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The Diffusion And Implementation of Innovation

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Abstract

In their efforts to try and meet the requirements of the 'new economy', corporations would be helped with a conceptual framework in which their innovative business models are combined with new perceptions of knowledge creation, the diffusion and implementation of innovations and change management. To come up with adequate problem analyses and (business) solutions for the complex issues they address, corporations need not only technological knowledge, but also have to gain insight into how technologies relate to the values of people, and how they can be implemented successfully. Action research set up in the form of reciprocal Human Resource Management projects is particularly designed to create solutions and implement strategies that cover this whole spectrum. In a corporate effort of academic researchers and experts in the field, technological and practical knowledge and skills are integrated in a mutual learning and knowledge creation process aimed at the implementation of innovative solutions. With that, it provides an answer to the call for a new knowledge and innovation paradigm that serves to support the 'new economy'.

Keywords: Knowledge Creation, Diffusion of Innovation, Technology Implementation, Change Management.

1. INTRODUCTION

In this era, in which we are faced with complex global issues that challenge our hopes for a long-lasting and prosperous future on earth, the need for innovative solutions is evident. To achieve these solutions, we are in demand of sustainable technologies which enable us to enter new avenues. Promising technologies only form the start of the transformations that have to take place though. In order to guarantee the diffusion of these technologies, we need to expand the academic research field and take issues such as politics, economics, planning, and communication into consideration too. For only when the whole chain that is involved in the actual implementation of new technologies is adequately aligned, can we expect technologies to be put into practices successfully. Companies and organisations operating in fields where people, planet and profit convene, are becoming more and more aware of the fact that we are in need of new models for the transfer and use of knowledge, in which this chain is taken as point of departure. In this article, I try to put forward an approach that can be helpful in building bridges between science and society, by offering a methodology in which academic researchers and practitioners work together go not only come up with useful innovative technologies but also make sure that they find their way into concrete societal and business practices.

2. FROM KNOWLEDGE GENERATION TO KNOWLEDGE CREATION

Innovative solutions usually address complex problems, which are often described as 'wicked problems' ([1] Brown et al., 2010) because of their unstructured character, unclear and discipline-transcending boundaries ([2] Mason & Simmons 2011, p. 162) and the lack of consensus regarding the question what strategies or solutions would be adequate to tackle them. The issues

are so complex, because they imply questions that not only relate to technological matters of fact (truth), but also to motivations and norms (values), and power factors (influence) (cf.[3] Nonaka, 1994, [4] Toulmin, 2001).

Traditionally, universities concentrate on the first aspect: the truth and nothing but the truth ([5] Habermas 1968, [6] 1969/1974, [7] 1981a). Their goal is to produce objective, value free and universally valid knowledge with which new models and technologies can be designed. Gibbons et al. ([8] 1994) and Nowotny et al. ([9] 2001) refer to this type of knowledge as mode one knowledge. It is a highly valued type of knowledge and rightfully so, since it is an important potential source for innovations in business, industry, and society at large. But this type of knowledge has its limitations and can only to a certain extent be expected to be useful outside the controlled environment of academic research settings. The obvious lack of the presumed 'trickle down' effect, resulting in the at least in Europe often quoted 'knowledge paradox', is illustrative in this respect. Universities and public research institutes generate an impressive innovative potential, but the pipeline perspective which assumes that knowledge flows from university research to industrial practice ([10] Laursen & Salter 2004, p. 2 in OECD 2002) seems too optimistic, for the science-to-industry spill-over is relatively low ([11] Ebersberger et al 2012).¹ This is rather unfortunate, in a situation where the transfer represents such a strong asset of our knowledge-based economies ([3] Nonaka, 1994, [12] Nicolopoulou, 2011, p. 526) in which the knowledge broker role of universities could play such an important role ([10] Ebersberger et al 2012, p. 74).

