“Intending Engineering Work”

A Conceptualisation of Engineers´ Understanding of Innovation through the Encounter with their Own Practice

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Abstract

Innovation is arguably one of the present-day buzzwords pervading economic, social as well as cultural life. The innovation concept however is highly ambiguous. Nevertheless most (positivistic) innovation studies employ seemingly “clear-cut” notions of innovation circumventing its highly elusive nature. These “clear-cut” innovation concepts are built on pre-conceived ontological assumptions. Interpretive research on the other hand either falls into a rationalistic trap or assumes absolute precedence of language. What is lacking are studies which embrace the ambiguous nature of innovation. In the following paper I intent to conceptualise how engineers *come to understand* innovation and how the creation of a contemplative space induced by their own practices breeds multiple understandings of innovation and what implications this might entail for the organisation. For empirical illustration I draw on material from a longitudinal case study of a high-technology company.

Introduction

Innovation is ubiquitous. It is arguably one of the most popular concepts in virtually every aspect. “Innovative” has clearly become a buzzword. Its declared significance gave rise to a barrage of publications and accordingly researchers and practitioners had to deal with the fundamental question: what is an innovation? Generally quantifiable concepts of innovation which lend themselves easily to operationalisation have dominated research. Operationalisation entails the possibility of establishing causal relationships which favours the creation of technical knowledge (Habermas, 1968). Basing research on such pre-conceived notions seems somewhat paradoxical if not tautological as authors prescribe measures to increase the output of something which has been defined by them at the outset. Needless to say approaches based on such pre-conceived notions of innovation have led to inconsistent and contradictive findings (Downs and Mohr, 1976; Wolfe, 1994). In answer to this deficiency a line of interpretative research has been established. This novel way of approaching innovation however has yielded mixed results. A group of scholars made an effort to ground meta-theories of innovation in empirical data (Poole and Van de Ven, 2000) whereas others devised dichotomies of good and bad innovating companies based on managers´ theories of innovation (Storey and Salaman, 2005). Others considered innovation to be a part of a power infused language game of competing discourses (Asimakou, 2009) or as a temporally fluid notion of valorisation (Rehn and Vachhani, 2006). Still others used actor-network-theory (ANT) to outline the network structure around which the concept of innovation had been spun (Harrisson and Laberge, 2002). Interpretative approaches suffer from shortcomings as they either unreflectively align talk, meaning and practice of innovation thereby risking to fall into a rationalistic trap or assume omnipotent discourses which can potentially define an “innovation reality” devoid of any materiality. These different understandings take a step towards the right direction namely taking subjectivity in innovation understandings seriously but they do stray in one particular direction without acknowledging for instance materiality or ambiguity. One way of understanding innovation in a more nuanced way is by embracing its ambiguity rather than discarding it and also taking the engagement with objects seriously. This connection is the focal point of my paper in which I intent to conceptualise a way on how individuals *come to understand* innovation. I draw inspiration from the phenomenological idea that “being” is always already present in the mind, i.e. individuals become conscious of an entity in their engagement with it (Husserl, 1913). Such a view implies that we are not confined to an intramental world but create our understanding of something through the extramental encounter with it (Sokolowski, 2000).

This fundamental relation to the existence of "things" has been at the centre of Martin Heidegger´s work. He claimed that the polarity between object and subject dissolves in their encounter as we are always already thrown into the world from our birth ("Geworfenheit") (Heidegger, 1926 [1967]; Safranski, 1994). I use Heidegger´s version of intentionality to argue that engineers understand innovation through creating a contemplative space in their work. I will argue that innovation can be understood through the shift from "presence-at-hand" to "readiness-at-hand" which is induced by traits of engineering practices such as the complexity of technology and communities. Such an approach shows how different understandings of innovation come into being and what the ramifications of these can be. Such a concept questions the positivistic approach to innovation as well as enriches the interpretative strands of innovation research as it shows how engineers understand innovation in a variety of ways based on their encounter with their own practice.

My paper is organised as follows. The first part is devoted to a short overview of different innovation concepts. I contend that these approaches do not sufficiently deal with how people come to understand innovation and present subsequently an analytical framework which draws inspiration from Heidegger´s ideas concerning the shift between different "modes of understanding". Additionally, I briefly discuss Knorr-Cetina´s (2002) ideas on "epistemic objects" and traits of engineering practices as these gain relevance in my analysis. In the empirical part of the paper I provide some illustrative findings from a study I conducted at a high-technology company applying my analytical framework. I conclude with some final remarks.

In Search of Innovation

Like any broad concept innovation defies a conclusive definition.

> "[...] innovation still manages to create *conceptual fluster* in the community of scholars who utilize the term: it may be taken to refer to a new product or process, or to a creative leap of mind, an innovation in the sense of 'to innovate'; the adverb of being 'innovative' has similarly been taken to mean being creative and original, or simply having a large number of products" (Hellström, 2004, p.632, emphasis added).

