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FIRST PERIODIC ACTIVITY REPORT (12 MONTHS)

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PART 2 – WORKPACKAGE PROGRESS OF THE PERIOD

The research efforts invested in the U-Know project during the first reporting period of 1 March 2006 to 28 February 2007 were all couched into WPs. This report provides an overview of the actions carried out in each WP that was active during this period.

*WP 0 NETWORK ALIGNMENT AND KNOWLEDGE PRODUCTION:
THEORETICAL FRAMEWORK AND RESEARCH AGENDA OF THE U-
KNOW PROJEC*

Workpackage objectives and starting point of work

- i The first objective is to appraise the hypothesis that knowledge creation, discoveries and inventions are driven by a change of paradigms, placing considerable weight on the cognitive, organisational, and institutional implications for an active knowledge process, i.e. the creation, dissemination, and use of knowledge.
- ii The second objective is to discuss the variety of terminologies with respect to 'knowledge' and to illustrate how different perceptions of what knowledge is, are reflected in varying organisational patterns and policy making in national knowledge systems.
- iii The third objective is to introduce the 'network alignment theory' and to show how this approach, in the U-Know project, serves as a tool to 'understanding knowledge' in complex environments, delivers system encompassing analysis, and provides a quantitative and qualitative basis for policy development.
- iv The fourth objective aims at establishing a framework for co-ordinating the research efforts across national teams and at pushing the research frontiers beyond the state-of-the-art in the respective fields of analysis.

Progress towards objectives

The first three topical objectives of this WP have been achieved by the presentation and discussion of the three reports of D1 at the kick-off meeting in Halle. In particular, it was established that still today, we lack knowledge about the way systems of innovation operate at different levels. As Nick von Tunzelmann points out in his part on "Approaching Network Alignment", rising complexity as the main characteristic in production/innovation/knowledge systems reinforces the need to think about alternative concepts which could capture the multi-level linkages between a growing variety of systems and agents which result in a 'heterogeneity of networks'. The concept of 'network alignment' is introduced to elaborate both the challenge and the inherent difficulties in governing collective action in systems of innovation, which are regarded to be sources for network failures or 'network misalignment'. One important conclusion is that we have to develop concepts which are not restricted by limited

complexity (such as the 'value chain'), but research must be directed to alignment problems, which eventually enhances our capacity.

Regarding the notion of changes of paradigms as precondition for the creation, the discovery of knowledge, and the generation of inventions, the part on "Innovation Research, Knowledge Production and Epistemic Diversity", presented by Dietmar Paier, examines the ways the concept of knowledge is used in the different areas of innovation research. Complimentary to von Tunzelmann's approach, the emergence of new systems of knowledge production and the conceptualization of knowledge in concepts responding to these structural changes, are analyzed. Emphasis is made on the emergence of 'epistemic diversity' which stands for the ever more complex interplay of different paradigms as a result of the growing institutional and organizational heterogeneity of agents involved in knowledge production. In the third presentation, Mark Knell focuses on "Belief Systems and Knowledge Processes". He holds that the importance given to knowledge has led to the use of concepts like 'the knowledge based economy', 'the information society' and even 'the new economy'. These concepts are used as a basis for policy development, both on the national and the European levels. It is not always clear what is meant by these terms or related concepts like 'knowledge', 'learning', 'competences' or 'innovation'. It is his view that while the term knowledge is extensively used, it is not fully understood. This also includes the sources of knowledge generation, knowledge acquisition and knowledge application in practice. He makes his point that better knowledge of knowledge processes is vital for policy makers, but also for citizens and indeed all institutional actors and stakeholders in a civil society. In his presentation, he reviews what ideas philosophers developed to solve this issue from their perspective, which turned out to be a very fruitful path to follow in refining those issues in a publishable paper. This analysis leads him to close by stipulating that the concept of knowledge capital in economic models needs to become biological in the sense that it considers the tacit dimension.

The researchers addressed research topics and questions which serve as thematic guidelines for further research in the U-Know project. In addition to this, von Tunzelmann elaborates guidelines for examining the role of S&T in catching-up economies.

With respect to the fourth objective that aims at establishing a framework for coordinating the research efforts across national teams and at pushing the research frontiers beyond the state-of-the-art in the respective fields of analysis, the researcher of the consortium have developed and agreed upon TORs and have developed state-of-the-art reports for the research planned.

Deviations from the project workprogramme

There are no significant deviations from planned activities in this WP.

List of deliverables, including due date and actual/foreseen submission date

| Del. no | Deliverable name | WP no. | Lead participant | Date due | Delivery date |
|---------|--|--------|----------------------|----------|---------------|
| D1 | Kick-off meeting: theoretical framework and detailed research agenda of the U-Know Project | 0 | CEE | Mar 06 | Mar 06 |
| D2 | Outline paper of analytical concepts adopted in U-Know | 0 | SPRU, CEE, NIFU-STEP | Apr 06 | Apr 06 |
| D3 | U-Know contribution to the State-of-the-Art | 0 | IWH | Feb 07 | Mar 07 |

List of milestones, including due date and actual/foreseen achievement date

| Ms. no | Milestone name | WP no. | Lead participant | Date due | Delivery date |
|--------|---|--------|------------------|----------|---------------|
| M1 | Analytical concept and research framework established at the kick off meeting | 0 | CEE | Mar 06 | Mar 06 |

*WP 1.1 THE DETERMINANTS OF THE INNOVATION PROCESS OF FIRMS***Workpackage objectives and starting point of work**

- i The first objective is to analyse determinants of innovation in its three categories with a comprehensive list of determinants that goes beyond the current state-of-the-art. The analysis will determine the relative importance of each of the determinants for each of the three categories.
- ii The second objective is to link the factors underlying the innovation process (scope, intensity, and knowledge content/character) with firms' performance, in order to assess how much the effect of innovation on the firms' performance depends on (a) the respective factors underlying the innovation process, and (b) on the individual internal and external innovation determinants.
- iii The third objective is to map national and sectoral differences in the innovation process and their impact on firm performance, with a particular focus on a comparison between countries of Southern Europe, EU-15, CEE, SA, as well as knowledge intensive sectors.