2.1 The end of the pipeline perspective

The 'fault' for this lack of transfer of knowledge from universities to companies lies neither with the universities nor with the corporations. Rather, it is the character of mode one knowledge production that causes the gap. First of all, we must realize that mode one employs a kind of knowledge that pertains to only a limited range of the actually broad rationality spectrum. It is specifically designed to produce cognitive-instrumental knowledge (facts and new technologies) and wishes to refrain from normative aspects and power factors that are also inherent in any rational learning process, but are much more 'messy' ([5] Habermas 1968, [6] 1969/1974, [7]1981a, [4] Toulmin, 2001). Secondly, mode one knowledge falls short where the aspect of implementation is concerned. Focused as it is on the task to produce knowledge that is generally true, it leaves business companies and society empty handed with regard to the question how this knowledge can be successfully used and implemented in concrete practices ([8] Gibbons et al, 1994, [9] Nowotny et al, 2001). Mode one clearly coheres with the component or element view of knowledge management (what facts are true, what technological knowledge do we have?), but has little to say about the architectural aspects and process of knowledge and change management (how do we diffuse this knowledge in society and how can we use it?) ([13] Balogun & Jenkins 2003, [14] Preuss & Córdoba-Pachon, 2009).

2.2 Enter corporate creative processes

Thus, the traditional approach to knowledge production does not form an adequate approach to help answer innovative questions ([3] Nonaka 1994), which have an economic background or are related to consumer issues, policy matters and politics. Instead, these issues ask for an approach that helps corporate actors to use technological, scientifically legitimated solutions to address the challenges they face in the modern economy. Quite recently, we have seen the rise of such an approach, in which academic and practical experts share their knowledge, experiences and skills in cooperative projects in an effort to analyse the problem together and subsequently try to come up with innovative (business) solutions. Gibbons et. al ([8] 1994, p. 11) refer to this relatively new approach as mode two knowledge creation. Mode two builds upon the mode one knowledge produced by disciplinary experts. But it also relies on the practitioners from the particular work field under study, who bring in their own expertise. This can be experts from every layer of the company or the broader network, e.g. managers, employees, users or other stakeholders. As mode two problem-solving approaches transcend not only boundaries between academic disciplines, but also between the academic and the non-academic world, these processes of co-creation ([3] Nonaka 1994, [12] Nicolopoulou, 2011, p. 529) can be regarded as transdisciplinary research practices ([15] Repko 2008, p. 15, [1] Brown, 2010).

2.3 From tunnel vision to a broad rational approach

In mode two, the rationality concept that is used will not remain confined to the cognitive-instrumental rationality that reigns mode one. For in the rational learning process implied in the practice-oriented knowledge co-creation, not only issues concerning how things work (causal explanation and technological solutions), but also issues concerning norms and power relations will need to be addressed. Surely, the problem analyses will be based on scientific explanations that have been extensively tested and proved. But they will also incorporate the motivations and values of potential customers, just as the solutions that are contrived will take into consideration existing legislation, power blocks and other factors that may enhance or hinder a successful introduction of the innovative technologies and strategies. It wouldn't be particularly rational to leave these aspects out during the learning process. In the same way, the question of how to apply the available technological knowledge is explicitly subject of attention in mode two. It might even be said that the implementation of the innovative technology is at the heart of the knowledge creation process. And it is here, of course, where the knowledge and experience of the practitioners, be it management, employees or customers, is of great value.

3. DIFFUSION OF INNOVATION – FROM CREATION TO IMPLEMENTATION

3.1 ... And action!

Within the transdisciplinary methodology of action research, academics and practitioners work closely together to find knowledge, formulate solutions to a particular problem, develop action strategies, and to implement, monitor and evaluate these strategies. As such, it can be regarded as an approach that shows a remarkable resemblance to the process of co-creation typical for mode two ([16] Greenwood & Levin 1998, p. 50 & pp. 109-110). What is more, it also closely corresponds to the needs that incited mode two knowledge co-creation. Those needs being, first of all, that the generated knowledge covers the whole range of the rationality spectrum, and not just the technological, cognitive-instrumental aspects (cf. [3] Nonaka 1994, [13] Balogun & Jenkins 2003). Secondly, and closely related to the first one, it means that the knowledge creation does not stop in the generation phase, but also stretches to the phase in which these new-found technology is applied and tested on its effectivity in real-life practices.

Though the original sources of inspiration lay elsewhere (see [16] Greenwood & Levin, 1998; [17] Reason & Bradburry, 2001; [18] Boog et al., 2003), action research is intended and designed to generate knowledge that enhances the realisation of innovations and social change, just as mode two knowledge is meant to do. Breaking with the traditional role division, academic researchers share brains and join hands with those of the people in the work field. Action research projects are preferably situated within organisations, as organisations have communal and, ideally, shared frames of reference. These frames of reference usually contain a future vision and explicit mission statement regarding the core values and/or core business of the organisation (depending on whether they are profit, not-for-profit or non-profit organisations).