These words aptly express the confusion the term innovation stirs up. Reviewing the literature on innovation is like diving in a bottomless pit. My review is driven by the motivation to

detect the conceptualisation of various *understandings of innovation.* Roughly two broad approaches can be distinguished: an objectivistic and an interpretative approach.[1]

Objectivistic Approaches

Objectivistic approaches reify innovation. An innovation objectively exists out there with distinct and generalisable features. Innovation is thus usually conceptualised as "static and objectively defined objects or practices" (Slappendel, 1996, p. 109). Objectification is necessary to determine causal relationships and interdependencies of variables that could positively affect innovation. The concept of innovation needs to be operationalised and preferably measured (Hurt et al., 1977; Johannessen et al., 2001; Tidd, 2001). Innovation or innovativeness is commonly assumed to be a dependent variable which is explained through different independent variables (Damanpour, 1992; Rogers, 1995; Storey and Salaman, 2005). This research set up entails that innovation needs to be regarded as a clearly defined entity with distinct properties. Innovation is consequently portrayed in simple terms stripped away of any notion of complexity which establishes closure and ontological security. The research results based on such an objectivistic approach however have been fragmented and inconsistent (Downs and Mohr, 1976; Wolfe, 1994). As a remedy Wolfe (1994) proposes a common research agenda that would allow for more cumulative results and coherent findings. He puts forward an impressive list of attributes that should be commonly used to conceptualise innovation. The progressive refinement of innovation attributes however might cure the symptoms but not the cause of the problem. I would argue that the abstract theoretical modelling of innovation deepens the rift between empirical understandings and pre-conceived notions of what an innovation is. This "alienation" obstructs getting closer to a more valid empirically based understanding of innovation. Research which aims to ontologically fix innovation into something reified and tangible thus runs the risk of one way or another "misrepresent" concepts of innovation.

[1] There are multiple ways of systematising research on innovation; for different approaches see for example Slappendel (1996), Wolfe (1994) or Gopalakrishnan and Damanpour (1997).

Interpretative Approaches

Realising that pre-conceived innovation concepts tend to miss the mark researchers have called for an interpretive approach. Their basic assumption is that knowledge about innovation can only be acquired by extracting its empirical articulation.

> "The interpretive perspective would emphasise that innovation is a highly uncertain and complex type of behaviour, which can be best understood from the *point of view of the actors involved in the innovation process*." (Van De Ven and Rogers, 1988, p. 638 emphasis added)

Authors working under an interpretative banner would acknowledge that innovation can only be understood empirically as it is based on subjective interpretations. Three different lines of interpretative innovation research can be distinguished: approaches inspired by grounded theory, discourse analysis and actor network theory (ANT). Let me briefly take these in turn.

Van de Ven´s et al. (2000) build their innovation research project[2] on an inductive approach which aims to ground theory in data collected from the field (Glaser and Strauss, 1967). In particular their intention is

> "[...] to discover an innovation process theory from data systematically obtained from longitudinal research, than to test existing theories that were logically deduced from a priori assumptions that often do not fit or are not based on concrete particulars of the phenomena to be explained." (Van de Ven et al., 2000, p. 11)

Based on the data of the research project Poole and Van de Ven (2000) build a meta-theory of innovation processes which specifies conditions and application of theories of innovation. It is an attempt to generalise the findings of their research project. It does not however bring us any closer to understanding the ontology of innovation let alone deliver an agreeable definition on innovation. It discloses however the complex and ambiguous nature of innovation. As Poole and Van den Ven (2000) remark themselves.

> "The result is a complicated, somewhat unruly set of empirical observations that described the multi-facetted nature of innovations and that are often beyond the explanatory capabilities of existing innovation theories." (Poole and Van de Ven, 2000, p. 637)

Their conclusion shows that the aspiration to draw up generalised conclusion from supposedly theory-free data is a fruitless endeavour. Essentially the pretension to generate abstract theories grounded in empirical data bears resemblance to rationalistic approaches (Alvesson and Sköldberg, 2009).

[2] In the middle of the 1980ies Van de Ven and a large team of researchers started an extensive longitudinal research project on innovation – the so called "Minnesota Studies". The purpose was to create a process theory of innovation which could potentially guide the management of innovation (Van de Ven and Angle, 2000).

Salaman and Storey (2002) and Storey and Salaman (2005) reiterate the importance of empirically extracting understandings of innovation as well. In contrast to Van de Ven et al. they assume understandings of innovation to be discursively constituted. They define discourse as "supplying a way of knowing a defined and constituted object" (Salaman and Storey, 2002, p. 149).[3] Innovation is embedded in various circulating discourses informing the organisational culture. Innovation is not something actualised but lying dormant in a particular discourse which will influence and imbue different individual interpretation and sense-making of innovation. Innovation understood in that sense is something yet unrealised and fluid as opposed to a definite tangible outcome. Despite these rather vague notions, however, Storey and Salaman (2005) aggregate their findings into nine dimensions which are used to distinguish between "poor innovating" and "good innovating" companies. Storey and Salaman (2005) assume an undisturbed alignment between talk, meaning and practice which can be problematic (cf Alvesson and Sveningsson, 2003). This creates a self-referential dynamic in which talk supposedly represents objectively (good) innovation practice.

