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Head and hands:
A study of skill in skilled workers in the
construction industry

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To Kaare Simonsen,
with love and gratitude

Sammendrag

Det har vært mye oppmerksomhet om byggebransjen de siste årene, særlig på problemer som useriøse aktører og mangelen på status og rekruttering. Dette er legitime bekymringer.

Imidlertid har det vært lite fokus på hvordan de seriøse aktørene kan snu utviklingen i bransjen.

I denne oppgaven ønsker vi å studere de seriøse selskapene: Hvis de skal snu utviklingen i bransjen i årene fremover, hvordan skal man forstå fagarbeiderne ferdigheter? Vi har brukt tre teoretiske perspektiver for å utforske denne problemstillingen. Vi har gjennomført halvstrukturerte kvalitative intervjuer med ledere og tillitsvalgte i seriøse bedrifter som vi fikk anbefalt av både LO og NHO.

I analysen fremgår det at informantene la vekt på høy kvalitet hos fagarbeiderne. Dette er spesielt viktig i en bransje som er prosjektbasert og dynamisk. Vi argumenterer videre for at evnen til å produsere høy kvalitet består av seks dimensjoner, som er gjensidig avhengig av hverandre, for eksempel en teknisk, en sosial og en innovativ og dynamisk dimensjon.

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Abstract

A number of concerns have been raised over the construction industry, such as junk enterprises and a lack of status and recruitment. These are grave concerns shared by a variety of people and institutions. There is, however, little focus on the professional enterprises and what they need from their skilled workers in order to move the industry in the right direction.

In the present study, we turn our attention to the professional actors in the industry: If they are to move the industry in the right direction in the years to come, how can we understand skill in the skilled worker? We have grounded our analysis in three theoretical perspectives: the Norwegian cooperation model, skills theories and socio-technical systems theory.

We conducted semi-structured, qualitative interviews with 4 managers and 3 union reps that represented professional companies in the construction industry. The companies had been selected on the basis of suggestions made by LO and NHO (Norwegian organisations representing employees and employers respectively).

In our analysis, we found that our informants emphasised high quality skill in skilled workers. Producing high quality proves especially important in an industry which is project-based and where each project contains many unique features, for instance unique sites and a unique combination of people and companies. The same complexity also places high demands on skilled workers.

In our analysis, we argue that high quality skill consists of six components or dimensions that are interdependent and overlapping, for example a technical dimension, a social dimension and an innovative and dynamic dimension. Our informants stressed that high quality skill takes time and practice to develop, and that both body and mind are involved. These findings are in keeping with theories on skill development, where tacit knowledge is emphasised as an important component of skill. Tacit knowledge is a form of knowledge developed through experience, modular repetition and the interplay between body and mind over time.

Our conclusion, based on our analysis, is that high quality skill is essential for professional enterprises in the dynamic and complex construction industry. However, high quality skill takes time to develop, and needs engaged workers who work with both body and mind.

Therefore, in keeping with our informants, we conclude that permanent employees are a prerequisite for developing high quality skill. Another conclusion is that since high quality

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skill is developed through specific and trained practice. Vocational education should reflect this and allow pupils to practice as soon as possible. Finally, we also suggest that socio-technical systems theory integrate tacit knowledge in its principles.



Photo 1: Proud construction workers at Grande entreprenør AS. Photo: Mac Lein Foto & Design

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Chapter 1: Skilled workers of the future

1.1 A skills crisis in Norway?

«Vocational education in crisis» (Aftenposten 2011) and «The construction industry is fighting for its reputation» (Bråten and Sved 2014a). These are just two of the many headlines on skilled workers that have made its way into national and regional newspapers in Norway in the last few years. Skilled workers have attracted much attention in Norway, and not just in newspapers, but in as different arenas as popular talkshows, conferences and books.