3.2 Innovation as an iterative problem-solving process

At the start of an action research project, both parties declare a mutual commitment to the challenge at hand. Though their interests may differ – the academics being mainly interested in technological or theoretical knowledge, the company in useful practical knowledge – the project can be mutually beneficial and serve both objectives. After that, they will make an inventory of the issues that need to be addressed and formulate a collaborative problem definition (inventory phase). In the next phase, the academics and practitioners jointly discuss what are the main issues within the defined problem cluster (diagnostic phase). At the end of this phase, they try to develop an action strategy that entails an answer to the problems and ideas for possible solutions, e.g. a new technology. Subsequently, they work on the implementation of that strategy (action / implementation and evaluation phase), meanwhile carefully monitoring the process and evaluating both its intended and unintended effects (cf. [19] Moser, 1975; [20] Coenen, 1996; [16] Greenwood & Levin, 1998, p. 116 & p. 163; [17] Reason & Bradburry, 2001).

The co-creative project forms an iterative problem-solving process, so the different phases must not be viewed as strictly separated compartments. In all likelihood, only in the diagnostic phase will the problem definition develop from preliminary ideas into more definite research questions and objectives. And the action or implementation phase will hardly ever be spared from unintended negative effects, which will give reason to review and adjust the planned strategies that were the result of the crystallisation phase. This way, action research projects will take the form of iterative, cyclic processes in which knowledge creation and learning takes place as the parties go along.

In action research, the quest for new knowledge and technologies is combined with an investigation into the norms, values and motivations of the corporate actors, their partners and customers, and of existing power structures that might hinder a efficacious implementation of the designed technologies and strategies. And it does not stop after charting those factors. In a continuous process, it tries to adapt to these factors as best as possible. If this does not prove successful, the research parties join forces again to reflect upon the findings, make the necessary adjustments to the technologies and strategies, and try again. The fluid transfer, i.e. the transition from the generation of new knowledge to the implementation of technologies makes this approach particularly interesting for business companies, whose predominant interest lies in the actual fruitfulness of the proposed innovation strategy in their specific situation.

4. CHANGE MANAGEMENT

4.1 Reciprocal value creation

As said, the sources of inspiration of action research are not quite the same as that of mode two knowledge creation. First and foremost, action research developed as a political and socially engaged form of research, intended to employ scientific knowledge to enhance democratization and emancipation (cf. [19] Moser, 1975, [18] Boog et al., 2003). Originating in the domain of the social sciences, the emphasis was put more on social improvement than on technological innovations. In proposals for innovative business models, the focus still mainly lies with technology ([21] Chesbrough & Rosenbloom 2002, [22] Chesbrough et al, 2006, [23] Chesbrough 2007). But in the 'new economy', where the focus is shifting from products to service-based value creation (cf. [24] Kindström, 2010), traditional boundaries seem to vanish or at least give cause to renewed reflection. If companies really want to develop sustainable innovative solutions, it seems wise that they think of ways to effectively combine the social and the technological aspects of the solutions.

In innovative business models the emphasis lies no longer solely with the company and the question what new product or technology it can bring to the market. Storbacka ([25] 2011), for instance claims that firms must move beyond selling and delivering ad-hoc solutions, and must start viewing solutions as processes, instead of as mere combinations of goods, services and knowledge elements. More and more, the company has to think about its place in a broader chain or network, how it can commit a customer to make use of a service within that chain, and stay in that network. From this perspective, the sustainable performance of the new develop technology and its value as it is perceived by stakeholders becomes highly importance for modern businesses ([26] Svensson et al, 2010, [27] Svensson & Wagner 2011, [24] Kindström, 2010, [28] Bilgin, 2012).

So, besides knowledge approaches, business approaches are in need of transformation too. In the new model, the relations between business and customers, and between businesses and the broader network become the core business. To be successful at that, companies need to adapt to the motivations, needs and values that drive the customers' behaviour (cf. [24] Kindström, 2010).

