjectivity and value in the cyclic processes, assessment and realisations (Haack 1976, Markus et al. 2002). This additionally implies that creativity oriented results resonate with path dependency and situational development (Nelson & Winter 1982, Lave & Wenger 2009).

Addressing the path dependency of entities, regional studies often employ the evolution theory of economic change (Nelson & Winter 1982). Vygotsky (1978) makes also far resonance in this view, the “distance between the understandings of the complexity of scopes between participants”, this balancing of proximities and “cognitive load” becomes a negotiated process between the student and the other actors in this environment (Vygotsky 1978, Engeström 1987). Carlson and Jacobson (1997) emphasise that learning takes place in the innovation process, which is rooted in a factual economic structure and in a local context, which includes strong elements of path dependency. In this case, this view is well implied in RIESCA and CoCo (appendix). According to the data from this study, path dependency obviously, and in particular, explains mental proximity, social proximity and cultural proximity.

According to this study, as an implication to ontology, the term “scope” was first approached as the interface for the integration of R&D and educational actualisations. Here, the term “scope” was understood as much more flexible than the term “problem”. The implication is that the flexibility of the term “scope”, as the core of LbD, can support more authenticity, innovativeness and creativity than the term “problem”; for example, in the creation of SATERISK.

Since, the term “scope” is kept flexible and supportive for “new start-ups”. It can also be used for balance in steering and challenges, management of cognitive load, measuring, modularising, achieving a collective atmosphere and trust, activating of motivation and social interactions. However, it is noteworthy that the data of this study implies that there is difference between “problem” and “scope”. The scopes are sometimes very useful, such as with SATERISK. Sometimes the abstract nature of a scope creates cognitive difficulties in constructive studies. Because of the uncertainty which is related to new scopes, and there is only a small amount of knowledge and body of knowledge about new research areas of scope and no readymade answers in area of studies (Barrows & Tamblyn 1980, Poikela 2001, Poikela & Poikela 2010).
Table 5. Summary of methodological and theoretical implications and aspects.

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<th>Aspect</th>
<th>Implication and theory binding</th>
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<td>Methodological integration</td>
<td>Proposed interdisciplinary models and continuum of research methods can be diverse and broad and cover many different and applied domains. In this domain of study, it brings together research, service and safety. The context of study, services, information systems and security management would be utilised in all organisations, domains and teams, then the research continuum is interdisciplinary and multimethodological in nature. Here, research is one function of a student-centred research university and national research agenda. The lead scopes, which we faced, were complex in that they could hardly be understood or solved from a single perspective. This aspect should be broadened to the creation of research themes, scopes and curricula that are multi-disciplinary, multi-university and include triangulation. To do so, the integrative aspects can expand domains of influence, direct and indirect impacts and share a mutual value regarding solving real-world scopes and problems. (Campbell &amp; Fiske 1959, Patton 1990, March &amp; Smith 1995, McKay &amp; Marshall 2001, Hevner et al. 2004, Nunamaker 2010, Hevner &amp; Chatterjee 2010).</td>
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<td>Constructivist sight</td>
<td>Knowledge is not transported to individuals, but it would be constructed by the individuals themselves or “co-created” by participants. Here, a social reality would be constructed by those who participate in it (Dewey 1897, Burr 1995, Helakorpi &amp; Olkinuora 1997, Tynjälä 1999, Rauste-von Wright et al. 2003, Hakkarainen et al. 2004, Rutten &amp; Boekema 2012). In this study, the evidence-based knowledge creation is artefact and service related; the knowledge-creation was understood as a process of inquiry where new ideas, tools and practices were created, and the initial knowledge was either enriched, significantly transformed or newly created during the process by individuals or collective participation. The actualisation (implementation) of thematic curricula implies that activities can be involved with R&amp;D projects from fields far beyond the knowledge base of the university.</td>
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<td>Path dependency nature</td>
<td>Integration and regional development, R&amp;D and higher education are not developed in isolation and rarely depend on situation, geography or historic and cultural bindings. Here, the aspects of path dependency can be described as “we did it our way” which can be worded as follows: “what we can do in our own way is related to where we are and then where we have been” (Tarkkanen 2009, Nelson &amp; Winter 1982, Reichert 2006, Arthur 2007, Johansson &amp; Ylönäplä 2012, Rickne et al. 2012).</td>
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<td>Activity theory</td>
<td>The focus of activity theory is that an activity cannot be analysed outside the context in which it occurs. Activity theory seeks to explain cultural and social practices in a real world context by relating them to the cultural and historic context in which the activity takes place. Here, the human mind emerges, exists and can be understood within the context of human interaction with the world. In this interaction, an activity itself refers to social and cultural dependency. In this study, at least, a value, new knowledge and the scope of research can be expanded between a student-centred research university and a national research agenda (Leontev 1978, Nonaka &amp; Takeuchi 1995, Engeström 2001).</td>
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4.1.2 Managerial implications

This sub-chapter includes four implications for management guidelines: (1) management should be based on the requirements of competitiveness, competences and capabilities of focused profiles in the large Helsinki metropolitan region, which can particularly be expanded within higher education as (Clark 2008, Gibbons et al. 2008) anticipated; (2) management as cooperation with networks and innovation systems, for example, regional-thematic scopes, active networking, and research agendas can all be used in steering R&D related study units in focused higher education as (Clark 2008) described; (3) according to the data of this study, the transactions of contributing opportunities for new economic activities, building a further regional focus, commercialisation and internationalisation services, research, development and support to “proof of commercialisation” were almost without exception, at least in some phase, related to regional support, external funding and innovation systems. This implies the significance of R&D collaboration, external funding and cooperation in R&D projects; then, more management effort and the triple helix is required to support emergent and growing enterprises in parallel with higher education. Therefore, the underlying implication is that regional collaborations matter in the collective R&D (cf. Braczyk et al. 1998, Salter & Martin 2001, Kautonen 2006, Asheim & Coenen 2006, Doloreux 2002, Cooke 2004, Asheim et al. 2007); and (4), according to this study, the integration of students’ everyday activities with the development of the international employment sector, which is based on working towards solving genuine problems and enabling the transformation of knowledge as well as competences in the global domain, can be particularly steered and triggered with the value, purpose and experience (Clark 2008, Engeström 2001, Leontiev 1978, Vygotsky 1978, Dewey 1897). The integration of students’ everyday activities can also be expanded to form regional strategy (cf. Study I, Study III, Appendix RIESCA and SATERISK).