Progress towards objectives

The lead researcher of this workpackage has decided with the lead researcher of WP 1.2 that it is most fruitful for the project to combine the literature survey and state-of-the-art reports of both WPs. This way, unnecessary redundancies in topics that are very closely related could be avoided. The lead researchers of WP 1.1 (Mark Knell) and WP 1.2 (Matija Rojec) have hence undertaken a combined and very comprehensive survey of the existing literature on the three sets of determinants of firms' innovation activity, i.e. firms' own creativity, their contacts with externally structured networks, and their absorptive capacity, with particular attention to international knowledge transfer and spillovers.

In the part of the survey closest to WP 1.1, it analyses the literature on the creation and distribution of knowledge in the global economy (D4a). It begins by exploring the economics of knowledge and knowledge accumulation. The first part provides a critical overview of how growth theory considered the subject and then looks at knowledge accumulation from the firm perspective. Issues covered include knowledge spillovers, R&D cooperation and R&D underinvestment. The report starts with a critical examination of the role of knowledge accumulation in the theory of economic growth by looking at how classical, neoclassical and alternative economic theories consider the subject. Knowledge has always been important to economic thought, as it is in the core of both the classical and neoclassical theories of value

and distribution. How to create and accumulate knowledge became the domain of growth theory, which is part of the broad view of the economics of knowledge. There have been many attempts to make knowledge endogenous, starting from at least the time of Adam Smith to the neoclassical endogenous growth models and evolutionary models. Some models presume that knowledge creation occurs outside the firm, while others assume that it is an intentional activity produced in a separate sector. The first type of model focuses more on learning activities and externalities in the form of spillovers, and the second type of model focuses more on education (human capital), R&D activities and property rights issues. Alternative theories often focus on particular issues important to the economics of knowledge.

In the following part of this report, the researchers have focussed on knowledge creation and firm performance. Since the neoclassical firm does little more than minimizing costs, it is necessary to look for alternative explanations for why firms exist and what functions they perform. Discussion often focuses on the institutional arrangements within which the firm operates and the organizational capabilities of the firm. There is also an important empirical literature that attempts to connect knowledge creation and assimilation within the firm to its performance, most often expressed as productivity growth. The most recent literature makes use of survey data on the innovative behaviour of enterprises, including the sources of knowledge, and cooperative activities. In this issue, some effort was invested into looking at financing R&D, especially through venture capital and public R&D subsidies. In concluding, the researchers suggest directions for further research. These include: (i) the meaning of knowledge, (ii) the link between knowledge creation and firm performance, (iii) the economics of knowledge spillovers, (iv) the data used to measure knowledge, and (v) the learning process and learning systems.

This combined literature survey and state-of-the-art report was preceded by another literature review conducted by Mark Knell from NIFU-STEP for WP 1.1 alone (D4a2: "The economics of knowledge and knowledge accumulation: A literature survey"). This survey has a particular focus on the link between innovation and productivity.

Following these literature and state-of-the-art surveys, some additional research was conducted in this WP. In particular, all researchers involved have conceptualised the econometric models for the analysis of innovation determinants and its application on the case of their respective countries. Due to the fact that each country follows a slightly different policy in terms of access to the data generated in the community innovation survey (CIS), this additional intermediary step was necessary. In addition to this, Jaanika Meriküll from UoT has presented her analysis on skill structure as determinant of innovative activity of firms. This research is related to objective 1 of this WP (D4f) and contributes to milestone M3 of this WP. This paper was delivered ahead of schedule.

Deviations from the project workprogramme

There are no negative deviations from planned activities in this WP, D4a2 and D4f were delivered too early, because the researchers were working on this topic before plan.

List of deliverables, including due date and actual/foreseen submission date

| Del. no | Deliverable name | WP no. | Lead participant | Date due | Delivery date |
|----------------|--|---------------|-------------------------|-----------------|----------------------|
| D4 | Report on determinants of the innovation process | 1.1 | NIFU-STEP | Oct 07 | |
| D4a | Report on the state-of-the-art | 1.1 | NIFU-STEP, IER | Nov 06 | Nov 06 |

| | | | | | |
|--------|--|-----|-----------------|--------|--------|
| D4a2 | The economics of knowledge and knowledge accumulation: A literature survey | 1.1 | NIFU-STEP | Nov 06 | Sep 06 |
| D4f | Skills structure of EU Countries – Result of Developments in Industry Structure or Technological Change? | 1.1 | UoT | Oct 07 | Nov 06 |
| D5 | Policy-paper from evidence generated in this workpackage in regard to innovation policies | 1.1 | NIFU-STEP, SPRU | Feb 08 | |
| D6 | Policy-briefing: Innovation Process in the Firm | 1.1 | NIFU-STEP, SPRU | Feb 08 | |
| D_TTC1 | Economic analysis of the South African 2006 Innovation Survey | 1.1 | HSRC, UCT | Oct 07 | |
| D_TTC2 | Qualitative aspects of innovation activities in 70-100 firms in four industrial sectors | 1.1 | HSRC, UCT | Aug 07 | |

List of milestones, including due date and actual/foreseen achievement date

| Ms. no | Milestone name | WP no. | Lead participant | Date due | Delivery date |
|--------|---|--------|------------------|----------|---------------|
| M2 | Mechanisms of knowledge creation within the innovation process of firms | 1.1 | NIFU-STEP | Feb 08 | |
| M3 | Human capital requirement of firms to excel in their innovation process | 1.1 | NIFU-STEP | Feb 08 | Nov 06 |

WP 1.2 FUNCTIONING OF KNOWLEDGE TRANSFER VIA FDI

Workpackage objectives and starting point of work

- i The first objective is to quantify the relative importance of different types of knowledge and technology transfer, as well as the respective determinants for each of the types of transfer.
- ii The second objective is to analyse knowledge transfer by focussing on the multinational companies' (MNCs) strategies towards their subsidiaries. We place special emphasis on intellectual property right (IPR) issues, the processes of R&D and innovation in international production networks, as well as the absorptive capacities (and related skills) in subsidiaries and domestic enterprises.
- iii The third objective is to discuss the appropriateness of FDI policies (general, horizontal or selective, industry-specific, and by use of e.g. subsidies, tax-breaks, provision of infrastructure for investors).