4.2 Innovation and the need for cooperative learning processess

Set up as a cooperative learning process that is fundamentally based on mutual respect for each other's competencies and builds on a relation of trust between the academic researchers and the non-academic co-researchers ([20] Coenen,1996, [29] Smaling, 1998, [18] Boog et al, 2003),

action research forms an inspiring approach for such innovative businesses. It clearly coheres with the definition of innovation as “a process in which the organization creates and defines problems and then actively develops new knowledge to solve them” ([3] Nonaka 1994, p. 29). As action research makes use of the broad range of available knowledge, expertise and competencies, it can also be viewed as a model for Human Resource Management. Whether it is theoretical knowledge or practical knowledge, subtle social skills or refined technical skills, all kinds of expertise and experienced are employed in the process of co-creation. Moreover, it appreciates the motivations, needs and other drives of those who are part of the company as important value sources, and tries to match these with the core values of the business. Particularly when sustainable value creation in the new business context is concerned, Human Resource Management can play an important strategic function ([2] Mason & Simmons 2011, [30] Sharma et al. 2009). Still, knowledge and change management often remain top-management driven activities, devoid of effective participation from the employees ([3] Nonaka 1994, pp. 29-33, [23] Chesbrough 2007, [30] Sharma et al. 2009, [31] Inyang 2011, p. 121, [32] Høgevoeld 2011).

But just as traditional approaches to knowledge production and business solutions fall short in meeting the requirements of the ‘new economy’, so do more conventional types of Human Resource Management. In a rough but hopefully illustrative characterization, we could say that ‘hard’ variants focus mainly on the needs related to the core business of the company and *manage* human resources strategically accordingly ([2] Mason & Simmons, 2011, p. 167, [33] Salaman et al, 2005, [34] Becker & Huselid, 2006), whereas ‘soft’ variants emphasize the knowledge and competencies of its expert workers and take their motivations and expectations as central point of departure in the *development* of the human resources ([2] Mason & Simmons, 2011, p. 168, cf. [35] Garavan, 2009). What seems most needed though, in the new business situation, is to cover the middle ground. In the new service-based economy, it seems crucial to find out what the core value of the company is or can be, what this entails, technologically, socially and economically, and how this can be matched – in a continuous process - with the available and potential knowledge and competencies of the corporate actors. Action research set up in the form of reciprocal Human Resource Management projects may be able to help cover this ground and reconstitute the missing link.

Defining a corporation as a body of people acting as one individual for business purposes, a company can be viewed as the result of the daily (re)production of the meanings, visions, norms and power relations within the corporation ([36] Coenen-Hanegraaf et al., 2001, p. 66, cf. [37] Giddens 1979 & [38] 1984). Taking as point of departure an innovative, reciprocal outlook on Human Resource Management, sustainable business practices can be developed in which the individual motivations and competencies of management, employees and customers are matched to the future vision and mission of the corporation. Mason and Simmons ([2] 2011, p. 168) view such a reciprocal approach, that transcends the dualism of ‘soft’ versus ‘hard’ Human Resource Management, as a precondition for any company that seriously wants to adopt Corporate Social Responsibility as a key driver of their business activities. Within this reciprocal approach, new business practices aimed at the creation of innovative, sustainable products, services and/or values are set up as projects. In the phase of value creation, the company defines a series of activities which yield a new product or service in such a way that there is net value created throughout the various corporate activities. In the phase of value capture, the challenge is to develop and operate the product and/or services in such a way that the company sees sufficient revenues from (a portion of) these activities to earn a profit ([22] Chesbrough 2006, [23] Chesbrough 2007, p. 12). The central point of departure is the aim to create a learning environment in which personal and collective learning trajectories are matched to each other so as to create an optimal fit.

4.3 A differentiated model for change management

Generally speaking, this will imply at least three steps. At the beginning of the project, the initial situation of the corporation will be assessed, i.e. the company’s vision and mission are charted and its position in the broad network is sketched. The vision, mission and position are related to the primary and secondary process, which together provides a picture of the current general

outlook of the corporation. At the same time, the individual situation of the corporate actors is assessed so that relevant aspects, i.e. aspects pertaining to the future vision and mission of the corporation, can be charted. Next, there is a commitment to further develop the personal aspirations of the individual actors (from work floor to management), against the background of the companies' intended future strategy. On the corporate level, this means that the future vision and mission are critically reviewed in light of the desired changes in (individual contributions to) the corporate strategies and that learning trajectories are developed to optimize the match. Last but not least, efforts will be made to improve the existing situation, i.e. to realize changes that are inspired by the goals and aspirations defined by the corporate actors. Subsequently, the trajectory of the company will be further developed, which means that the strengths of the individual actors are effectively deployed to jointly support and realise the corporate strategy. Finally, the attention will shift to the implementation of this developmental strategy in the daily business practices.