Much of the attention and debate in Norway is on the problems skilled workers and the industries they work in face: for example, a lack of recruitment and apprenticeships (e.g. Tiller 2014), low prestige for skilled workers (e.g. Bråten and Sved 2014a), undeclared work (e.g. Tiller 2014), internationalisation and globalisation (e.g. Friberg and Eldring 2011), bad reputation in the construction industry (Dahl and Haakaas 2014) and educational content and quality (e.g. Nyen and Tønder 2014). Norway is not alone in its concern for skilled workers. The same questions are raised in many Western countries, for instance in the UK (e.g. West 2015), the US (e.g. Sennett 2008) and Denmark (e.g. Tesfaye 2013).

An underlying premise in much of the debates in Norway is a need for skilled workers. There seems to be a consensus across party lines that the lack of recruitment is worrying and while theoretical knowledge is important, our society also depends on skilled workers, i.e. what the American woodworker and blogger Doug Stowe (2015) aptly calls «the wisdom of the hands». For example, Robert Eriksson – who at the time of writing is the Minister of Labour and Social Affairs in Norway's centre-right coalition government – stated in an interview with a regional newspaper that «not everyone can work as doctors or lawyers» (Bråten and Sved 2014b). Furthermore, Mr Eriksson claimed that the myths about high and low status occupations need to be destroyed and that the need for skilled workers will be enormous in the years to come. On the other side of the political spectrum, Jonas Gahr Støre, the leader of the Norwegian Labour Party, emphasises the need for skilled labourers in the years to come and a concern for the lack of recruitment (Støre and Bals 2014). Among other things, Mr Støre (op.cit.: 308) also stresses the need for knowledge, «but knowledge in itself is not the solution; what we have to develop is knowledge applied to unsolved tasks» (ibid.). The argument that knowledge should be rooted in practice is supported by scholars and

practitioners, such as the American sociologist Richard Sennett (2008) and Danish author and bricklayer Mattias Tesfaye (2013). This is the topic of the section below, chapter 1.2.

1.2 The wisdom lies in the hands

Internationally, both scholars and craftsmen have voiced their concern over a decline in practical skills, for instance American sociologist Richard Sennett (2008) and Danish author and bricklayer Mattias Tesfaye (2013). Their concern goes deeper than worrying about a lack of skilled workers who can perform important tasks in society, such as constructing houses or roads. Ultimately, Sennett (op.cit.) and Tesfaye (op.cit.) claim, skill development is intimately connected with cognitive development and shapes our relationship with the material world as well as our relationship with other people. Woodworker and blogger Doug Stowe (2006) makes a similar claim when he argues that the hands and brain constitute an integrated learning and creating system. He further argues that

[i]t is the opportunity to be engaged through the hands that brings the seen and known to concrete reality in human experience. Without the opportunity to learn through the hands, the world remains abstract, and distant, and the passions for learning will not be engaged (Doug Stowe 2006).

In other words, the fracturing of hand and head has far-reaching consequences not only for skill development as such, but also for how we view the world (Sennett 2008, Stowe 2006, Tesfaye 2013). Tesfaye (2013:9) refers to the fact that many people in a range of professions where practical and theoretical knowledge are combined, experience a loss of connection between hand and head:

In later years, the craft of the journeyman bricklayer and the professionalism of the teacher have lost prestige. As with many other professions that combine practical and theoretical skills, our experience and insights have been pushed aside, in favour of a very theoretically founded worldview. With the consequence that we are many who have lost power over our own working life, educational system and the society at large (Teskfaye 2013:9).

The problems this fracturing of hand and head causes, take many shapes and forms, such as poor quality, frustration, a lack of motivation and a loss of professional pride (Sennett op.cit. and Tesfaye op.cit.). You can find examples of this in many different professional fields. When teachers in Norway protest against standardisation, this can be seen as a reaction to the experience of losing control over their own professional execution, and therefore over their own skills.

Another consequence can be seen in the construction industry, as a fixation on design over quality in the execution (Sennett 2008 and Tesfaye 2013). There are many examples of buildings receiving accolade for their design, although it has been evident that the actual constructions have serious flaws. Tesfaye (ibid.) gives an example of a house in Denmark – the 8 House. This construction has won several internationally prestigious awards – for its design. However, the quality of the construction has been deemed extremely poor and a number of practical problems occurred only a year after it was built. Similar examples can be found all over Norway.