Asimakou (2009) uses a slightly different discursive approach to innovation. She employs critical discourse analysis to study the relationship between power relations and various discourses on innovation in a single case company. In particular she investigates the clash between, what she calls, scientific and commercial discourses on innovation. Similar to Storey and Salaman (2002) she conceptualises discourse as constitutive of individual realities and a force which shapes social realities. She concludes that innovation is essentially an "empty signifier" (cf Glynos and Howarth, 2007), which means that it is filled with meaning by various interest groups which compete in a "language war" to implant their understanding. The most powerful strategy will then determine its discursive meaning within the company. Her ideas imply that discourse is a force which forcefully determines the constitution of individuals´ realities. Such an approach however neglects that people do not solely derive their meaning through language but that materiality does play a role in deriving understandings (Alvesson, 2004).

Material objects are the main constituent of ANT which has been used as a framework to analyse innovation. In a nutshell, ANT proposes that stable networks are formed by actors which relate to each other all the while making other actors accord with their wishes.

[3] Discourse is a highly contested concept among scholars. For a systematisation of concepts see Alvesson and Kärreman (2000).

According to the “radical symmetry” assumptions actors are not only persons but can be machines, plants or any other object in the network. A machine could thus be viewed as an active agent. Eventually a network is built up which appears to be working as a coherent whole. (Whittle and Spicer, 2008) Basing their analysis on ANT, Harrisson and Laberge (2002) assume that innovation is an amalgamation of social and technological network components which in conjunction impact individual identities in work organisations. In their study they describe the introduction of a process innovation over a period of time and analyse the construction of the emerged network. During the implementation of pre-defined roles required by the innovation blueprint resistance grew and the network became shaky. They conclude that the adoption of innovation is essentially based on a translation process which is strongly determined by power relations and political influences.

Their description of the innovation network builds on the idea that an innovation already objectively pre-exists out there as a sort of “package” which just needs to be adopted. The authors do not explicitly discuss the nature of the innovation but rather the subsequent acceptance of it. Additionally, the implementation of the innovation could potentially be seen as an organisational change process. The strong overlap shows how wide the term innovation has been employed by scholars and how diluted it has become. In general ANT´s inclusion of material objects as coequal agents has certainly appeal for innovation research. Notwithstanding ANT has been criticised as being atheoretical and overly descriptive when proposing to just “follow the actors” (Alvesson and Sköldberg, 2009). In their discussion of ANT´s critical stance Whittle and Spicer (2008) purport that “[...] ANT actually tends towards an ontologically realist, epistemologically positivist and politically conservative account of organizing” (Whittle and Spicer, 2008, p. 623). These observations reinforce the impression that ANT based on its descriptive stance lacks reflexivity.

Concepts of innovation have thus been dominated by objectivistic approaches which reify and simplify innovation. Interpretative approaches as a counterpoise have either aimed to theorise from empirical articulations without paying much attention to an alignment between talk, meaning and practice; have build on the omnipotence of discourse to define social reality or have delivered descriptive accounts which reinforce existing realist positions on innovation. What would be fruitful is a lens which (a) draws on individual interpretations (b) acknowledges materiality in understanding innovation (c) allow for reflexivity in capturing different understandings of innovation. In the following I will suggest such an approach.

An Analytical Framework

In the following I will present an analytical framework inspired by Heidegger´s ideas on the shift of states between "readiness-to-hand" and "presence-to-hand" (1926 [1967]) as well as Knorr Cetina´s (2002) suggestions on objectual practices.

Throughout his whole work Heidegger (1926 [1967]) was concerned with the rather difficult question of being[4]. He argued that from our birth we are already thrown into our own subjective world ("Geworfenheit"). This state of "being-in-the world" determines exclusively our understanding of reality and more fundamentally the relationship to our own existence. In our constant dealing with the world we tend to use equipment ("Zeug") which distinct properties dissolve in the act of using it. Put more prosaically, we tend to take the properties of things-in-use for granted and do not attempt to make a cognitive effort to theorise them until they break down or become in some other way "unhandy". Heidegger uses the term "Zuhandenheit (Readiness-to-hand)" to refer to our habitual frame of mind and "Vorhandenheit (Presence-at-hand)" to describe the contemplative state in which we theorise and reflect on properties of equipment previously in-use. The act of making something present-at-hand shows traces of the concept of Husserl´s intentionality even though Heidegger never used the term explicitly (Moran, 2000). The phenomenological concept of intentionality (Husserl, 1913), purports that we are always already consciousness *of* an object rather than constructing intramental images of it. These so called intentions can be either filled with meaning when an object is directly apprehended in its presence or intentions can be empty, i.e. something is intended in its absence (Sokolowski, 2000). Heidegger, a student of Husserl, argued that the original concept of intentionality only focused on the consciousness and thereby neglected to capture the essence of the thing being intended. Furthermore Husserl´s concept did not abolish the separation between the subject and the object as the mind was still considered to be the locus for representation (Moran, 2000). Heidegger consequently abandoned Husserl´s original concept of intentionality and developed them further. An act of intentionality in Heidegger´s sense occurs when we shift from "readiness-at-hand" to

[4] The question of how things appear to us or how we understand reality and the existence of things have been of continuous interest to scholars. Usually this musing lies at the core of discussing ontological questions. Ontology is thus concerned with the constitution of objects; the "being" of the world we experience around us and the relationship of the existence to the subject in it (Burrell and Morgan, 1979). The ontological quest throughout the centuries has yielded an impressive array of answers on the essence of being albeit a definite answer is still at large.