Kindström ([24] 2010, p. 483) states that, in order to shift towards a service-based business model, companies need to approach change in all areas of their business model. In scheme 1, I have adjusted the six common business model parameters that he uses (taking it from [21] Chesbrough & Rosenblum, 2002 and [23] Chesbrough, 2007) so as to align to the value creation that is put in a central position within service-based business models.

Phase	Service-based Business Model parameters	Level of implementation	Implications for HRM
Value creation	Value premises and Value proposition	Corporate vision	Defining the importance of an innovative approach for a successful future of the company
	Comparative value (Competitive strategy)	Mission and positioning of the corporation	Setting up the company as an innovative learning corporation aimed at service development and seeking for new service opportunities
	Customers of the value (Target market)	Primary process	Developing trajectories with users and/or potential customers
	Value chain	Primary process	Co-operation with other partners in the chain
	Value network (Company's ecosystem)	Primary process	Co-operation with other businesses in the network
Value Capture	Value revenue (advanced mechanisms to create profit, e.g. value-based pricing, variable value-based contracts, availability-based contracts or selling customer data)	Secondary process	Developing a learning trajectory at the company level, primarily driven by customer perceived value creation, instigating an innovation process in its culture, hierarchical structure, staff policies, reward structures, revenue mechanisms, and the planning of control of the corporate business activities

TABLE 1: The implications of a shift towards service-based business model for HRM (Based on [21] Chesbrough & Rosenblum, 2002, [23] Chesbrough, 2007, [3] Nonaka, 1994, p. 26, [24] Kindström, 2010, [36] Coenen-Hanegraaf et al., 2001).

5. THE CORPORATE UNIVERSITY – ACTION RESEARCH AS AN INNOVATIVE FORM OF RESEARCH & DEVELOPMENT

This process to aim both at an individual and collective level at learning and development trajectories, can be fed and supported by a knowledge creation process ([36] Coenen-Hanegraaf et al., 2001). In action research, this process is envisaged as a cyclic learning process in three phases. The support in the form of this alternative form of Research & Development (R&D), as action research can be understood to be, is explicitly designed to connect the individual competencies of the corporate actors to the collective actions that (re)produce the corporation, i.e. the business company as a whole. With Nonaka ([3] 1994, p. 33), we could denominate this pillar in the framework as the 'corporate university'.

To start with, a picture will be sketched of the initial situation of the corporation, i.e. in its vision, mission, and position in relation to the broader network within which the company operates. This is meant to gain insight in how the collective actions of the corporation relate to those of the other stakeholders. This insight will hopefully grow during the course of the research project. The focus and direction of the analysis will be determined by the objectives that were agreed upon at the start of the research process, and to which both the academic researchers and the corporate actors committed themselves. The shared mission and the overarching vision of the core business and/or core values form the anchor points of the individual learning trajectories and the learning trajectory of the company. They are pivotal to connecting both trajectories and to connecting the trajectory of the business as a whole to that of the broader network, including the customers.

This connection can be further enhanced by making explicit which definitions and interpretations are being used, which norms, needs and values prevail within the project, both for the academics and for the corporate actors. These discussions will form the basis for the problem analysis and the choice for the central problem cluster in the inventory and diagnostic phase. Different people can formulate these in various ways, but that does not necessarily need to hinder the formulation of a comprehensive strategy and implementation of innovative solutions that can be supported by all. As long as there is a shared framework, a shared vision on the direction that the corporation as a whole needs to take, the learning process can be successful. Equally, the actors need to agree on the values and norms that are leading the process, such as which ideals are worthwhile to strive for and the way people treat each other within the network. Moreover, a minimal degree of consensus is needed about the authoritative power that is delegated to be able to carry certain responsibilities. Preferably, the power is not restricted to the top-management positions in the company's hierarchical structure. For promoting the creation of innovative knowledge and efficient technologies in business organizations, a 'middle-up-down management' model seems much more suitable ([3] Nonaka 1994, p. 29).