Although the local thematic continuums and the local social knowledge sharing between the various actors still matters as trigger, drivers and relevant enablers, the overall implications of the study are that the integrative model would not be steered as an isolated entity but it would be increasingly more connected to the externalities, global markets, pipelines and open innovations (Bathelt et al. 2002, Wolfe & Gertler 2004, Teräs 2008, Laage-Hellman et al. 2012, Teräs & Ylönenpää 2012). The most significant managerial implications and aspects of this study are summarised in Table 6.
Table 6. Aspects of managerial implications.

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<th>Aspect</th>
<th>Managerial implication</th>
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<td><strong>Focused university</strong></td>
<td>The concept of the focused university points to a type of organisational character that growing classes of universities will need for sustainable development; universities can become robust as they develop capabilities built around a flexible and novel focus (Clark 2007, 2008). The context of study, higher education of information systems, services and security management are primarily located inside schools. The implication of study is that the implementation of services, information systems and security management should be present as a regional-national R&amp;D agenda and contribute to needs with information and knowledge at the centre of research and national competitiveness and capabilities within an interdisciplinary framework and as facilitated R&amp;D resources.</td>
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<td><strong>Triple helix</strong></td>
<td>In this study, the sight of a triple helix was on the innovations produced through the dynamics of interactions and communications among academia, industry and government and on the social mechanisms of selection, variation and retention responsible for their evolution as sectors. The realisation of the triple helix was directed towards the realisation of an environment with innovativeness, consisting of university spin-offs, bilateral initiatives for knowledge-based economic development, and strategic alliances between R&amp;D actors (Etzkowitz 1998, 2003, 2008, Etzkowitz &amp; Leydesdorff 1998, 2000, Teräs &amp; Ylinenpää 2012). Here, the vertical and top-down steering in this integrative and bottom-up orientation made implications to several viewpoints as guidelines to the regionally focused and student-centred university. The managerial implication is that we would place more emphasis on the research of entrepreneurial triggers, drivers, enablers and knowledge sharing with international externalities for both potential and vital profiles, functions and interactions, and for novel competences, capabilities and competitiveness.</td>
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<td><strong>Gibbon’s modes</strong></td>
<td>In this study, as a management approach, Gibbon’s mode-1 effects as a setting where the creativity of an individual is the driving force of development and is operated through disciplinary structures of identifying and improving the management and that collective perspective as the consensual figure of the scientific community. Gibbon’s mode-2 was applied as the novel quality setting in management and leadership. Here, the creativity was understood as a collective group “co-creativity” phenomenon with individual contributions. In the union of mode-2 and mode-1, the management and steering would be exercised as a more socially extended process, which accommodates a variety of interests in an implementation process with leadership and management (Gibbons et al. 2008).</td>
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<td><strong>Bottom-up model</strong></td>
<td>The integrative model in the form of strategy includes integrative environments and realisations of education functions which supports R&amp;D collaboration and expertise sharing. This bottom-up accounting is diverse but it is well connected (cf. Maassen et al. 2012: 12) and it can act as a motivation-based trigger-driver between the student-centred university and expertise in the workplace and practice. Then, the implication is that new scopes and ideas for innovations can be related into student work and relationships, this emphasises that the governance of networked expertise and relationships management may serve as a trust-based knowledge bridge, which contributes triggers and drivers for new advances.</td>
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4.2 Towards the future of the integrative model

The basis of the integrative model was in development projects that were genuinely rooted in the communities of work, which (between 2002 and 2004) attempted to produce new practices, competences and knowledge in the help of research orientation, authenticity and development. Between 2003 and 2006, the development of the integrative model required collaboration between lecturers, students and workplace experts; the integration of regional development and the operational environment of a UAS represented a one way situation networked community and practice of the collaborative environment and its model for forming a collective space for R&D related education. The purpose of study was to support the fulfilment of regional development related outcomes while also allowing for new creative and collective production, development and interactions in R&D processes. In the integrative model strategy, there were no separate regional development or R&D units; rather, the R&D activities had been integrated with focused activities and implementation of study units as a student-centred university (Regional Development Strategy 2002, Research and Development Strategy 2004, Pedagogical Strategy 2002).

Then, since 2005, in student-centred R&D, students were at the centre of operations and development in efforts to promote the acquisition of the competences by students, staff and partners to enable them to function as proactive and pioneering developers. The student-centred R&D was then a new form of combining R&D, learning and the regional development, where the student not only implements the project, but also takes active responsibility for the related preparation and applications that form R&D (cf. Eraut 1994). Here, the LbD base was created in a collective process between 2004 and 2006. However, between 2007 and 2012, the focus of the LbD model shifted from a strong pedagogical orientation to an R&D orientation and R&D with international externalities. Since early 2002, the selected model, which was related into management strategy, has been known as the integrative model strategy (Regional Development Strategy 2002, Pedagogical Strategy 2002). In this strategy, the learning environment and living labs utilise internal and external networked expertise and act as trigger-drivers with the communities of expertise, practice and work. New knowledge is acquired for genuine and mutually interesting purposes, such as collaboration within a mutual theme, which is in the regional R&D agenda.
The progress in the integrative model changed considerably between 2002 and 2012. In the middle of this change, there were the following: focused targets in education, new strategic profiles, changes of operational environments, R&D, and services, as well as creating and strengthening networks, collaboration, living labs (Ståhlbröst 2008, Sölvell 2009) and activities with actors of regional development and clusters (Teräs 2008). The regional responsibilities and collaborative relationships also brought UASs nearer to entrepreneurial action methods e.g. (Auvinen 2004, Rauhala 2008). The latest design of the integrative model joins authentic R&D, which includes students of higher education with international externalities. The regional integrative model, which I remarks for the future, is described in Figure 5.