"presence-at-hand" (Mulhall, 1996). Triggers for such an intentional act are manifold and they are inherent in engineering practices. What are engineering practices though? A sound description of four traits of technical work has been put forward by Barley and Orr (1997). For them technical work comprises:

> "(a) the centrality of complex technology to the work, (b) the importance of contextual knowledge and skill, (c) the importance of theories or abstract representations of phenomena, and (d) the existence of a community of practice [...]" (p. 12)

I observed technology and community to be the two most important triggers in my particular case. The nature of technology is a disputed issue among scholars (Grint and Woolgar, 1997) so I will draw on a specific concept on the ramifications of technology on organisational structures put forward by Barley (1986). He posits that even if technology´s physical properties are identical, i.e. the same technology is introduced into a context, the appropriation and meaning-providing effect is context-dependent.

> [...] technical uncertainty and complexity are social constructions that vary from setting to setting even when identical technologies are deployed." (Barley, 1986, p. 106)

In his study Barley investigated the effects on organisational institution but I would claim that the ramification of technology can also be responsible for triggering reflections on the nature of innovation.

Communities in organisations have also been discussed extensively; especially in respect to knowledge sharing (Brown and Duguid, 1991; Orr, 1996), control (Kunda, 1992; Ouchi, 1979) and innovation (Kanter, 1988). I characterise a community based on Tönnies (1887 [2005]) conception as a union of individuals bound together by values, behavioural norms and similar expectations; in my particular case similar educational background and company interests.

Heidegger´s ideas on the shift between "readiness-at-hand" and "presence-at-hand", described above, have also been appropriated by Knorr Cetina (2002) for her ideas on epistemic objects. As Heidegger remains rather vague about the specifics of equipment, Knorr Cetina proposes her idea of epistemic objects as the subject matter of contemplation. An epistemic object is an entity possessing an "unfolding ontology". More specifically, epistemic objects are characterised by their non-identity and fleeting essence. According to Knorr-Cetina individuals create an emotional attachment to such objects drawing on relational resources which include taking the other´s standpoint, making an emotional investment and exhibiting moral and altruistic behaviour. In contrast to "closed" objects, epistemic objects

> "appear to have the capacity of unfolding indefinitely. They are more like open drawers filled with folders extending indefinitely into the depth of a dark closet." (Knorr Cetina, 2001, p. 190)

Epistemic objects are the epicentre of research as they instil continuous desires due to their unceasing incompleteness and merely temporal reification. Researchers strive to find the missing piece in the puzzle while the puzzle is continuously rearranging and reconstituting itself which instigates even more desire to complete it.

The above described constituents can now be casted into a framework which models the interrelationship between the different parts. Figure 1 provides a summary of this analytical framework