In Bergen, a block of flats was nominated for a prestigious international architectural award. This nomination happened after many headlines in the media about the «scandal building» (e.g. Åkernes 2014). The house was designed as student accommodation, but had extremely serious construction failures: The house would have collapsed had these faults not been discovered by chance. The wisdom of the hands had been ignored. These examples reflect the fact that in today's society, there seems to be a focus and appreciation of high academic skills such as the skills of the architects, but not on high quality skills in practical work such as skills of the vocational workers.

1.3 The construction industry

Many of the challenges described above, in 1.1 and 1.2, can be found in the construction industry. After a dialogue with our supervisor we decided to focus on this particular industry, for several reasons; first of all because we found it interesting. The construction industry is an important industry that touches the life of most of us. We wanted to do something that felt valuable in a societal context. In addition, we have a personal connection to the industry, since our family once ran a company in the industry and we have many family members who work in the industry.

Secondly, a project was already in progress at SINTEF that dealt in part with the construction industry (see SINTEF 2014).

Our focal point was to be on the professional enterprises and their view on what skills their workers need, if they are to compete in today's challenging situation and the time to come.

1.4 Research question

Our research question is:

In the light of future demands in the construction industry, how can we understand skill of the skilled worker?

We explore this question by interviewing managers and trade union representatives.

1.5 Involvement in SINTEF's innovation project HPWS.no

The present thesis is written in cooperation with an innovation project headed by SINTEF Technology and Society. How this collaboration came about we will explain more fully in chapter 4 on methodology.

The innovation project *HPWS.no* (SINTEF 2014) was a project about how to make the Norwegian work model more explicit. The title of SINTEF's innovation project is *HPWS.no*, which is a reference to the international work model High Performance Work System (HPWS), where many of the features connected to a Norwegian working life may be found, such as information sharing and the involvement of employees (Levin et al 2014, for more details on our theoretical foundation, see chapter 3). The innovation project receives funding from the Research Council of Norway. The goal of the project is to adapt this international system to a Norwegian context and at the same time make the work model more explicit. In addition to SINTEF, there are three companies involved in this innovation project: a construction company, a manufacturing company and a company involved in training and authorisation of skilled workers.

1.6 Explanation of central terms

In this section we explain some of the central terms that may need further clarification.

The Norwegian term *bas* is given the title *team leader*. The *bas* is a skilled worker who is given extra management tasks, such as the responsibility of leading other skilled workers or extra responsibility for coordination. This is a title and does not mean that a *bas* or a team leader always leads a team. In one company, for example, we are told that skilled workers may work alone, but because of the responsibility involved they are given the title *bas* and given wages according to this title. In this company, an apprentice may also be assigned to

them. The term team leader seems to be equivalent to the terminology used in Pauwels et al (2012), a Belgian analysis of construction workers. The terminology is also in keeping with Skarbøvik (2012:15), who wrote a master's thesis at the University of Oslo, Norway, on innovation and learning in construction companies.

The Norwegian term *fagarbeider* is translated as *skilled worker*, meaning a person who has reached a certain level of vocational skills and training. We have consulted native speakers of English to make sure that the connotations are equivalent in Norwegian and English.

The Norwegian term *tillitsvalgt* is translated as *trade union representative* or *union rep*. We have consulted our supervisor, literature and dictionaries.

The term *junk enterprises* will be used about companies that operate on the wrong side of the law, in accordance with Torvatn and Finnestrand (2011). This term is equivalent to the Norwegian term *useriøse aktører*.

Skill is a term and a concept which we will discuss further in our analysis in chapter 6. Sennett describes skill as «the capacity to work well» (ibid.2008:285).