Progress towards objectives

The part of the combined report closest to WP 1.2 surveys the literature on international knowledge transfer and spillovers. While firms often generate new knowledge through their own R&D activity, including reverse engineering and copying, they can access existing knowledge through a variety of different modes of technology transfer: (i) foreign-owned firms, (ii) joint ventures, (iii) technical assistance programmes and other forms of aid, (iv) technology licensing contracts, (v) imports from upstream suppliers, especially capital goods, (vi) exports to downstream customers, (vii) research collaboration, (viii) subcontracting agreements, and (ix) people, including hiring skilled labour, education, training and trade fairs. The first four methods of technology transfer comprise the formal channels, whereas the later five comprise the informal channels. Each mode of technology transfer is not exclusive; the process of taking advantage of a technological opportunity may involve several of these methods, and the sources need not be foreign. In general the organization of the transnational corporation (TNC) mediates modes 1 and 2, governments and international organizations mediate the third mode, the market mediates modes 4 through 6, and networks mediate modes 7 through 9.

In spite of considerable controversy which surrounds the effectiveness of each mode of technology transfer in reducing poverty and increasing economic growth, the fact remains that international technology transfer can provide important opportunities to access existing knowledge and increase economic growth provided they have the appropriate technological capabilities to recognize these opportunities and to use the technology. TNCs are one of the most important 'agents' of technology transfer.

In its first section, part 3 deals with international knowledge spillovers and TNCs. Second section tackles the issue of knowledge spillovers from foreign ownership, i.e. the processes of knowledge transfer within TNCs, and from TNCs and their affiliates to other actors in an economy. In this context special attention is given to FDI spillovers, from theoretical, empirical and methodological point of view. Third section looks at trade as a source of knowledge accumulation, while section four at the importance of absorptive capacity for knowledge accumulation. Section five offers suggestions for further research. The literature survey suggests that the future research should pay more attention to: (i) knowledge creation and transfer processes within TNCs, (ii) complementarity of different channels of international technology transfer; (iii) knowledge spillovers via FDI, that is, knowledge spillovers from foreign affiliates to domestic firms, and (iv) refining the aspect of domestic firms' absorption capacity for knowledge, especially FDI, spillovers.

Following this literature and state-of-the-art survey, some additional research was conducted in this WP. In particular, the method and instruments for the field work that is so central to this workpackage was developed. In a first step, an analysis of substantive and methodological reasons for the lack of empirical evidence of knowledge spillovers via FDI has been prepared. The analysis provides a comprehensive list of suggestions for the improvements in econometric analysis of FDI spillovers. For this, however, firm-specific data is needed and yet not available. The research planned hence foresaw some effort in field work to generate an own database, targeted at those suggestions. In a second step, therefore, the source of comparable databases for addresses and firm-specific financial data was determined and with it the rules of selection of firms (representativeness of the survey) from these databases to be interrogated by the questionnaire. Following on from this, the questionnaire was developed and extensively tested and translated into the national languages of the partners involved in this field work. The English version of the questionnaire is attached to this activity report in Annex IV. Field work has been concluded in all countries with the raw data having become available for further analysis by the owners of this database.

Following this literature and state-of-the-art survey, some additional research was conducted in this WP. In particular, a paper was prepared on "The impact of outward FDI on the home country employment in the low cost transition economy" by Urmas Varblane, Priit Vahter, and Jaan Masso from UoT which relates to objective 2 of this WP (D7d) and contributes to milestone M5 of this WP. This paper was delivered ahead of schedule. Additionally, Matija Rojec from IER has developed a descriptive analysis of the data generated in Slovenia by use of the common questionnaire (D7e). This contributes to objective 2 of this WP and to milestone M5 of this WP.

Deviations from the project workprogramme

There are no negative deviations from planned activities in this WP, D07d and D07e were delivered too early, because the researchers were working on this topic before plan.

List of deliverables, including due date and actual/foreseen submission date

| Del. no | Deliverable name | WP no. | Lead participant | Date due | Delivery date |
|---------|--|--------|------------------|----------|---------------|
| D7 | Report on knowledge transfer and technology spillovers in selected European countries | 1.2 | IER | Oct 07 | |
| D7a | Report on the state-of-the-art | 1.2 | NIFU-STEP, IER | Nov 06 | Nov 06 |
| D07d | The impact of outward FDI on the home country employment in the low cost transition economy | 1.2 | UoT | May 07 | Nov 06 |
| D07e | Questionnaire on R&D and innovation activity of foreign subsidiaries in Slovenia | 1.2 | IER | Jul 07 | Nov 06 |
| D8 | Policy-paper synthesizing the evidence from the innovation process with the evidence from this WP in regard to FDI and innovation policies | 1.2 | SPRU, UoT | Feb 08 | |
| D9 | Policy-briefing: FDI effects, innovation, and policy | 1.2 | SPRU, IWH | Feb 08 | |

List of milestones, including due date and actual/foreseen achievement date

| Ms. no | Milestone name | WP no. | Lead participant | Date due | Delivery date |
|--------|---|--------|------------------|----------|---------------|
| M4 | Mechanisms of knowledge and technology transfer within the production networks of the enlarged EU | 1.2 | IER | Aug 07 | |
| M5 | Human capital requirement of domestic firms to increase absorptive capacities | 1.2 | IER | Feb 08 | |

WP 1.3 MARKET STRUCTURES IN KNOWLEDGE BASED PRODUCT MARKETS

Workpackage objectives and starting point of work

- i The first objective is to establish where and how market structures differ in particularly knowledge-intensive product markets such as such as ICT, biotechnology, pharmaceuticals, nanotechnology etc. From a more dynamic perspective, it assesses how much product market changes relate to changes that stem from the application of new technologies to older product areas and to services.
- ii The second objective is to determine how much of the observed structural differences are rooted in the specific properties of knowledge involved, and how much of such differences give rise to non-levelled playing fields or even to possible abuses of market power.
- iii Assessing the results, the third objective is to discuss where and how national and European competition policy should take account of structural differences, i.e. where and how to align legal rules and regulations to the particularities of knowledge-intensive product markets.