![Fig. 5. Revised design of the integrative model for the future.](image-url)

Beginning from the outer edge of the revised integrative model, the “most macro area” is represented as global world and international markets. The next sphere is environments as “region or domain”. Then there is an interface of “integrative” environments, which joins clusters, innovation systems, and living labs (as described in the third study) and which include cooperative actors in the national and international R&D stage (as described in the fifth study). The integrative model has gradually developed into an operational model in which student-
centred learning integrates R&D (as referred in the second study). This is described in the centre of the model as a micro area, which includes steering forums (as founded in the fifth study), implementations (as explored back in the first study), evaluation and quality of results (as described in the fourth study) and research in the integrative R&D framework (which was proposed in the second study).

In Figure 5, realisations of regional development task involve an R&D agenda based on joint activities, where international expertise and externalities can be shared and pipelined over distance and borders with R&D collaboration. In this vision of student-centred higher education, a UAS focuses on the expertise and regionally oriented form and profiles of higher education. It cooperates with communities of work and then business, industry and services. The assumption of this future vision is still that if a large number of learners from the workplace as well as students of higher education can be trusted and mobilised to further regional R&D, then more regional results and impacts would be achieved. The regional-national-international research agenda and themes are subsequently used for the “creation” of “scopes”. In addition, the learning transactions generate authentic results and impacts, which improve regional capabilities.

From the perspective of the future view, there is no easy or single way to determine validity of R&D. The revised integrative model proposes that the future evaluation of R&D activities includes both qualitative and quantitative data (AMKOTA), which would be interpreted in the form of: (1) achieved results which can be assessed, (2) direct impacts, (3) indirect impacts and (4) feedback. The strength of the construct validity in the study relies on the statistical nature of the analysed units, such as theses based on projects or R&D, the publication number produced, and the external funding of R&D (AMKOTA). However, the study has significant implications for further research. The vision of the integrative model suggested that the development of multiple methods in multiple environments for the measuring of outputs, direct and indirect impacts are needed (cf. Goldstein & Renault 2004). For advancements, the measurement of impacts would necessitate the integrated view of regional, national and global factors. Conversely, the difficulty is in the maintenance of different measures and usefulness between the different actors. The summary of the main entities of integrative vision from the perspective of regional development, student-centred university and integrated R&D are summarised in Table 7.
Table 7. Summary of main entities of the integrative vision for the future.

<table>
<thead>
<tr>
<th>Entity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose</td>
<td>The purpose of the integrative model is in the fulfilment of the three tasks. It would provide new regional development and higher education in the areas of R&amp;D and design of services and artefacts, foundations, methodologies and integrative interactions, which contribute original and relevant regional capabilities, authenticity, experimental nature, creativity and networked partnership.</td>
</tr>
<tr>
<td>Guidelines</td>
<td>Using inquiry studies to design and develop in understanding, &quot;co-design&quot;, &quot;co-creation&quot; as building, improving and evaluation of artefacts and services and using research for dissemination of advantages, which are based on a research-oriented approach, regional studies, student-centred university and &quot;co-creation&quot; theories. (Fränti &amp; Pirinen 2005, Pirinen 2008, Keränen &amp; Ojasalo 2011).</td>
</tr>
<tr>
<td>Steering forum</td>
<td>The steering forums were identified in the fifth study. This forum covers everything that is steering the realisation and regional integration of R&amp;D and regional development and student-centred higher education as insiders, outsiders, actors of governance, funding, management, R&amp;D externalities, situations, retentions, R&amp;D continuums, networks, clusters and innovation systems.</td>
</tr>
<tr>
<td>Interface</td>
<td>The integrative transactions and action interfaces would be based on novel scopes, lead objects of the innovation system, research strategy and agenda, and the needs of regional capability, which are based on authenticity and experimental nature (cf. Auvinen 2004, Harmaakorpi 2004, Fränti &amp; Pirinen 2005).</td>
</tr>
<tr>
<td>Role of study units</td>
<td>In integrative model, students use and apply research and recognise its value from the perspective of development, design and understanding within the regional development mind. It can be identified for the future that the student-centred R&amp;D in regional development is based on and includes the implemented R&amp;D and comprises regional development. Then, the R&amp;D related study units consist of an individual’s mind-on and hands-on activities, and social, mutual and constructive interactions, which are creating something new within integrated R&amp;D and a regional development agenda, and emergent knowledge, which is shared with communities of work and communities of R&amp;D and international externalities and pipelines, which are facilitated for transformations and a proactive sense. Then, the integrative model is implemented in the authentic R&amp;D expertise field, which includes students of higher education with international bindings and attractive global and proactive possibilities.</td>
</tr>
<tr>
<td>Result data</td>
<td>The results data would include both qualitative and quantitative data, which can be interpreted in the form of results, direct impacts, indirect impacts and feedback. Then, the results data presents the data collection set (e.g. AMKOTA and INKA); which includes transparent qualitative, quantitative and longitudinal data for purposes of understanding, design, improving, follow-up and analysing.</td>
</tr>
<tr>
<td>Impact</td>
<td>In this context, the term “impact” refers to welfare, marked and educational effects and influences such as R&amp;D related learning, which have clear competence, capability and competitiveness properties and improved powers to the regional-national scale.</td>
</tr>
</tbody>
</table>
4.3 Audit of the study

First, in this chapter, the external evaluation transactions are described for audit reference. Second, the four tests commonly used to establish the quality of any empirical social research consideration are reviewed. These include: (1) external validity, (2) internal validity, (3) construct validity and (4) reliability (Yin 2009, Corbin & Strauss 2008, Seale 2004, Patton 1990, Miles & Huberman 1994, Denzin & Lincoln 2005, Lincoln & Guba 1985).

4.3.1 External evaluations


As the starting point of outsider evaluations, the first evaluation of regional impacts by the FINHECC was in 2001. The evaluation group stated that the nominated units of UASs had close contacts with the enterprises and new ideas, how to serve the regional advances and strategies and they had a clear strategy for the regional role. The critical feedback addressed that: “information and communication technology were too prominent in the regional activities” and, simultaneously, that the “welfare sector was not paid attention to” by UASs (Huttula 2001: 22–23). During this time, the expected economic growth in Finland was primarily concentrated on information and communication, and other technological efforts and the suggested future objective was the “interaction between education and R&D”; and the “activities of UAS’s would improve a strategic wholeness and that the regional development would be better integrated and taken into the account across different educational sectors” (Huttula 2001: 17–23).