1.7 The organisation of the thesis

Chapter 1 provides the reader with an introduction to the topic we have chosen. We also present our research question. In *Chapter 2* we describe central features of the industry where our informants work, namely the construction industry. In *chapter 3* we give an overview of the three main theoretical perspectives that together form the foundation of our analysis: the Norwegian cooperation model, the socio-technical systems theory and theories on skill and skill development. *Chapter 4* gives an account of our research design, our data collection and data analysis as well as other reflections on methodology. *Chapter 5* provides the reader with an overview of our empirical data and an initial analysis. Here we divide our material into six main categories and further subcategories. *Chapter 6* contains our main analysis and implications. In our analysis we take complexity as our starting point, since this is such a vital feature of that industry. We concentrate our analysis on four main dimensions of skill, before we look at theoretical implications. *Chapter 7* is the concluding chapter of the thesis. This is where we summarise the thesis and our analysis, draw wider conclusions and give advice to the industry and the educational authorities based on our research.

Chapter 2: The construction industry in Norway

Our daily lives are intimately connected with the construction industry: We live in houses built by workers in the industry, work and go to school in them, seek medical help in them, buy food in them and are entertained in them. And when we transport ourselves between the houses, we use roads, sometimes traversing bridges or tunnels to reach our destination, also the products of this industry.

The construction industry is one of the largest and most important industries in Norway, in terms of both value creation, employment and turnover (see for instance Virke 2013, the Ministry of Trade, Industry and Fisheries 2012-2013 and Goldeng and Bygballe 2013). In turnover the construction and property sector combined make up the third largest industry in Norway, after oil and trade (Røsdal and Ørstavik 2011). In 2013 more than 218,000 people worked in the industry and it comprised some 54,000 enterprises, according to Statistics Norway (2014).

In this chapter we will explore central aspects of the industry in order to put our own study in a wider perspective. We first look at some key characteristics of the construction industry (section 2.1), before examining three key challenges in section 2.2.

2.1 Key characteristics of the construction industry.

A key characteristic of the construction industry is that it is project-based, which means that a temporary organisation is formed with each project (Dainty et al 2006). Other key features include in situ production and being labour-intensive (ibid.). We will in this section look at some of these key characteristics. Dainty et al (2006) is our main reference here, unless others are specifically mentioned.

First of all we have to take a closer look at what it means to be project-based. «A project is a temporary endeavour undertaken to create a unique product or service» (ibid.:20). There is, in other words, a time and cost constraint. In addition, each new project entails a new form of organisation and a unique scope of work and specific quantitative and qualitative objectives. Especially qualitative objectives may be hard to pin down.

Secondly, we have to look at what characterises construction projects. Even though projects in general pose challenges, Dainty et al (ibid:22) see the construction industry as even more

complex and difficult to manage than other project-based sectors. Dainty et al (ibid.) refer to Loosemore et al. (2003), who have identified several features common to the construction industry. Below, we will look more closely at some of these features:

Their unique one-off nature: Projects always have unique features. However, unlike many other sectors, prototypes cannot be tested before production. The construction project is a unique undertaking to meet a particular client's needs. Even when standard designs are used, individual sites and conditions will provide unique features. In addition, each construction project involves a unique combination of people and companies who have to collaborate

Their tendency to be awarded at short notice: Many construction projects are awarded at short notice and there is usually pressure to deliver projects as rapidly as possible, therefore design and construction activities often have to occur simultaneously.

The labour intensiveness of construction activity: Staffing costs represent the majority of costs on most projects. The industry employs an extremely diverse range of people from very different professions.

Jargon, semantics and the potential for misunderstandings: As a consequence of the point above, the industry has developed a range of different formal and informal language use, which can create misunderstandings.

The reliance on a mobile workforce: Even with the use of prefabricated components, they have to be assembled, completed and adapted to the specific site. Therefore, with each project, there is a change of site. In addition, there are different stages in a project, and in these different stages a varying number of employees are used.

An increasingly diverse labour market: There is an increasing number of nationalities among the workers in a construction project. This causes cultural and linguistic challenges.

2.2 Three key challenges

We will look at three key challenges which affect skilled workers in the construction industry: 1) health hazards and accidents, 2) junk enterprises and 3) recruitment and status.

We begin by exploring *health hazards and accidents*: This is a high risk industry, according to the Norwegian Labour Inspection Authority (2013). People employed here are exposed to a

number of health hazards, such as falling from heights or the inhalation of dust. Norwegian studies cited by the Authority (ibid.) report that the complexity in the industry contributes to the safety situation. According to the Authority (ibid.), three times as many people employed in the construction industry has had work-related injuries leading to absence than the workforce in general.