Progress towards objectives

The state-of-the-art in the literature on "Market Structures in Knowledge Based Product Markets" focussed on two main issues: the first pertains to what the literature suggests about how best to conceptualize and proxy in empirical research the two industry-characteristics of 'knowledge intensity' and market structure'. Here, the research team around Niels Krap (IWH), Dragos Pislaru (GEA), Johannes Stephan (IWH), and Liviu Voinea (GEA) selected from a whole variety of possible candidates for 'knowledge intensity' suggested in the literature the conceptualisations of (i) R&D and innovation intensities as technological indicators, (ii) marketing and patenting & licensing intensities as indicators for knowledge management, and (ii) IPR-regulations as policy indicators. With respect to market structure, two possible approaches are suggested in the literature, each depending on the research question

at hand: the first is the level of concentration (i.e. how many players the market has) and second the intensity of competition itself. The latter, however, proves to be very difficult to measure in empirical work.

The second main issue pertains to what the literature holds about the relationship between sectors' knowledge intensity and sectors' market structure. Here, the literature typically treats knowledge intensity as a determinant of the intensity of competition of sectors, i.e. assumes a clear causal relationship. For the purpose of the planned research in U-Know, this direction of causality is too narrow: rather, we want to find out what effect the transition to a knowledge-based economy may be expected for market structures. Here, the report established very little literature and what is available appears to be of rather significant age. This suggests that the research question of this WP is an important and yet largely overlooked issue in the literature. Related to this, an additional research question pertains to the role of knowledge properties (private, club, public; tangible, tacit; etc.) as determinants of market structures. Here, the literature is primarily concerned with the public or private source of funding for R&D and a lot of further research is needed to satisfactorily answer this question.

Following this literature and state-of-the-art survey, some additional research was conducted in this WP. In particular, an empirical analysis was conducted to map European sectors with respect to knowledge intensity and market structure. The objective of this was to assess whether we can find empirically significant particularities of knowledge-intensive sectors in terms of their market structures. In fact, the mapping and an econometric analysis was able to convincingly prove that market structures do appear to be more concentrated in particularly knowledge intensive sectors.

Deviations from the project workprogramme

There are no deviations from planned activities in this WP.

List of deliverables, including due date and actual/foreseen submission date

| Del. no | Deliverable name | WP no. | Lead participant | Date due | Delivery date |
|---------|---|--------|------------------|----------|---------------|
| D10 | Report on Knowledge and Market structures | 1.3 | IWH, GEA, BC | Oct 07 | |
| D10a | Report on the state-of-the-art | 1.3 | IWH, GEA | Nov 06 | Nov 06 |
| D10b | Mapping European sectors and the particularities of knowledge-intensive sectors in terms of their market structures | 1.3 | IWH, GEA | Nov 06 | Nov 06 |
| D11 | Policy-paper on the alignment of competition policy to industry-specific knowledge processes | 1.3 | IWH, GEA | Feb 08 | |
| D12 | Policy-briefings where competition authorities conduct investigations in industries assessed in the project | 1.3 | IWH, GEA | Feb 08 | |

List of milestones, including due date and actual/foreseen achievement date

| Ms. no | Milestone name | WP no. | Lead participant | Date due | Delivery date |
|--------|---|--------|------------------|----------|---------------|
| M6 | Market structures in knowledge-intensive product markets and competition policy | 1.3 | IWH | Feb 08 | Mar 06 |

WP 2.1 PUBLIC SCIENCE AND INDUSTRY LINK - FUNDING,
ORGANISATIONAL CONDITIONS AND OUTCOMES

Workpackage objectives and starting point of work at beginning of reporting period

The overall objective is to increase the understanding of the link between the public funded science systems and industry. The following research questions will be answered:

- i How has the funding of public science changed and how important are these changes for the characteristics of the research carried out?
- ii What are the main organisational conditions and institutional arrangements that facilitate the link between public science and industry?
- iii What are the main outcomes and characteristics of specific public science-industry arrangements?
- iv What are the main policy implications from the analysis?

Progress towards objectives – tasks worked on and achievements made with reference to planned objectives, identify contractors involved

There is a large and extensive literature (both academic and policy-related) on the nature and extent of such linkages. The purpose of the state-of-the-art report is to review mainly the more recent studies since the mid 1990s. The review has been compiled by Antje Klitkou (NIFU STEP), Magnus Gulbrandsen (NIFU STEP), Pari Patel (SPRU) and Sidonia von Ledebur (IWH) The focus of the literature survey is in three themes: commercialisation of academic research, collaborative research, and the development of skills/personnel mobility. The reports takes a theoretical and empirical point of view and has been implemented by means of a rigorous bibliometric study looking at more than 1.000 studies.

General theoretical framework

The literature reviews argues that there is no definite theory or causal model of the relationship between universities and industry. In practice, empirical works often use models and concepts from innovation studies and from science and technology studies. The Triple Helix perspective (Etzkowitz and Leydesdorff 1997, 2000) and the "Mode 2" (Gibbons et al. 1994) concept are key references. However, both seem are often used as a general framing for empirical investigations rather than as a starting point for hypotheses and proposed causal relationships with regard to the university-industry interface. There is an increasing number of studies utilising sectoral/technological/business systems perspectives. This might be promising with respect to future opportunities for an improved integration of theory and data, as the sectorial systems perspective seems to offer a better starting point for constructing hypotheses about the role of different types of university-industry relations.