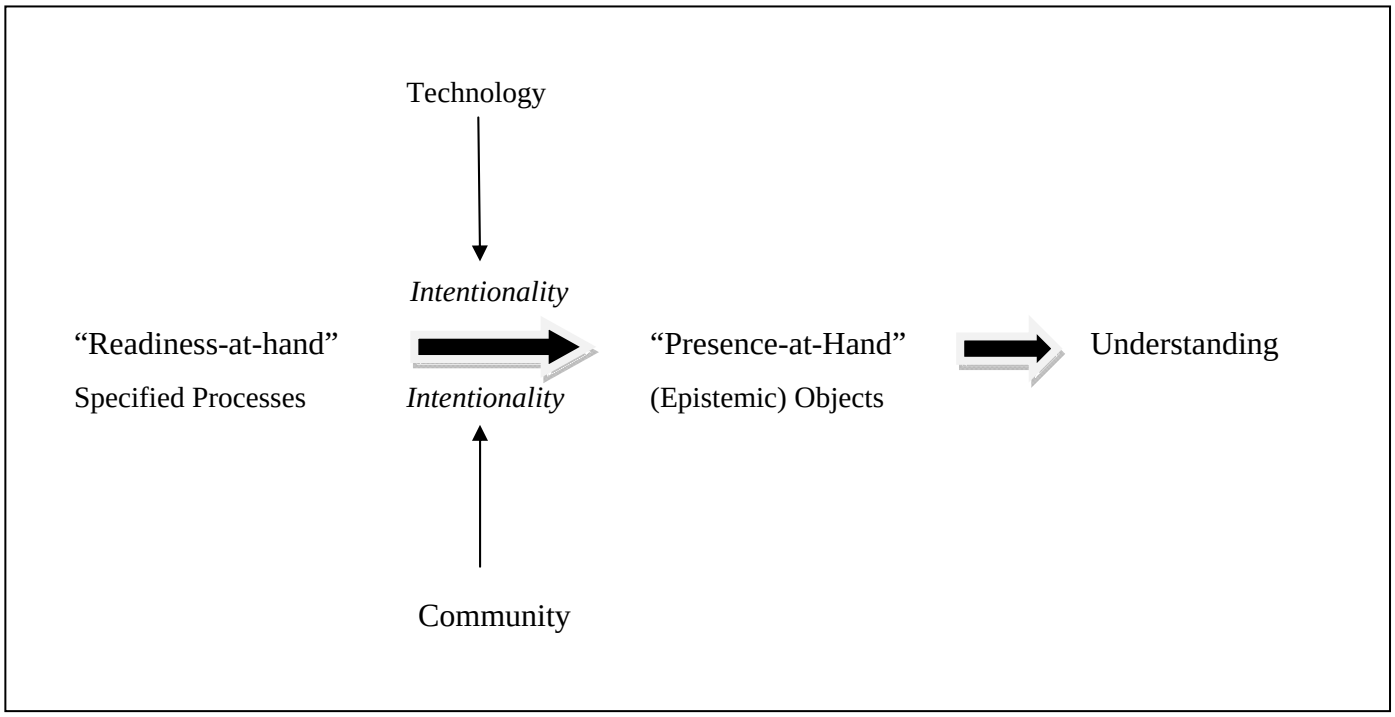

Figure 1: Analytical Framework

I contend that the baseline of work routines consists of specified processes in which subject and object are fused in a tied relationship. Through an act of intentionality triggered by technology and community a dissociation of object and subject is created in which objects become "present-at-hand" and in flux. A contemplative space is created in which the individual ponders the object at hand. This active reflection then leads to a contingent understanding of the pondered object.

I will now proceed to present an empirical illustration of this framework related to understandings of innovation at a high technology company.

An empirical illustration

In the following I will provide a short description of my case company and my field methods. I then illustrate the work processes as well triggers for active contemplation at my case company. Finally I discuss the pondered objects and conclude the section with a brief summary.

The case study

The company I studied is a joint venture incorporating the divisions of two high technology companies. Due to reasons of anonymity I will henceforth refer to it as “Technovator”. Technovator manufactures high technology products integrating hardware components and software applications in a B2B market. Technovator´s workforce comprises approx. 90% engineers from various engineering sub-disciplines. Quite recently the marketing department has made an effort to implement a branding program intending to communicate Technovator´s innovativeness: new logos and company colours were introduced, flags were flown and TV screens with the three new brand messages installed. These branding efforts however have been met with little interest by employees. The branding project was also a reaction to the fact that there is of today no policy on innovation or any other guidelines on how to “manage” innovation. Previously and presently efforts to increase innovation are mostly based on managers´ grass root initiatives. The branding project has not changed this dynamic very much.

The virtual nonexistence of innovation policies and guidelines makes Technovator an interesting case study as understandings of innovation are not yet “contaminated” by an official company discourse. I had the feeling that my interviewees were struggling to convey their understanding of innovation reflecting heavily on the issue in lack of a company line they can fall back on. For my study I conducted in total 44 scheduled interviews with engineers from the hardware and software department as well as product management and marketing. Additionally over a period of 7 months I attended meetings of a unit comprising 5 highly skilled engineers and their manager assigned to do “innovation work”. During these

meetings I also had some informal chats with the participants. To receive some feedback on my first tentative interpretations I organised workshops in which I explained my ideas to some of my interviewees. During these sessions my interpretations were validated or clarified. I was also recommended to talk to other people who were known to have different views on the subject matter which I did.

In the following I will draw on some of my interview material and observations to illustrate the dynamics I proposed in my analytical framework.

Routinised Work Processes

Technovator drives projects for customers which are usually very well specified in advance. Customer requirements are trickled down the chain from systems management to the respective software and hardware units. These requirements are then implemented in the corresponding units. The whole process is defined extensively from the start.

> "I mean why it´s not innovative work or ideas in the project time because that´s...it´s kind of defined from the beginning what it should be and it is visible and it is just end work to do it. It´s like put together a pile of bricks and you know you have a big pile over there and then you should put it together. [...] Yeah and you have the pile there and you know that here should be a wall 200 meters high ten meters wide. Start. And then you look at it and you say: yes that will be possible but it will take some time. Many projects are like that. That is no innovation." (Software Manager)

The tight deadlines which are driving projects are leaving no space for deviations.

> "[...] you get this already boxed-in task which is connected to a very connected time schedule. I mean in that sense it doesn´t give much room for innovation because you don't have the time. I mean for me innovation happens in the boundaries between either software modules or different technologies as such. If you already have boxed in what you should focus on it gives less space." (Software Engineer)

The focus at Technovator is on delivering end products optimising lead times. Deviating from these pre-defined processes would take away costly time. Deviations are contrasted to execution. One software manager uses the factory metaphor to describe normal project work suggesting mundane repetitive work.

> "Being the software factory is not innovation that we are. Innovation is definitely more grand than the day-to-day work delivering a project. Because innovation to me is if you take a step." (Test manager)

Another manager employs the machine metaphor.

> "[...] if you have too much process then there is also the risk that you kill the creativity you become a very good machine and you cannot think outside the box and I think thinking outside the box is a very good skill that should be encouraged." (Software Manager)

Work at Technovator is dominated by pre-defined processes, which necessitates the application of familiar tools and known solutions. Put metaphorically, engineers are urged to remain inside the box without the liberty to step outside. As opposed to "factory work", innovation would mean creating distance to repetitive day-to-day routines.