The second outsider evaluation of the regional impact of UASs was in 2003, when the FINHEEC evaluation group classified the UASs into four categories regarding regional impacts. These categories were: (1) passive; (2) subcontractors;
(3) partners; and (4) proactive actors. The evaluation group stated that the majority of UASs were subcontractors who participate mainly in the realisations of different regional programmes and the UASs, which were elected as top units, were proactive and proposed new openings in their area. In particular, the criticism was similar to that in 2001 as technology was furthered in many UASs as leading orientation and “increasing the social or cultural capital did not rise strongly out” (Impiö et al. 2003: 21–26.). In this FINHEEC evaluation, the UASs, which were elected as top units in regional impact, displayed samples such as: (1) a good strategic approach and strong proactive role in regional programme work; (2) a new feature was that several top units were praised for co-operation with traditional universities; (3) the top units developed regional innovation environments; and (4) some of them also showed good integration of education and R&D, which clearly improved after 2001 (Impiö et al. 2003: 28–40).

In the third FINHEEC evaluation of regional impact in 2006, the evaluation group stated: (1) The narrowest role of UAS is primarily educator and executor of projects, which addresses to existing possibilities and assembles something new innovative activity; (2) there are the new structures, which develop the area; (3) central is then the strong role of know-how in the UAS; (4) the alternative role is a member of developmental network, which springs from strong substance knowledge; (5) the special knowledge of UAS is a strategic top and is transferred by thesis, internship and R&D projects to the use of the environment; (6) as defaults, it were continually in integration of education and R&D work and the coverage of regional impact concerning educational sectors; and finally (7) internationalisation and promoting of entrepreneurship were more in the focus than before (Käyhkö et al. 2006: 20–21).

Those UASs, which were elected as top units in the field of regional impact in 2006, had adopted the role that almost all R&D activities in the UAS were focused on regional development (Käyhkö et al. 2006; Rauhala 2008). The coverage of regional development was also respectable in the field of services and concerning the more distant areas of the physical territory of the UAS (Käyhkö et al. 2006: 29–103). The elected units also had evidence of promoting the entrepreneurship in the region and co-operation with business life (Rauhala 2008; Pirinen et al. 2009).

The fourth influenced FINHEEC evaluation transaction between 2007 and 2010 was addressed to the term “quality assurance system”, which was used to systematically monitor and develop the operations (Lampelo et al. 2010). Here, the term “quality” referred to the suitability of procedures, processes and systems
in relation to strategic objectives. In this context, the quality assurance systems combine the knowledge-based structures with a body knowledge. The fourth study, as the realisation of quality and its empirical studies marked the integration of the multiple interests: (1) quality implementation and confirmation; (2) research-based development of operations and strategies; and (3) problem-solving interest (Pirinen 2012b). The quality reviews and visitation of outsiders also produced effects to the objectivity: the data was in the quality assurance system and in the form available for reanalysis by others regardless of the method or role of researcher between insiders and outsiders.

The last two FINHEEC evaluations of RDI (research, development and innovation) activities in Finnish UASs (2011) decided that there are a number of aspects to the fulfilment of RDI tasks at their full potential: (1) the commitment and enthusiasm in the work on the development of RDI function; (2) the environment of the UAS is positively dedicated to the further development of the UAS sector’s RDI function, as well as by the fact that the funds invested in RDI activities at UASs were increased relatively quickly; (3) from an international perspective, the development since 2003 of the R&D function of the UAS sector has given UASs unique advantages. However, the key future activities of UASs would be in strengthening the ways in which this sector can develop more coherent, sector-wide R&D activities (Auvinen et al. 2010, Maassen et al. 2011).

The report by Maassen et al. (2012) includes a more critical feedback of the development and current situation of the RDI and innovation function as well as the RDI tasks of the Finnish UAS sector. In the evaluation panel’s view, “There are a number of aspects of the overall steering, legal and funding framework of the RDI function and tasks that need considerable strengthening before the UAS sector will be able to perform RDI activities at its full potential”. This concerns, “the lack of a generally accepted RDI definition, the relatively small basic funding basis for R&D, the fragmented and in some respects uninviting external funding context, the education dominated academic culture in the sector, the weak international dimension in the sector’s R&D projects, the relatively weak institutional links to public and private organisations in the UASs’ environments that are in need of RDI services, and the absence of an effective, sector specific set of RDI indicators that can be used for funding and policy purposes in the sense that important strategic choices have to be made by the UAS sector as a whole and by individual UASs” (Maassen et al. 2012: 62–63).
4.3.2 External validity

In this study, external validity refers to establishing the domain in which a study’s findings and integrative model can be generalised (Miles & Huberman 1994, Seale 2004). Here, the external validity addresses a greater significance of results and advances of the study and the level of possible generalisation in the domain of higher education (Miles & Huberman 1994, Denzin & Lincoln 2005, Lincoln & Guba 1985). Laurea UAS and its development network were successfully used as a domain, where the integrative model and student-centred R&D were built, improved and tested between 2002 and 2012.

In this study, the external reviews and visitation of outsiders created improvements to the external validity, hence: (1) the used models were discussed and analysed from different perspectives; (2) a comparison with other UASs as considering samples of evidence; (3) composing a larger view of the theoretical frameworks used in the higher education domain; (4) reflection of general boundaries and limitations in the UAS context; (5) discussions of potential transferability and improvement of models; (6) discourses of theory bindings; (7) transferability to different settings; and (8) collocation with other UASs and regional innovation systems (Impiö et al. 2003, Käyhkö et al. 2006, Auvinen et al. 2007, Auvinen et al. 2010, Maassen et al. 2012).