Direct commercialisation of academic research

This part covered "intellectual property rights (IPR) regulations", "spin-offs", "science parks and incubators", "technology transfer offices (TTOs)" and "industrial funding of university research". The increase in publications on those themes shows the importance of technology transfer from universities. Nevertheless there are a lot of American studies not yet verified for other countries and several topics could be further developed. The relative importance of different transfer channels is not yet

sufficiently evaluated as well as the overall importance of academic research for the industry. The literature seems mostly concerned with TTOs, science parks and incubators whereas the themes on IPR regulations directly and industrial university funding are covered much less so.

Collaborative research, contracting and funding

This section of the report looks at collaboration between public research organisations, especially between universities and private firms in particular collaborative research, R&D contracting and consultancy, as well as industrial funding of university research more generally. The considers different types of R&D collaboration, measurement, motives, outcomes as well as policies towards R&D collaboration. The reports finds most literature to be concerned with the structural level of collaboration (Landry et al. 1996) less so with the coordinating level in particular behavioural rules (Landry, Traore et. al. 1996).

Development of skills and personnel mobility

The university-industry relations literature only to a little extent deals with skills, mobility, teaching etc. Given the recognized importance of the development of skills and personnel mobility as a means for linking university research with business, there are only few studies devoted to this issue.

Beyond the state-of-the-art report on the aspect of job mobility the first original contributions came from a paper by von Ledebur (2006). She argues that new employees to a firms are a source of new knowledge and innovation. Based on a model by HECKATHORN (1996) the conditions of efficient knowledge transfer in a team are analysed. Offering knowledge to a colleague can not be controlled directly by the company due to information asymmetries. Thus the management has to provide incentives which motivate the employees to act in favour of the company by providing their knowledge to the rest of the team and likewise to learn from colleagues. The game theoretic analysis aims at investigating how to arrange these incentives efficiently. Several factors are relevant, especially the individual costs of participating in the transfer. These consist mainly of the existing absorptive capacity and the working atmosphere. The model is a 2x2 game but is at least partly generalised on more players. The relevance of the adequate team size is shown: more developers may increase the total profit of an innovation (before paying the involved people) but when additional wages are paid to each person a greater team decreases the remaining company profit. A further result is that depending on the cost structure perfect knowledge transfer is not always best for the profit of the company. These formal results are consistent with empirical studies to the absorptive capacity and the working atmosphere.

Deviations from the project workprogramme, and corrective actions

There are no negative deviations from planned activities in this WP, D13d was delivered too early, because the researcher was working on this topic before plan.

List of deliverables, including due date and actual/foreseen submission date

| Del. no | Deliverable name | WP no. | Lead participant | Date due | Delivery date |
|---------|--|--------|------------------|----------|---------------|
| D13 | Report on the Industry-Science-link-Funding, Organisational Conditions and Outcomes | 2.1 | NIFU-STEP | Oct 07 | |
| D13a | Report on the state-of-the-art | 2.1 | NIFU-STEP | Feb 07 | Feb 07 |
| D13d | Sidonia von Ledebur (2006) A game theoretic analysis of the conditions of knowledge transfer by new employees in companies, Halle: IWH Discussion paper, 03/06 | 2.1 | IWH | Feb 08 | Feb 07 |
| D14 | Paper on policy implications from evidence on funding, organisational conditions, and characteristics of research outcomes of the science industry link in selected EU countries | 2.1 | NIFU-STEP, SPRU | Feb 08 | |
| D15 | Policy-briefing/or open workshop: funding, organizational conditions, and the science-industry link | 2.1 | NIFU-STEP | Feb 08 | |
| D_TTC3 | Science-industry relationships in South Africa: Overview and case studies | 2.1 | HSRC | Oct 07 | |

List of milestones, including due date and actual/foreseen achievement date

| Ms. no | Milestone name | WP no. | Lead participant | Date due | Delivery date |
|--------|---|--------|------------------|----------|---------------|
| M7 | The relationship between changes to funding of public science and the research characteristics in a knowledge based society | 2.1 | NIFU-STEP | Feb 08 | |

WP 2.2 PUBLIC SCIENCE AND INDUSTRY LINK - ENTREPRENEURIAL EDUCATION**Workpackage objectives and starting point of work**

The overall objective is to explore to which extent the higher educations sector is responsive to the labour marked demand with a particular focus on the provision of and needs for entrepreneurial education:

- i The first objective is to map and analyse the provision of entrepreneurial education and other specific skills in higher education institutions in selected European countries.
- ii The second objective is to assess the needs of industry with respect to entrepreneurial skills in selected European countries.
- iii The third objective is to analyse policy implications with respect to the provision of entrepreneurial education.

Progress towards objectives

Olav R Spilling (NIFU STEP), Dragos Pislaru (GEA) and Jan Sauermann (IWH) compiled a state-of-the-art paper that summarise the existing literature within the field of entrepreneurial education. Given the U-Know framework, the main purpose of analysing entrepreneurial education (EE) is to analyse how EE contributes to the science-industry-link, and to what extent higher education institutions (HEIs) provide EE as part of a strategy for facilitating the science-industry link. This means that it is important to understand the universities' provision of EE in a broader systemic context.

The first part of the review follows up inherent conceptual frameworks, rationale for and strategy EE, types of programmes/courses, variations in the provision of EE between types of HEI, regions and nations, career patterns of participants in EE, societal needs for entrepreneurial skills, role of EE in regional and national innovation

policies. The majority of existing papers addresses two main areas. The first is related to the provision of EE and design of EE programs (EE program design, target groups, curricula, teaching methods, strategies for developing entrepreneurial skills). The second main field is related to the provision of EE in various economic and geographical settings. Particularly during the early 1990s when there was a main focus on the provision of EE in transition economies. However, there are also some less researched areas such as the short term and medium term actual impact of EE. Hardly any attention has been paid to questions how EE is related to science industry linkages and how EE may be provided in order to address target groups of special interest to the commercialisation of research based knowledge.