Note that this approach also allows room for diversity: the role that a person can and wants to play within the corporate process, will depend on each individual's specific trajectory, and consequently can vary to a considerable extent.ⁱⁱ Whether the whole corporation will immediately be involved in the implementation of an innovation or whether it is preferable to start with a pilot project, will depend to a large extent on the level of commitment of the various corporate actors.

When the individual trajectories are connected to the collective trajectory in a successful way, the corporation can move into the next phase: the implementation of the action plans with regard to the developed technologies and innovative strategies. As said, this process evolves in a cyclic way: evaluation of the strategies can lead to more refined insights and more elaborated strategies or to alternative solutions. Moreover, it is process that is not confined to the corporation itself, but can be expanded to include interfaces with other partners in the chain or broader network as well ([3] Nonaka 1994, p. 27).

6. SOCIETAL AND ACADEMIC RELEVANCE

6.1 Integration of theory and practice

In conclusion, I have tried to sketch an approach that provides in the demand for a new, integrated approach to knowledge creation ([3] Nonaka 1994), knowledge transfer ([12] Nicolopoulou, 2011), and organization development and change management ([13] Balogun & Jenkins 2003, [14] Preuss & Córdoba-Pachon, 2009) that contributes to the diffusion and implementation of new technologies.

Action research can be regarded as an approach in which the element view and process view ([14] Preuss & Córdoba-Pachon, 2009) or the component and architectural aspects of knowledge and change management ([13] Balogun & Jenkins 2003) are integrated within an overarching framework. Co-creative processes in the form of action research projects structurally build upon relations of trust that need to be developed between academic researchers and non-academic co-researchers if knowledge creation is ever to take off ([20] Coenen, 1996, [29] Smaling, 1998, [18] Boog et al, 2003, [3] Nonaka, 1994, p. 24, [10] Ebersberger et al, 2012). And the design of the methodology of action research is such, that these relations can be expanded to customer – business chain – network partner relations, which is a necessary precondition of the new business context ([23] Chesbrough 2007, p. 14, [134] Preuss & Córdoba-Pachon, 2009, [2] Mason & Simmons 2011, p. 167, [3] Nonaka 1994, p. 27).

In order to be able to cover the broad range of aspects related to innovative technological solutions, action research projects are set up as a corporate effort of experts from the academia, from the corporation itself and from the connected network. Besides the design of the research, the development and evaluation of the proposed action strategies form an integral part of the knowledge creation. To be able to realize this, action research makes use of the broad range of knowledge, expertise, experiences, skills and competencies that are needed to not only find new technological and social knowledge but also implement it. This way, it provides the transdisciplinary framework of action that is required for the fusion of mode one and two knowledge and the integration of different skills that form the foundation for innovative change processes (cf. [8] Gibbons et. al, 1994, p. 4).

To enhance a good integration of new technologies into business practices, action research can be set up as a model in which the development of individual trajectories is connected to trajectories at the corporate level. The matching takes place in cyclic, co-evolutionary learning processes that simultaneously forms a knowledge creation process. The learning and development trajectories are not confined to the level of causal explanations (the interpretation of facts), but will also take into consideration normative and power aspects that are inherently related to the issue of implementation. Thus it transcends the technological, cognitive-instrumental rationality to which mode one knowledge production remains bounded. The model covers the whole range of rationality that plays a role in the processes that drive the economy, the 'new' one probably even more than the traditional economy. As such, action research forms a means to help bridge the current gap between what traditional science is providing for and the actual challenges that business corporations are facing. Within this context, reciprocal Human Resource Management can function as a flywheel for innovation (cf. [36] Coenen-Hanegraaf et al., 2001). But if and only if the trajectories of the individual corporate actors are structurally related to that of the company as a whole; otherwise the innovative practices will remain ad hoc practices that will come to a halt soon after the projects have finished. Viewing technological solutions as processes, instead of as combinations of goods, services and knowledge elements, we must realize that effective innovative solutions require intricate coordination across all functions ([25] Storbacka 2011).