The national evaluations have recognised the evidence of a future-oriented development and research of the integrative model. Laurea UAS was nominated as the Centre of Excellence in Regional Impact for 2003–2004 and 2006–2007 and as a Centre of Excellence in Education for 2005–2006 and 2008–2009. The student-centred R&D led to the nomination of a Centre of Excellence in Education for 2010–2012 and Laurea was the only UAS to receive the nomination for the entire University. As a summary of the evaluations by FINHEEC (from the perspective of external validity of the of the integrative model): (1) the integrative model as a whole can be particularly well suited to UASs and Laurea can set an example for the Finnish UAS; (2) the model has actively been presented in national and international forums and a significant proportion of Laurea’s research and publication activity was also related to the model; and (3) the operations have been actively developed in order to become established in the European higher education area (Impiö et al. 2003, Käyhkö et al. 2006, Auvinen et al. 2010). In addition, the methodology and research design, such as, use of replication logic in multiple case studies was “intended to deal with external validity and next sub-chapter’s internal validity” (Yin 2009: 136).
4.3.3 Internal validity

In this study, internal validity refers to the establishment of causal relationships among audiences (Yin 2009, Corbin & Strauss 2008, Seale 2004, Patton 1990, Miles & Huberman 1994). The design of the study was based on a combination of a thorough understanding of the theoretical framework and wide experimental knowledge; for example, the concepts and their relationships, which were used to explain actions and meaning concerning the research questions. The internal validity of the results produced by the newly created models was in the realisations of study units, both parallel the analyses, methods, models and new processes. The objective was in ensuring that the new propositions were logical, authentic and internally valid from the perspective of implementation of study units and information systems, the security field, and services in context of a UAS. From the perspective of authenticity, the transparency of data displays (e.g. collectively revised in development days) inspired our thinking and allowed new ideas, new models and new types of action to emerge.

The reviews and visitation of outsiders produced such effects to the internal validity aspects as: (1) an expanded perspective to the theoretical framework; (2) the configuration of regional development and collaboration within innovation systems; (3) triangulation with other institutions, path dependency, effects and used methods (Chatterton & Goddard 2000, Salter & Martin 2001, Goldstein & Renault 2004, Lester 2005, Koski 2006, Goddard & Puukka 2008, Konu & Pekkarinen 2008, Ritsilä et al. 2008); (4) increased data relationships to the constructive educational theories and relations of concepts as in quality system evaluation (Lampelo et al. 2010); critical feedback and challenges for improvement (Huttula 2001, Impiö et al. 2003, Käyhkö et al. 2006, Auvinen et al. 2010, Lampelo et al. 2010, Maassen et al. 2012); rival explanations; replications of findings; and produced predictions in strategies. However, as critical consideration of internal validity: should the articles be sent to completely different journals; the comments made by the reviewers could vary to some degree resulting in slightly different outcomes; therefore, the analyses could have provided different results.

In addition, this study involved experienced experts in fields of the university and UAS evaluation forums, the supervisor and pre-examiners of the study with whom the research findings, literature recommendations and methodological viewpoints were revised (Kess et al. 2002, Saari 2009, Karran 2009).
4.3.4 Construct validity

In this study, construct validity refers to the correct operational measures for the integrative theme being studied (Yin 2009). The view of construct validity was addressed to the extent “what was to be measured was actually measured” or as Robson (2002) asked, “does it measure what you think it measures”. In this study, the utilized framework that “what was to be measured” was illustrated in detail in the form of a category and descriptions in the fourth study.

As Robson (2002) states, there is no easy, single way of determining construct validity. In this study, the strength of the construct validity addresses the statistical nature of the analysed units, such as theses based on projects or R&D, the publication numbers produced, and the external funding of R&D. The one identified weakness of the construct validity of the study lies in the estimation nature of the criterion based analysed units, such as the number of credits completed in R&D. The study also had significant implications for further research regarding construct validity. It is suggested that the development of multiple methods in multiple environments “by R&D actors of a region” for the measuring of impacts is needed, because the impacts would exist in study unit, research environment, working life or regional-societal networks, and during the time of implementation of study unit, or long afterwards. For advancements, the measuring of impacts would need the integrated view of regional, national and global factors. In turn, the correct operational measures can be met by multiple sources of evidence, as Robson (2002) states. In this sense, the study used different collected types of data: documents, archival records, extended abstracts, presentations, collected observations and publication series, which include participant observations as sources of evidence by colleagues. Numerous experts provided feedback on the conclusions and verifications of the collected data. The validating procedures include 17 presentations at international conferences, providing comments and suggestions by the conference participants regarding the research issues, and all five scientific articles in five studies included a double review process by the international expertise. Nonetheless, as critical feedback of construct validity: should the involvement of researcher, steering and managers consulted differently when “co-designing” the research profiles and targets to be studied be different, or should the studied domain be different, then the result could vary to some degree. Furthermore, should the number of selected perspectives or themes be different, this could also influence the obtained results to a certain degree.
4.3.5 Reliability

In this study, the term “reliability” refers to demonstrating that the operations of a study, such as the data collection procedures, can be repeated with the same results (Miles & Huberman 1994, Robson 2002). Regardless, that in all five studies, the study is limited to the activities and creation of the model in relation to the scope of integration of regional development, R&D and education in a UAS. From the perspective of thesis would have applicability across the nation state UASs, it should be at least potential to repeat similar integration of regional development in any Finnish UAS (Maassen et al. 2011, 2012). However, according this study, each integration would be done in “own way” and “strategy-based paths” (Chatterton & Goddard 2000). In this kind of integration of the research continuum, the influence of the researcher and other insiders, such as the spirit of management, might be somewhat difficult to renew in precisely the same way. Consequently, due to the environment and management of the research organisation, the performed interventions and spirit of action might be difficult to repeat. Nonetheless, I have explained my thinking carefully with numerous references in order to enable repetition of the actions taken during the performed research processes. Then, the quality-system-based data collection and themed data categories can be used for reliability verification. The setting of the study enables both insider and outsider roles as researchers, as in Stringer (2007), where the action research framework describes the integration of qualitative research and action research. Then, separate qualitative or quantitative research can be used for verification of the reliability of this study (Brannen 2004).