> "[...] sometime under pressure you stop thinking on day-to-day and you decide to find a global solution for a couple of topics and then you force yourself to stop these crazy games, answering mails and operation on a day-to day and spend some time to analyse what could be a solution that cover more fields either on the same project or multiple projects. Sometimes you have to do it." (Hardware Engineer)

Scholars have analysed the characteristics of routines and practices in a variety of different ways. An underlying assumption was always that they are stable; determining a specific behavioural trajectory (Cyert and March, 1963.; Nelson and Winter, 1982). Feldman (2000) amongst others however argues that routines are constantly undergoing change thereby creating flux. This would support the observation that even in well-defined organisational set-ups in which project execution reigns supreme contemplative spaces are created. At Technovator the two main triggers for interrupting routines or incrementally probing them are technology and community.

Technology

During my study some engineers talked about the concept of "reverse engineering", i.e. taking apart competitor´s products and spreading the knowledge of its technological content within the company. Technological solutions developed and used by consumers function as a means of contemplating own products and work processes.

> "[...] we were taking impressions from the outside all the time. What's happening right now…[Product A] is coming out, something like the [Product B], they were talking about, now we knew this the first week it happened, we knew, no, we're buying [Product A], and stuff, and looking at it, we were reverse engineering things, taking them apart and looking at them. Then this information is supposed to, sort of, spread into the entire company." (Software Engineer)

> "I heard from a customer input from ... that they were concerned about power consumption in the [Product A] and then I started to think about it and I had some... based on my expertise and I did a problem description and found out what are the real problems and then I looked for how this problem is solved by [Third Party] and there I propose other solutions that we could do to improve." (Software Specialist)

A hardware engineer talks about a manager who used physical models to induce new thinking.

> "In the past there was a manager [..]. He always used the size of the product to drive the innovation process. "Now we have this big product that you can carry around like this. Next time I want... Create a physical model and say how can you get the electronics into this?" Then people start to think. So if you can do some symbolic... If we are really innovative we should be able to put this type of product into this type. Very simple sometimes. In [Company X] they used the kind of physical size and weight as a way to drive thinking." (Hardware Engineer)

A hardware engineer talks about the complexity of the technology which necessitates further reflection in order to cope with such complex matters.

> "Innovation for me is to find new ways of solving a known problem that is my thinking. [...] Our innovation is needed in order to conquer the complexity of our technology. [...] Because it becomes more and more complex the amount of functionality you can integrate in such a device it´s growing, you know, the more by and large. And that means that a number of functions as well as the size of the organisation grows more and more and in order to manage that you need to be innovative in the way you actually develop your techniques."

The unit I was observing as part of my study was constantly engaged in discussions of technology. Their conversations usually centred on complex technological problems which needed attention in order to continuously ensure being on level with the competition.

Another trigger for contemplation originates in the community in which the engineers are embedded.

Community

The community Technovator is characterised by similar educational backgrounds and specific knowledge in Technovator´s field of business. One software manager described the homogeneity of Technovator´s employees.

> "Engineers we are.. it is very likely that engineers develop products for other engineers. They know their own needs. We all go to the same school we all learn the same type of thinking. We are all too homogenous." (Software Manager)

There are also other sub-communities within Technovator centred on specific interests. The "innovation" unit´s members I observed were all part of a community within their special fields such as graphics or security.

The members of a community act as a sounding board as they are usually enmeshed in the same net of processes, impressions and interests. Consider in this regard the statement of a software specialist. He relates that unstructured and seemingly random discussions are most suitable for coming up with ideas as opposed to being organised like a machine. Input from peers stimulates reflection.

> "I think every time I have come up with some innovation it has been like at a coffee break or something with just a few people and you didn't have an agenda. It just happened that you started discussing something like at the whiteboard at the coffee area. We don't have that too much now but before we did. That was a good scene for discussing things. Then you discuss and brainstorm and you come up with new stuff." (Software Specialist)

It is important to be embedded within the different communities to induce reflections. Another software engineer describes the repercussions transferring to the new unit which would catapult him out of his previous community which is important for his expertise.

> "I mean all the people have good knowledge in different areas and they say we have read this here and they ring up. And you learn a lot from those discussions. Then I'm not sitting next to the others, I don't know how much that is sort of a drawback from one sense that you don't discuss daily with them. But then on the other hand if I would sit there then I would lose more or less all the contact with the security team here and that's.. that's also a drawback because then you sort of you are not involved in the different erm.. [product] solutions." (Software Specialist)

Another software engineer recounts an experience where others in her community pointed out that something she was working on might potentially be worth contemplating.

> "Yeah. It´s to me... it is normal. Like somebody else that does something else and for me that is: oh that is really incredible but for him it is... but for me it is normal. I don't think innovation at all." (Software engineer)

Another engineer reiterates this point.

> "I came up with an idea that other people told that I should... if you talk about patents you should really try to patent this. So I think it is easy to be blind for you own innovations that you... other people might have to tell you that this is great." (Software specialist)

These examples show that communal interaction potentially interrupts work flows which have become ingrained or "ready-at-hand". Such an interruption trigger acts of contemplation. In other words, the encounter with community members ensures that you take a step back and look at the constituents of your own and others work routines. The nature of these constituents will be discussed in the next section.

Objects of contemplation

Engineers ponder various objects while being caught up in a contemplative state. It seems that software programmers in a contemplative state unceasingly mull over their code in an infinite loop.