The second part of the state-of-the-art literature looks at the role of skills as determinants for founding as well as surviving of young firms. In order to meet the firm side, skills required for newly founded firms will be described and analyzed. The main research questions related to this part deal with the operationalisation of skills, skills demanded in newly founded firms, complementarity of skills, sectoral, regional, and other firm determinants of skill structure demand.

Based on the extensive literature review on EE and already existing surveys in the field the researchers decided to design a new survey that is going to pay particular attention the relationships between EE and the industry-science link. In this context the survey is going to look at its specialisation towards specific disciplines or fields of commercialisation such as biotechnology, engineering, informatics etc as well as the degree of interaction between EE is organised in order to interact with the support structure for academic entrepreneurship and commercialisation. Furthermore, the survey may try to identify to what extent the HEIs' strategies for developing EE is based on specific knowledge about its impact. The survey implementation is currently under way in Norway, Germany, Romania, Estonia, Slovenia.

The first step towards original contributions was delivered by a paper by Boring (2007). He examines the match between skill demand and supply in the transition from higher education into the labour market in Norway. Based on survey data of new graduate students from 1995 to 2005, we measure the match between skill demand and supply by the level of mismatch in the labour market among different educational groups, and by their self-reported wage level, six months after graduation. We have also used a special survey in order to examine the development in the wage level in the longer term for graduate students. The results indicate that there is a relative weak match between skill supply and demand among graduates in humanities, while there is a relative strong match for graduates in health, social and sports subjects.

Deviations from the project workprogramme, and corrective actions:

Unfortunately, the researcher Jan Sauermann left the workpackage participant IWH. The project co-ordinator agreed with the workpackage leader that the 2 PMs envisaged for the IWH researcher will be transferred to another not yet determined participant who is in the position to take over the additional responsibility. D16b was delivered too early, because the researcher was working on this topic before plan.

List of deliverables, including due date and actual/foreseen submission date

| Del. no | Deliverable name | WP no. | Lead participant | Date due | Delivery date |
|---------|--|--------|------------------|----------|---------------|
| D16 | Report on aspects of Entrepreneurial Education in Europe | 2.2 | NIFU-STEP | Oct 07 | |
| D16a | Report on the state-of-the-art | 2.2 | NIFU-STEP | Feb 07 | Feb 07 |
| D16b | The Match between Skill Demand and Supply in the Transition from Higher Education into the Labour Market in Norway | 2.2 | NIFU-STEP | Jun 07 | Feb 07 |
| D17 | Paper on policy implications from evidence on demand for entrepreneurial skills | 2.2 | GEA, NIFU-STEP | Oct 07 | |
| D18 | Policy-briefing/open workshop on demand for entrepreneurial skills | 2.2 | GEA, NIFU-STEP | Feb 08 | |

List of milestones, including due date and actual/foreseen achievement date

| Ms. no | Milestone name | WP no. | Lead participant | Date due | Delivery date |
|--------|---|--------|------------------|----------|---------------|
| M7 | The supply of entrepreneurial education and other specific skills in selected European higher education institutions and the demand for entrepreneurial skills in the industry of selected European countries | 2.2 | NIFU-STEP | Feb 08 | |

*WP 2.3 POLICY LEARNING AND KNOWLEDGE POLICIES FOR SCIENCE/INDUSTRY INTERACTION***Workpackage objectives and starting point of work at beginning of reporting period**

The overarching objective is to assess the interrelatedness of policy making in the fields of research, education, and innovation, with different understandings of what knowledge is and how knowledge is functioning in European economies. Hence this workpackage has the following main objectives:

- i To deepen our understanding of different concepts of knowledge and of how knowledge works in society leads to different policies at the national and European level.
- ii To study how this different understandings give birth to different measures for implementing and increasing public private partnerships.
- iii To gain a better understanding of how strategic policy mandates relate to the success and failure of mission-directed scientific and industrial research in the public and private sector.
- iv To scrutinize the relationship between national knowledge policy frameworks and the implementation at regional level.
- v To analyse the role and impact of various policies aimed at promoting knowledge and technology transfer, with special reference to university technology transfer offices.

When the project started, the researcher responsible for this WP at NIFU-STEP left his then-affiliation and moved to a new institution in which he is in fact engaged with the other side of the table of the research he suggested for this WP. He continues to take interest into U-Know – now from the other side of the table – and this is particularly interesting for U-Know.

Progress towards objectives

On the negative side of the issue, the participant, having lost this researcher, had to reorganise its efforts. As counter-weight, the new partners HSRC, UCT, CSIR, and

PGWC have taken an interest in this workpackage. Also, the partner UoT is involved in this WP. Hence, the relative weight of effort invested in this WP increased to a quite considerable size.

Deviations from the project workprogramme

This meant that research in this WP, planned to commence in month 10 at the Brighton-meeting of the consortium, was not able to do so. This is not necessarily a problem because the respective deliverables are only due in December 2007. No corrective action was necessary.

List of deliverables, including due date and actual/foreseen submission date

| Del. no | Deliverable name | WP no. | Lead participant | Date due | Delivery date |
|----------------|---|---------------|-------------------------|-----------------|----------------------|
| D19 | Report on the Policy Process in Science-Industry relations | 2.3 | NIFU-STEP | Feb 08 | |
| D20 | European open workshop on policy learning and public private partnerships in co-operation with the EU Trend Chart on Innovation or a similar organization | 2.3 | NIFU-STEP | Feb 08 | |
| D_TTC4 | Horizontal and vertical processes aimed at knowledge intensification of science-industry relations in SA | 2.3 | HSRC, UCT, CSIR, PGWC | Dec 07 | |

List of milestones, including due date and actual/foreseen achievement date

| Ms. no | Milestone name | WP no. | Lead participant | Date due | Delivery date |
|---------------|--|---------------|-------------------------|-----------------|----------------------|
| M9 | Relationship between concepts of knowledge and policies at the national and European level (e.g. PPPs) | 2.3 | NIFU-STEP | Feb 08 | |

WP 3.1 MATCHING DEMAND AND SUPPLY OF HUMAN CAPITAL AND SPECIFIC SKILLS FOR THE KNOWLEDGE PROCESS

Workpackage objectives and starting point of work at beginning of reporting period

- i The first objective is to assess the match between the human capital and skills demand requirements for the knowledge process in the enterprise sphere, and the corresponding supply-side conditions in the sphere of the education system.
- ii The second objective is to assess the role of the government/administration sector in the social fabric, both in facilitating the match between the enterprise sphere and the education sector by use of policies and in how far universities and firms contribute to organisational and technological learning in the government/administration sector itself.