The reviews and visitations by outsiders produced aspects of the reliability of study: (1) the research results and conclusions of this study were explicitly drawn and based on the five selected studies; (2) the description of the researchers role; (3) consideration of the data collection across the full range of appropriate settings; (4) multiple evaluation results converging different themes of evaluation transactions; (5) performed peer reviews; (6) colleges’ participation in transactions and feedback sharing; and (7) clear parallelism of data across collected data files of themes. However, as critical reflection and comment: the research methodology and process used in this thesis are documented and described for each individual article and archive, making it possible to repeat the research and compare the findings. Nonetheless, no one researcher is perfect and incorrect conclusions are possible.
4.4 Limitations and suggestions for further research

There are certain limitations in this study, which provide standpoints for future research. The study was limited into the three study programmes, information systems, security management and services in domain of Laurea UAS. In this study, it is presented that the proposed models and realisation has theoretical binding and contribute to the discursion which is related to the domain and perspective of study.

First: the study has implications for further research of realisation of regional R&D in a wider context and different views and relations of higher education. This first question would extend to such as: what are the characteristics of the dynamic and core capabilities in a region; how could future research be used more effectively in exploring potential regional development and “co-creative” environments, such as living labs and last-mile research from the perspective of regional success and advances; how could a shared and collectively created vision be built in a region, given that the regional development network consists of actors with different backgrounds, vary relationships and quality assurance procedures, and how can we “co-create” a portfolio of strategies in a region to enable a successful future development path to take place.

Second, the development of organisational culture, new profiles, relations and trust-commitment-based management and steering between all actors would be in the interest of the future research of regional integration and regional studies. This second implication in this study include two relatively disparate perspectives: how to understand the everyday line management and linear quality in this situation; and how would one define and save “agility-, trust-, motivation-, creativity- and vision-based profiles, triggers, drivers and enablers in higher education” with its steering and leadership of collaborative networks.

Third, the study has implications for further research for a deeper understanding in the measurement of results and impacts as evaluation design. The future research question would include such views as: how to understand conceptualisation of information and its quality in the union of regional innovation networks and higher education; how to systematically measure achieved impacts such as regional and longitudinal impacts by actors in the perspectives of quality, outputs and impacts; and how to manage the quality of knowledge growth, knowledge reserves and advanced research continuums; even national or regional innovation systems, research associations or higher education cannot systematically control or utilise the continuously expanding knowledge.
5 Concluding remarks

In this continuum of research, the overall research question was: How can regional development function be understood, designed and actualised in a UAS? In addressing this question, I developed a theoretical and empirical foundation for the integration of regional development, R&D and higher education in the context of a UAS. The answers to research questions and new propositions were produced with the integrative model and the approach of student-centred R&D in regional development viewpoints. It was described in the five articles of study. Here, the term “integrative model” was referred to the integration of three statutory tasks: regional development, R&D and higher education in a UAS context. The study was based on the inductive and empirical research in a UAS, which was elaborated in union with the studies of master’s, bachelor’s, and degree education in information systems, security management, and service programmes at Laurea between 2001 and 2012. The scope of the study was to provide an improved understanding of the structure, design and realisation of regional development and R&D in higher education. The emerging knowledge and the empirical data on the research topic were evaluated and presented in the five studies.

The seven themes of research data were inquired for data collection of study between 2001 and 2012. In order to facilitate the data processing, all data was organised into data categories based on the practical activities and action. The collected data was adaptable and reflective and it provided a focus on everyday and practical activities. The data was primarily in the form of collected samples from evidence of the entity being studied, and the continuous data analyses were performed during the five studies. Reflective reading and the preliminary analysis of the research data had already began when the research data was collected and transferred to the directory and searched for analysis. Because of the cyclic research continuum, and the fact that the research data was continuously being enriched, the research data was analysed while new data was being collected. While the research data became more enriched, preliminary interpretations of the data were conducted in the next phase of the study. The preliminary interpretations of the research data guided the continuous data collection process. In order to focus on the specific phenomena of interest to the research, the reflection activities were designed on the basis of the analyses. From the enriched and analysed data, the researcher selected the samples from limited domain of study. These samples were used as the parallel data in the next reflection activity.
In the first study, two action research cycles were incorporated; both were addressed to the realisation of regional development in the domain of Laurea UAS. The first action research cycle was between May 2001 and June 2003 and the second action research cycle was between August 2003 and December 2008. Individually, the action research cycles also included an outsider’s involvement; the three FINHEEC evaluations were dedicated to the impacts on regional development. The overall aim of the realisation was in a sustainable integration of the three statutory tasks of UASs. The purpose of the integration of education, R&D and regional development is that a knowledge-based society would create and share knowledge for the well-being of its people by creating competence and education, which takes place using a body of knowledge in action. In the beginning of the study, the role of higher education was typically seen as creators of new scientific and applied knowledge and technology. A new contribution of the study was towards the repositioning of knowledge production and the development of service and artefacts in execution of study units within regional development and R&D. The change was taking place due to: (1) collaboration in value networks; (2) “co-created” innovations; (3) contributions of lead innovations; and (4) especially the integration of regional development task that has an impact on global improvements and social knowledge diffusions. The study contributed (1) new forms of action; (2) models and relations of integration; and (3) methods of R&D collaboration, which were realised for the creation of innovation in services, technology, safety, economy and society.

In the second design research study, the more detailed methodological view of the integrative model was in understanding and design of regional R&D from the perspective of its research framework. The main contribution of this second study was the integrative research framework in information systems, security, safety and service domains in a UAS context. The study described the R&D framework, which comprises R&D related theoretical bindings and research methods. The framework was as a continuum of research for increasing understanding and building, improving and testing information intensive services and artefacts relevant to the realisation of regional-national R&D agendas and into focused and strategic oriented R&D profiles. The reasoning for the realisation of continuums of studies lies in findings that the integration of regional development, innovation systems, clusters and activities of higher education merge value, contribute expertise networking and create valuable relations. Therefore, a single R&D intervention was understood as part of a larger collaborative network of R&D interventions and international transformations and
scalability. The research continuum comprised the following approaches: case study research for understanding, proactive forecasts and activities; design research for building, improving and evaluation of services, artefacts and methodology; and action research for change and epistemological utility.