> "A lot of programmers don't consider themselves as engineers but as artists. It is a true kind of craftsmanship that make them proud and they devote a lot of energy but the problem is; when do you let go, when is it good enough. To be honest the best solution is

> the beautiful solution. They are usually the ones that last long enough. But the reality is that you need to hit a certain record window and you can get away with ugly code as long as it works. [...] Software engineers never stop. That is the problem." (Software Manager)

Similarly in hardware development certain features on the product force you to contemplate processes and functionalities. An engineer who I chatted to on the way to his bus told me that their work is based on a scientific premise that every second year the hardware element will accommodate more functionalities so that you have to adapt to it continuously. Hence there is a constant development which necessitates adjustments in order to keep up with the development and ultimately the competition. Hence these objects are not "closed boxes" (Knorr Cetina, 2001, p. 190) but require constant changes and improvements. Consider the following statement by a software engineer though.

> "When in April I got the 2nd [Product] they were claiming like oh and you know what: it is a new [Product] and it even records video. And it was like; excuse me? More is happening regarding video for a long time so what is the new part. [...] I already seen this, this is not innovation that is something done for a long time. [...] They manage to sell it to the customer; wow it is really recording video. I don't say that [Product] is not good or something but it is just this particular you know marketing thing that really I mean I was like... (Software Engineer)

In the eyes of the engineer this product has forfeited its innovative status as the claimed technological advance is nothing new. She discovers with apparent disappointment that it is not an epistemic object but rather a reified yet unsubstantial image.

Thus objects or representations which are pondered can fall into different categories. The most common are arguably epistemic objects which instil a desire for closure and completeness but objects can also cause disappointment as the promise of its ingenuity is merely window dressing.

A short reflection on the dynamic of understandings innovation

The above derived and empirically illustrated framework is intended to show different understandings of innovation. It thus functions as an analytical frame to exemplify a multitude of different innovation understandings. Let me give an example of this dynamic.

Once an engineer is confronted with a piece of new technology from a competitor which interrupts her work routines she contemplates its features and arrives at the conclusion that the technology is not at all advanced then she would arrive at the understanding that innovation in that particular case is an *image*. In another case an engineer would be told by a colleague that

his solution is potentially innovative which would trigger an active contemplation of his solution as something which might not be necessarily apt for including in the product but nevertheless an inventive step which could be patented and thus protected from competition. In that case innovation is understood as *property*. My material suggests a variety of such dynamics and different understandings. It would however go beyond the scope of this paper to present and discuss all these different images.

Conclusion

My paper aimed at conceptualising how engineers come to understand innovation through intending their own practice. To that end, after a critical analysis of the literature, I devised a framework and put it to the empirical test. Conceptualising the process of understanding innovation in such a manner challenges positivistic notions by pointing out that innovation does not objectively exist out there as a distinct entity. It also challenges purely discursive understandings as engineers do engage with materiality which bears meaning-making properties.

A framework always necessarily has to simplify and box in a highly subjective, complex and contingent reality. As such I have made some simplifications which enabled well-ordered analytical work at the expense of simplifying reality. I have assumed a rather straightforward process which in reality would overlap and merge. I have also reduced the triggers to technology and community where there are most likely more. Additionally I have separated the triggers community and technology when they could be intertwined; an example would be the influence of the open source software community on organisations.

Hence there are certainly limitations to my framework but my intentions have not been to establish a prevailing truth but rather to offer food for thought for research as well as practitioners.

References

Alvesson, M. (2004): Organizational Culture and Discourse, in: D. Grant, C. Hardy, C. Oswick & L. Putnam, (eds.): *The SAGE handbook of organizational discourse*. Sage, London, pp. 317-337.

Alvesson, M. & Kärreman, D. (2000): Varieties of discourse: On the study of organizations through discourse analysis. *Human Relations* 53(9), pp. 1125-1149.

Alvesson, M. & Sköldberg, K. (2009): Reflexive Methodology - New Vistas for Qualitative Research 2nd edition, Sage: London.

Alvesson, M. & Sveningsson, S. (2003): The great disappearing act: Difficulties in doing "leadership". *Leadership Quarterly* 14(3), pp. 359-381.

Asimakou, T. (2009): Innovation, Knowledge and Power in Organizations, Routledge: London.

Barley, S. R. (1986): Technology as an Occasion for Structuring: Evidence from Observations of CT Scanners and the Social Order of Radiology Departments. *Administrative Science Quarterly* 31(1), pp. 78-108.

Barley, S. R. & Orr, J. (1997): Between Craft and Science - Technical Work in U.S. settings, Cornell University Press: Ithaca.

Brown, J. S. & Duguid, P. (1991): Organizational Learning and Communities-of-Practice: Toward a Unified View of Working, Learning, and Innovation. *Organization Science* 2(1), pp. 40-57.

Burrell, G. & Morgan, G. (1979): Sociological paradigms and organisational analysis: elements of the sociology of coporate life, Heinemann: London.

Cyert, R. M. & March, J. G. (1963.): A Behavioral Theory of the Firm, Prentice-Hall,: Englewood Cliffs.

Damanpour, F. (1992): Organizational Size and Innovation. *Organization Studies* 13(3), pp. 375-402.

Downs, G. W., J. R. & Mohr, L., B. (1976): Conceptual Issues in the study of Innovation. *Administrative Science Quarterly* 21(4), pp. 700-700.