Progress towards objectives – tasks worked on and achievements made with reference to planned objectives, identify contractors involved

Research started in the WP with a paper on “Corporate and institutional governance, management and technical change in transition economies” (D21b) developed by David Dyker (SPRU). This paper contributes to objective 2 of this WP. In this paper, the author holds that in no area of the production function is the standard paradigm of the market economy less applicable in the advanced economies than in that of R&D and innovation. Whereas conventional economic theory prescribes a clear-cut distinction between private and public sectors based on considerations of monopoly and competition, external economies and diseconomies, appropriable and non-appropriable goods and services etc, the reality of R&D sectors in the advanced economies is a sometimes bewildering mixture of public and private endeavour, not

to mention the key role played by autonomous institutions – universities, research institutes etc with mixed systems of funding. Competition is an important factor within the R&D sector, especially in relation to start-up companies – and to government funding of non-core projects, but there are also strong elements of institutionalised monopoly, e.g. through patent systems. There is a strong and ancient tradition of collegiality and cooperation, especially among university researchers, but many R&D workers work within hierarchical systems – in both public and private sectors. For this issue, formally socialist transition economies are a particularly interesting field of analysis, because there, market disciplines were ‘naturally’ mixed with a more cooperative paradigm, but where at the same time the hierarchical principle was powerful and pervasive.

In his conclusions, he states that, as a general rule, operational technological governance is not a major problem in the transition region. Multinational firms implement their own, tried-and-tested in-house systems of operational governance and maintain a high degree of control over technological variables. Local firms for the most part work on a much lower level of technological governance (not necessarily on a lower level of technology as such), but are able to control and develop technological variables within that constraint. There are two main exceptions to this generalisation, one sectoral, one regional:

- Levels of operational technological governance, and indeed of governance in general, are unsatisfactory in most of the R&D institutes and units in the region. The managers of these organisations do not, on the whole, have any clear idea of how their activity does or should relate to the general process of economic catch-up, and tend to be focused rather on financial improvisation and/or considerations of scientific prestige.
- In the former Soviet Union there is a significant number of domestic companies in which levels of operational technological governance are unsatisfactory. Managers of these companies do not have a clear understanding of how their in-house levels of technology relate to world levels, or of the relationship between specific and generic technologies and the requirements of modern global supply networks.
- Levels of strategic technological governance are generally unsatisfactory throughout the region. Multinationals are hemmed in by their fear of technological incongruence, local firms by the weakness of their innovatory efforts, and local R&D organisations are of little help to either. Failures of strategic technological governance are as much network failures as failures of particular organisations. As such, they reflect critical network misalignments in the economies of the transition countries. These misalignments are not easing as the economies in question continue to grow and develop. This must ultimately pose the question of limits to that process of growth and development which might stop the transition economies well before the point of catch-up with Western Europe.

Deviations from the project workprogramme

There are no negative deviations from planned activities in this WP, D21b was delivered too early, because the researcher was working on this topic before plan.

List of deliverables, including due date and actual/foreseen submission date

| Del. no | Deliverable name | WP no. | Lead participant | Date due | Delivery date |
|----------------|--|---------------|-------------------------|-----------------|----------------------|
| D21 | Report on matching demand and supply of skills | 3.1 | SPRU | Oct 08 | |

| | | | | | |
|------|---|-----|-----------------|--------|--------|
| D21b | Corporate and institutional governance, management and technical change in transition economies | 3.1 | SPRU | Oct 08 | Nov 06 |
| D22 | Paper on policy implication and policy learning in the government/administration sector to improve the matching of demand and supply of human capital | 3.1 | SPRU, NIFU-STEP | Aug 08 | |
| D23 | Policy-briefing/open workshop on social fabric to match supply and demand of skills | | SPRU, GEA | Oct 08 | |

List of milestones, including due date and actual/foreseen achievement date

| Ms. no | Milestone name | WP no. | Lead participant | Date due | Delivery date |
|--------|---|--------|------------------|----------|---------------|
| M10 | Assessment of the extent of matching between the human capital and skills demand and supply | 3.1 | SPRU | Oct 08 | |
| M11 | Set of recommendations concerning the promotion of policy learning and specific forms of network governance in the countries of southern and eastern Europe | 3.1 | SPRU | Oct 08 | |

WP 3.3 THE IMPACT OF NON-ECONOMIC MOTIVATIONS AND SOCIO-CULTURAL ATTITUDES ON THE KNOWLEDGE PROCESS AND CHARACTERISTICS OF KNOWLEDGE

Workpackage objectives and starting point of work at beginning of reporting period

- i The first objective is to study the link between non-economic motivations and knowledge creation, use, and dissemination processes in relation to the specific characteristics of knowledge in the non-profit sector.
- ii The second objective is to study in firms the impact of socio-cultural attitudes as relevant determinants on different dimensions of the knowledge processes (market and network relations as well as human capital), and the effect on the resulting knowledge characteristics in the respective arrangements.
- iii The third objective is to study the mutual perception of science and industry, its impact on formal/informal arrangement of the science-industry, and the effect on the resulting knowledge characteristics in the respective arrangements. This is complemented with the perceptions of policy makers on the science-industry dynamics.