In the third study, the continuum to the research theme of integrative regional development in a UAS included: experiences of integrative R&D environments; aspects of operative environments and living labs; and experiments of first involvements of the externally funded R&D projects. The perspective of this case was globalization models and their effects in higher education. It demonstrated that higher education institutions could promote knowledge transfer through their international operations; this makes the greater region by knowledge and mobilisation, which is a genuinely international and multicultural environment with strong functional links to the world’s top innovation regions and strategic alliances with the world’s top universities e.g. Cambridge.

According to this third study, students in higher education are satisfied with improvements of their own R&D competencies and the international value network gives them concrete prospects and possibilities for continuing their studies on a global scale. In summary of the strengths and challenges from a student perspective: *Strengths*: great international employment prospects, effective participation in authentic R&D projects, being at the centre of novel R&D work, highly experimental learning, raised aspirations, improved social skills, self-confidence, personal responsibility for results, contact with companies and organisations, and rote learning rather than management through study events. *Challenges*: the system relies tremendously on group commitment, motivation and coaching; “self-learning” is demanding and takes much longer than ready instructions and solution settings.

The fourth study continues with the case study, which addresses the realisation of the regional development task from the perspective of quality assurance in a UAS. The analysis included systematic and empirical data collection and the evaluation of a quality system by the FINHEEC between 2001 and 2012. Here, in the repositioning of innovation-driving industry and services, UAS and government relations take place in quality assurance. The focus of this fourth study was on the reconsideration of the quality assurance system due to innovation networks, “co-created” innovations, the offerings of lead and open innovations and a regional development task that has an impact on national and global improvements. The main contribution of the study includes understanding and design of quality and confirmation; benefits of strategy-based R&D for
realisations; explaining of quality related challenges; and allowing greater transparency to research by insiders and outsiders. Several conclusions emerged in the analysis: the advantages to ontology where the key terms were bridged to empirical evidence; the operational environment was investigated and presented from the perspective of quality and empirical evidence; the theoretical connections were explained in viewpoints of past experience and quality in R&D related education; the concept of quality was described from the perspective of integration of regional development and for improvements of future implementations of R&D related study units in a UAS; the concept of thematic curriculum for integration of R&D and “regional-national interest”; and finally the concept of evaluation design was analysed, which can produce the background for future improvements, such as new settings of measures of regional and national impact.

The focus of the fifth multiple case study was in governance of the activities that realises R&D and regional development, and share the regional-national R&D capabilities, interests and R&D agenda in the R&D collaboration of higher education, regional innovation systems and integrative R&D environments. The study was a multiple case study of the eleven externally funded R&D projects which effected on regional developments in domain of study between 2008 and 2012. The investigated R&D projects, as sample, develop academic knowledge, competences and regional capabilities for networked participants by contributing to R&D in real-life situations. The research domain comprised the collaborative R&D networks, partnership of higher education, and mutual interactions of industry, service sector and higher education. The advance of study was in finding that participant interest and “co-creative” motivation were based on value and trust, such as the economic value gained from an R&D project and the value of knowledge given to a collaborative R&D project. Consequently, the new proposal of this study involved the “steering forums”, which described shared value relations, retention and management aspects of participants between academic, research, empirical and education domains. The contribution of the concept was in understanding and utilising the roles of the actors on the regional-international R&D stage. This steering and concentration of values is needed in the integration of research context; R&D agenda and scope; methodology; regional capabilities and different R&D abilities; and higher education in collaborative R&D projects. Therefore, as an integrative system, R&D can promote a value that is achieved or “co-created” in an R&D project and this value can be expanded and utilised by actors.
References


Pirinen R (In press) Governance of an externally funded research and development: A multiple case study analysis. WSEAS Transactions on Advances in Engineering Education.


Appendix

This study included the externally funded and actualised R&D projects as cases. The projects involved participants from regional innovation systems, higher education, industry and service sectors, described as follows:

1. Rescuing of Intelligence and Electronic Security Core Applications (RIESCA) (October 2007 to March 2010) was the first of our externally funded R&D projects. The research of RIESCA addressed a number of systems such as transport and logistics, power and telecommunication, hydropower and nuclear power stations, which are critical to the day-to-day functioning of any technologically advanced society such as Finland. In RIESCA, the understanding and design of the R&D continuum as a driver and relationships of trust-based networked expertise were founded. This was our first integrated and externally funded R&D project, which was particularly actualised in study units in an interoperative and student-centred way. It represents the beginning of student-centred R&D discussion and the sample of evidence series in publications of Laurea (Pirinen & Rajamäki 2010).

2. SATERISK (SATEllite positioning RISKs) was initiated by two security management students at Laurea UAS. Between 2008 and 2011, it evolved into a substantial three-year R&D project. Collaboratively shared with universities, industry and service partners, SATERISK was funded by the Finnish Funding Agency for Technology and Innovations (TEKES). The funding of SATERISK was secured on 14 November 2008 and allocated for the period 1 September 2008 to 31 August 2011. SATERISK proved that, in itself, student expertise and a student-workplace relationship could be seen as a knowledge bridge, trigger and driver of externally funded R&D projects. Regarding future continuums and activities, SATERISK has two derived spin-offs, the AIRBEAM FP7 and PERSEUS FP7 (Rajamäki et al. 2012).

3. MayFly is the driver project in the fields of security and public safety. This collaboration is shared with the University of Arizona (USA) and the University of Information Technologies, Mechanics and Optics (ITMO), in St. Petersburg, Russia. The R&D of MayFly is addressed to the investigation of novel uses of micro air vehicles (MAVs) for use in the security and public safety fields. MAVs are miniaturised remote-control, autonomous air vehicles, which can collect imagery and other information from the air and send it back to ground stations or mobile networks, allowing users to understand and respond to a variety
of critical scenarios. The scope of R&D on MayFly includes the development of service models and business cases for a variety of MAV applications, including police, border control, rescue services, customs, and industrial surveillance. The R&D plan includes a demonstration to test the University of Arizona’s Dragonfly MAV in Finnish winter conditions. The uses of the MAV’s novel electro-optical sensors, developed by ITMO, are also included in the R&D plan. The MayFly was initiated in the SATERISK project, and was furtheered for proactively gaining new expertise in the field. Initially funded by Laurea’s own budget, MayFly was an R&D trigger-driver; later (in March 2011) it inspired the externally funded spin-off, the AIRBEAM.