Feldman, M., S. . (2000): Organizational Routines as a Source of Continuous Change. *Organization Science* 11(6), pp. 611-629.

Glaser, B. G. & Strauss, A. L. (1967): The discovery of grounded theory : strategies for qualitative research, de Gruyter New York.

Glynos, J. & Howarth, D. (2007): Logics of Critical Explanations in Social and Political Theory, Routledge: London.

Gopalakrishnan, S. & Damanpour, F. (1997): A review of innovation research in economics, sociology and technology management. *Omega* 25(1), pp. 15-28.

Grint, K. & Woolgar, S. (1997): The Machine at Work: Technology, Work and Organization, Polity Press: Cambridge.

Habermas, J. (1968): Knowledge and Human Interests, Beacon: Boston.

Harrisson, D. & Laberge, M. (2002): Innovation, Identities and Resistance: The Social Construction of An Innovation Network. *Journal of Management Studies* 39(4), pp. 497-521.

Heidegger, M. (1926 [1967]): Sein und Zeit, Niemeyer: Tübingen.

Hellström, T. (2004): Innovation as Social Action. *Organization* 11(5), pp. 631-649.

Hurt, H. T., Joseph, K. & Cook, C. D. (1977): Scales for the measurement of innovativeness. *Human Communication Research* 4(1), pp. 58-65.

Husserl, E. (1913): Logische Untersuchungen, 2nd edition, Niemeyer: Halle a.d. Saale.

Johannessen, J.-A., Olsen, B. r. & Lumpkin, G. T. (2001): Innovation as newness: what is new, how new, and new to whom? *European Journal of Innovation Management* 4(1), pp. 20-31.

Kanter, R. M. (1988): When Thousand Flowers Bloom: Structural, Collective and social conditions for Innovation in Organizations. *Research in Organizational Behavior* 10, pp. 169-211.

Knorr Cetina, K. (2001): Objectual Practices, in: T. R. Schatzki, K. Knorr Cetina & E. Savigny, (eds.), pp. 175-189.

Kunda, G. (1992): Engineering Culture: Control and Commitment in a High-Tech Corporation, Temple University Press: Philadelphia.

Moran, D. (2000): Introduction to Phenomenology, Routledge: London.

Mulhall, S. (1996): Heidegger and Being and Time, Routledge: London.

Nelson, R. R. & Winter, S. G. (1982): An Evolutionary Theory of Economic Change, Harvard University Press: Cambridge.

Orr, J. (1996): Talking about machines, Cornell University Press: Cornell.

Ouchi, W., G. (1979): A Conceptual Framework for the Design of Organizational Control Mechanisms. *Management Science* 25(9), pp. 833-833.

Poole, M. S. & Van de Ven, A. (2000): Towards a General Theory of Innovation Processes, in: H. Van de Ven Andrew, H. L. Angle & M. S. Poole, (eds.): *Research on the*

Management of Innovation - The Minnesota Studies. Oxford University Press, Oxford, pp. 637-662.

Rehn, A. & Vachhani, S. (2006): Innovation and the Post-Original: On Moral Stances and Reproduction. *Creativity and Innovation Management* 15(3), pp. 310-310.

Rogers, E. M. (1995): Diffusion of Innovations, The Free Press: New York.

Safranski, R. (1994): Ein Meister aus Deutschland. Heidegger und seine Zeit, Hanser: München.

Salaman, G. & Storey, J. (2002): Managers' theories about the process of innovation. *The Journal of Management Studies* 39(2), pp. 147-165.

Slappendel, C. (1996): Perspectives on Innovation in Organizations. *Organization Studies* 17(1), pp. 107-129.

Sokolowski, R. (2000): Introduction to Phenomenology, Cambridge University Press: Cambridge.

Storey, J. & Salaman, G. (2005): Managers of Innovation - Insights into Making Innovation Happen, Blackwell: Malden.

Tidd, J. (2001): Innovation management in context: environment, organization and performance. *International Journal of Management Reviews* 3(3), pp. 169-183.

Tönnies, F. (1887 [2005]): Gemeinschaft und Gesellschaft - Grundbegriffe der reinen Soziologie, Wissenschaftliche Buchgesellschaft: Darmstadt.

Van de Ven, A., Angle, H. L. & Poole, M. S., (eds) 2000. Research on the Management of Innovation - The Minnesota Studies. Oxfrod University Press, Oxford.

Van de Ven, A., H. & Angle, H. L. (2000): An Introduction to the Minnesota Innovation Research Program, in: H. Van de Ven Andrew, H. L. Angle & M. S. Poole, (eds.): *Research on the Management of Innovation - The Minnesota Studies*. Oxford University Press, Oxford, pp. 3-31.

Van De Ven, A. H. & Rogers, E. M. (1988): Innovations and Organizations: Critical Perspectives. *Communication Research* 15(5), pp. 632-651.

Whittle, A. & Spicer, A. (2008): Essai: Actor Network Theory Critique? *Organization Studies (01708406)* 29(4), pp. 611-629.

Wolfe, R., A. . (1994): Organizational innovation: review, critique and suggested research directions. *Journal of Management Studies* 31(3), pp. 405-431.