Progress towards objectives – tasks worked on and achievements made with reference to planned objectives, identify contractors involved

In a first start into this WP, the researchers involved, Dietmar Paier (CEE), Jutta Günther and Cornelia Lang (IWH), Matteo Ploner and Stefano Comino (UTN) have met at the Brighton-meeting and discussed cooperation in terms of research methods. This workpackage developed first ideas for a common theoretical foundation, which proves to be very difficult due to differences in the approaches of objective 1 on the one hand and objectives 2 & 3 on the other hand. However, an agreement was reached to continue to watch and work out possible theoretical connections between all objectives. Amongst other things, like the planning of future work and the exchange on the more elaborated research ideas, the following theoretical approaches were identified being a first orientation and promising for future work:

- Objective 1: non-economic motivation and knowledge creation:
 - behavioural economy

- institutional economy (e.g. principal-agent-theory, game theory)
- Objective 2: impact of socio-cultural attitudes on knowledge processes in and between firms:
 - systems of innovation approach
 - organizational theory
- Objective 3: mutual perception of science-industry link
 - organizational theory
 - structuralist approach
 - sociology of science

Deviations from the project workprogramme

There are no deviations from planned activities in this WP.

List of deliverables, including due date and actual/foreseen submission date

| Del. no | Deliverable name | WP no. | Lead participant | Date due | Delivery date |
|---------|--|--------|------------------|----------|---------------|
| D27 | Workshop on complementarity of research methods employed in WP 3.3 | 3.3 | UTN | Nov 06 | Nov 06 |
| D28 | Report on non-economic motivations and the knowledge process | 3.3 | UTN | Oct 07 | |
| D29 | Policy-briefing/open workshop with stakeholders involved on non-economic motivations | 3.3 | UTN | Oct 07 | |

List of milestones, including due date and actual/foreseen achievement date

| Ms. no | Milestone name | WP no. | Lead participant | Date due | Delivery date |
|--------|---|--------|------------------|----------|---------------|
| M13 | The role of socio-cultural attitudes and/or non-economic motivations on the knowledge creation, use, and diffusion and knowledge characteristics in firms, non-profit organisation, universities and policy making bodies | 3.3 | CEE | Feb 09 | |

WP 3.4 COGNITIVE FLEXIBILITY AND NETWORK ALIGNMENT IN INNOVATION SYSTEMS

Workpackage objectives and starting point of work

- i The first objective is to scrutinize: (a) which are the typical characteristics of processes of knowledge creation in complex structures of collaboration, knowledge application and diffusion (b) how does 'knowledge governance' impact on cognitive flexibility when knowledge actors with heterogeneous knowledge bases, attitudes, norms and values interact, (c) which particular network arrangements and network management techniques enhance cognitive flexibility and the ability to create, apply, and diffuse knowledge, and (d) to which extent is it possible to standardise policy instruments targeting cognitive flexibility, knowledge production and diffusion.
- ii The second objective is: (a) to investigate governance structures, incentive mechanisms, technological trajectories and knowledge bases that prevent proper use of domestic facilities for 'absorptive capacity' through 'network failures', (b) to detect network misalignments i.e. missing, anti-developmental or mutually inconsistent networks, (c) to identify the weakest link in the respective 'regional' and 'national innovation systems', and (d) to develop country- and sector-specific insights as to how policy makers at various government levels can contribute to fostering 'good' (i.e. pro-developmental) network interactions.

Progress towards objectives

The first effort invested into this WP was a workshop at the Brighton meeting on the development of a comprehensive set of network analysis techniques (D32). The participant responsible for that meeting was Nick van Tunzelmann (SPRU). At this meeting, the participants Nick von Tunzelmann, Dietmar Paier, Jutta Günther, Matija Rojec, Matteo Ploner, Stefano Comino, and Jo Lorentzen have discussed the various possibilities to transform the network alignment concept into an empirically measurable model. This discussion is still going on and the various ideas will be tested as the project evolves.

The first steps towards empirical research and an original contribution to network alignment aspects were undertaken by research by Oztagan (2007). She looks inter-firm linkages arising in global production networks and assesses their nature. In this analysis, she is particularly concerned to identify power asymmetries characterising the new global linkages and analyse how these impact upon firms' innovative behaviour. To pursue these objectives, she draw on primary data gathered in 2006, through structured interviews with auto-parts firms in Turkey. The data is employed to distinguish between the different types of inter-firm linkages, and assess the nature of these relationships and the implications on firms' innovative behaviour.

In subsequent research she is going to implement the same structured instrument in a Polish automobile cluster. This is going to give the basis for more comparative work on networks and innovation under different institutional setting.

Deviations from the project workprogramme

There are no negative deviations from planned activities in this WP, D35b was delivered too early, because the researcher was working on this topic before plan.

List of deliverables, including due date and actual/foreseen submission date

| Del. no | Deliverable name | WP no. | Lead participant | Date due | Delivery date |
|---------|--|--------|------------------|----------|---------------|
| D32 | Workshop aiming at the development of a comprehensive set of network analysis techniques | 3.4 | SPRU | Nov 06 | Nov 06 |
| D33 | Network analysis in a regional perspective | 3.4 | CEE | Oct 08 | |
| D34 | Policy-briefing on the EuroRegion | 3.4 | CEE, IER, UTN | Feb 09 | |
| D35 | Network misalignment in selected regional, sectoral, and national innovation systems | 3.4 | SPRU | Oct 08 | |
| D35b | Inter-firm relations, innovation and the global restructuring of the auto-components industry: evidence from Bursa, Turkey | 3.4 | SPRU | Feb 08 | Nov 06 |
| D36 | Policy-briefing at EU level | 3.4 | CEE, SPRU | Feb 09 | |
| D_TTC5 | Report on network misalignment in local and provincial innovation systems in South Africa | 3.4 | HSRC | Oct 08 | |

List of milestones, including due date and actual/foreseen achievement date

| Ms. no | Milestone name | WP no. | Lead participant | Date due | Delivery date |
|--------|---|--------|------------------|----------|---------------|
| M14 | Understanding the role of cognitive flexibility an developing the intellectual management techniques in regional innovation systems | 3.4 | SPRU | Feb 09 | |
| M15 | Network misalignments, i.e. missing, anti-developmental or mutually inconsistent networks, and weakest links in the respective 'regional' and 'national innovation systems' | 3.4 | SPRU | Feb 09 | |