This dynamic approach takes root in concrete organizations and business practices aimed at solving problems in specific situations. Nevertheless, it can have context-transcending meaning and explanatory power, for the research process takes place on different levels, within the company and within the chain and broader network. Thus, local, national and even global perspectives can be taken into consideration to come to overarching solutions.

6.2 Towards a new knowledge paradigm

For all these reasons, action research can be considered to have the potential to meet the requirements that R&D functions need to fulfill in the 'new economy'. Stressing the dynamic dimension of knowledge creation as a result of the interaction between scientific researchers, corporate actors and other stakeholders (partners in the chain, customers et cetera), and as part of a dynamic and multi-layered learning process, action research clearly breaks away from the traditional approach to knowledge production. With that, it perfectly fits the description of the new knowledge paradigm proposed by Gibbons et al. ([8] 1994, pp. 87-88): "The older view of a linear process connecting discoveries and inventions to the production process is displaced by a more interactive one. While in the linear view, the university was distanced from the commercial process, and could still preserve its academic values, in technology interchange it must become involved at both individual and institutional levels and adapt to new rules." Answering to this call for involvement, action research set up as a 'corporate university' that helps to develop and support sustainable business projects can be viewed as a response to the needs of both science and society.

In our own 'corporate university', the approach takes the form of a learning process towards interdisciplinary research and education that has crystallized in the programme of Future Planet Studies. In a joint learning process, researchers from a diversity of expert fields within and outside the University of Amsterdam have combined their knowledge and experience to design an integrated bachelor programme that focuses on (the nexus of) energy, climate change, food, water, and the quality of life. This could only be attained because we managed to build a relation of trust in this broad network, and refrain from falling into the gap that all too often still divides the beta domain (the natural sciences) from the gamma and alpha domains (the social sciences and the humanities).

Within Future Planet Studies, theoretical and technological knowledge, research competencies and social and communicative skills are combined with vision development, including ethical and normative orientation on the complex challenges that our societies are faced with. This way, we try to do justice to the broad spectrum that a truly rational perspective entails, and which is definitely needed to come up with adequate solutions for the urgent challenges. In an effort to bring the outside in, we invite innovative companies to introduce students to new ways of thinking and new ways of doing business (e.g. sustainable entrepreneurship and green banking). We also enhance students to put their knowledge and skills into practice by encouraging them to engage in local sustainability projects (e.g. via internships). Thus, the set-up of the studies is such, that the integration between mode one and mode two is enhanced, and co-creative knowledge generation at the intersection of science and society encouraged.

We consider it crucial to discover the core motivations and technological, cognitive, social and communicative potential of our students, and find out how this can best be matched to suitable study trajectories within our flexible programme. The ultimate goal being to get them in a position where they can make their optimal contribution to the global challenges we are faced with. By attracting a sufficiently large group of students and becoming a viable, officially recognized programme that is taken up in the existing education system, Future Planet Studies has proved that the new knowledge approach manages to realize its goals with regard to value capture. As for the value creation: even during their studies, we see many of the students finding a part-time job in new businesses initiatives related to, for instance, renewable energy and climate change mitigation. Therefore, besides the value that is already realized with the development of our new programme, we trust that further results will become visible when the first cohorts of students leave the university, and find their place and prove their added value in the new, innovative business corporations.

Both managers and academics are only beginning to learn how to organize transdisciplinary processes in which they jointly analyse the problems, create knowledge, develop technological solutions and implement the proposed strategies. With all those who think we are at most only half-way the learning process ([39] Habermas 1981b & [40] 1981c, [41] Giddens 1981 & [42]

1990, [43] Bourdieu, 1992, [44] Beck 1992, [45] Beck et al. 1994, [3] Nonaka, 1994, [4] Toulmin, 2001), I would hope that by expanding on these experiences in the form of corporate action research projects, it may become possible to monitor the unintended and unwanted side-effects of the technological, cognitive-instrumental rationality that dominated the last centuries. Hopefully we will be able to repair some of the damage it has done, and offer really rational, thus innovative, sustainable solutions and strategies that help to leave earth a better place for those who come after us.

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ⁱ Ebersberger et al. (2012, p. 75) note that 13% of innovative companies highly appreciate the universities as informal sources of inspiration for their innovation process.

ⁱⁱ This applies to the corporate actors, but to their partners and potential customers as well.