(4) Open rendering environment (ORE) (June 2008 to December 2009). Rendering is the process of generating 3D images and movies on computers. The ORE project aims to bring the Berkeley Open Infrastructure for Network Computing-based Big and Ugly Rendering Project distributed rendering service to Finland. This goal was realised by the opening of the “Renderfarm” service in June 2009. Advocating the use of Creative Commons licenses, Renderfarm is the world’s first publicly distributed rendering service. The ORE project also aims to help companies and universities adopt the open source 3D-modelling suite, Blender, into their everyday workflow. While creating new information about social behaviour and distributed computing, Laurea and the project also function as a pilot project for TEKES as it researches the possibility of using higher education as supporting structures for bringing new technologies into the reach of small and medium enterprises. ORE is the pure creation of a student, and so far, it has one spin-off company; the scope is inspired by movies, games and animations (Tuomisto 2011).

(5) Laurea Living Labs (LLL) is a member of the European Network of Living Labs (ENoLL). ENoLL has a Europe-wide platform for providing user-driven innovation capabilities and services to small and medium-sized enterprises, international corporations, public sector agencies, academic institutions and individual citizens. LLL is an approach to stimulating and accelerating industrial and societal innovation. It is also a means of connecting and empowering users to participate in research, development and innovation. This partnership was related to the actualisations of hospitality management and information systems studies since 2008, and it has advanced to the acceptance of the ITEA2-DiYSE and ITEA2-GUARANTEE as a living lab for R&D (Leminen et al. 2012).

(6) ITEA2-DiYSE (March 2009 to December 2011) stands for Do It Yourself Smart Experiences. The project has enabled people to direct their everyday
environment into a highly personalised, meaningful communication and interaction experience that can span the domains of home and city. The project aimed to create a sustainable marketplace for user-generated applications for an Internet of Things World, in which non-technically skilled people can participate by using well-abstracted components, capabilities and devices. As such, it goes beyond web, mobile or multimedia applications. A Finnish consortium aimed to develop and evaluate technologies that empower elderly and disabled people, as well as young children, to create interactive experiences like quizzes, collaborative school assignments or educational games. The R&D scopes of DiYSE have been integrated to the actualisations of study units since 2009. The DiYSE was initialised by LLL and RIESCA.

(7) ITEA2-GUARANTEE (September 2009 to August 2012) provides a technical solution for personal safety in the home environment. It introduces local and network-supported decision making for safety applications based on sensor input and with immediate response and feedback to the people concerned. Technology and services will be researched and developed addressing the specific personal safety needs of individuals in residential environments. The R&D scopes of GUARANTEE have been integrated to the actualisations of study units since 2009. GUARANTEE is related to the LLL collaboration and RIESCA.

(8) The target of a Finnish national research, development and innovation program, Mobile Object Bus Interaction (MOBI) (September 2010 to October 2013), is to create a common ICT hardware and software infrastructure for all emergency vehicles. This infrastructure includes devices for voice and data communications, computers, screens, printers, antennas and cablings. The interlinking with factory-equipped vehicles’ ICT systems is also researched. The project utilises the results of the related research project and aims to develop product concepts, which have potential in both domestic and export markets. The R&D scopes of MOBI have been integrated to the R&D actualisations since 2010. MOBI is a spin-off of RIESCA.

(9) The FROM Co-PRODUCTION to Co-CREATION (CoCo) research project is an on-going Tekes-funded project in the service field (October 2010 to December 2012). Laurea holds the ownership and the administrational responsibility for this project. The project is conducted in conjunction with five companies. The scope of CoCo is that companies are moving from business models in which value came mainly from physical goods to models where value comes more or less from intangible things, such as services, knowledge and relationships. Moreover, within this shift, customers should be seen as “co-
creators” of value rather than as passive recipients of goods and services. For this transformation, traditional marketing and strategy literature lack explanatory power. Therefore, the CoCo research project focuses on creating new knowledge and “co-created” innovations in the service field by encouraging the development of competitive value “co-creation” service concepts. The aim of R&D is to develop a conceptual framework of value “co-creation” in business-to-business (b2b) services, which offer tools for “co-creation”. This research is accomplished using action research methods. In the first phase of the empirical research, the current state of the business approach is analysed in the case companies. The second phase of the research will focus on the value “co-creation” development based on the needs identified in the current state analysis. So far, CoCo has been one of the most student-intensive and student-centred R&D projects at Laurea.

(10) Protection of European borders and Seas through the Intelligent Use of Surveillance (PERSEUS) is coordinated by INDRA Sistemas with 29 partners (January 2011 to December 2014). In this context, PERSEUS represents the first demonstration project implemented by the FP7 Security Research Theme. Demonstration programmes represent a novelty for the EU Framework programmes. They are directed toward large-scale integration, validation and demonstration of novel security systems, and represent European flagships, providing a federative frame to join research in areas of significant European interest. PERSEUS is expected to deliver tested, demonstrated and validated recommendations.

(11) AIRBorne Information for Emergency Situation Awareness and Monitoring (AIRBEAM) is a Seventh Framework Programme (FP7) project related to crisis management (March 2011 to February 2015). The goal of AIRBEAM is to develop a multi-platform approach to situational awareness for crisis management, especially utilising unmanned aerial vehicles (UAVs), aerostatic platforms and satellites. In addition to EADS, the AIRBEAM Consortium includes 22 partners, including some of the largest high-tech companies in Europe. The role of Laurea is as coordinator of Work Package 1 of AIRBEAM, which focuses on studying potential concepts of use and specifying end-user requirements and conducts interviews and panels to understand the needs of authorities in crisis management better.
Original publications

This thesis is based on the following continuum of publications:


V Pirinen R (In press) Governance of an externally funded research and development: a multiple case study analysis. WSEAS Transactions on Advances in Engineering Education.

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Original publications are not included in the electronic version of the thesis.
432. Wang, Meng (2012) Polymer integrated Young interferometers for label-free biosensing applications
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