In later years, the Authority (ibid.), has registered an increase in the number of fatalities at work among migrant workers in Norway. The number of immigrants to Norway has increased significantly in the last ten years, especially from Eastern Europe, and is expected to continue in the next few years (Statistics Norway 2014). Many of the immigrants work in the construction industry.

Junk enterprises: Another key challenge in the construction industry is junk enterprises, i.e. enterprises that operate on the wrong side of the law (Torvatn and Finnestrand 2011). They create a poor image and reputation for the entire industry and destroy fair competition. Our informants mentioned junk enterprises as one of the main culprits in creating a poor image for the whole industry, thus making it difficult to recruit skilled workers.

Status and recruitment: There is a lack of recruitment to the construction industry. 60 % of the undertakings experience a lack of competent workers, according to an annual competence survey by NHO (2015), the organisation that represents the largest proportion of employers in Norway. The number of applicants to vocational education has been reduced by 40 per cent since 2007 (Sjøberg 2014).

A survey by Norstat (cf. Sjøberg 2014) shows that 73 per cent of the respondents under the age of 30 thought that the construction industry had a poor reputation, though they agreed that the industry is important.

Young people in the survey cite the use of cheap foreign labour, shadow economy and a heavy focus on higher education as the main reasons for the low status.

Chapter 3: Theories

3.1 Problems and solutions in the construction industry

A number of concerns have been raised over the construction industry, such as health and safety issues, a lack of status and recruitment and junk enterprises that not only create the poor image of the industry, but also create unfair competition (e.g. Dahl and Haakaas 2014; NHO, the Confederation of Norwegian Enterprise, 2014; and others). These are grave concerns shared by a variety of people and institutions ranging from politicians, where the concern cuts across party lines, to the media; from the industry itself, to scholars and the police alike.

The issues above are all very real and highly acute. As the manager in one construction company told us: «This is a critical time for the skilled worker». There is, however, little focus on the professional enterprises and what dimensions of skill these companies need in order to move the industry in the right direction.

In the present study, we turn our attention to the professional actors in the industry: If they are to move the industry in the right direction in the years to come, how can we understand skill?

We will ground our analysis in three theoretical perspectives: First of all we will see our material in relation to the Norwegian cooperation model. The background for this choice is that the cooperation model is the context within which our informants operate. The Norwegian cooperation model is covered in chapter 3.2.

Secondly, we include theories that deal specifically with skill, since our research question is about this topic. Skills theories are covered in chapter 3.3.

Thirdly, we use socio-technical systems theory (STS). The reason is twofold. Our first reason is that a lot of research on the Norwegian cooperation model has been conducted using the framework of STS, see e.g. Karlsen and Munkeby (1998) and Finne and Nilssen (1998). Our second reason for using STS theory, is that it focuses on the relationship between the social and technical systems. This is highly relevant for an industry where both social and technical systems are represented. STS theory is the topic of chapter 3.4 below.

3.4 Taylorism: the separation of head and hand

In this section we describe Taylorism. Its one-sided focus on the technological system, and its lack of focus on motivation, represent the antithesis of Sennett's (2008) philosophy of skill.

When Frederick Taylor (1911) wrote his work on the Principles of Scientific Management, this was the first time anyone had put work organisation under academic scrutiny. Taylor believed a lot of time was wasted in the workplace for several reasons, among them that employees wilfully wasted time (so-called soldiering) and that they learnt their work methods from observing colleagues, i.e. tacit knowledge. Taylor, in other words, discarded tacit knowledge. His work model was explicitly designed to do away with tacit knowledge, or «rule of thumb», as he called it. In Taylor's view it was possible to identify and develop the one best method by «scientific study and analysis of all of the methods and implements in use, together with accurate, minute motion and time study» (ibid:25). Since, in Taylor's mind, workers had no relevant knowledge, there was no reason for investing in skill development in employees or collaboration. Taylor concluded that there should be a sharp division between management and workers, and that workers should be highly specialised.

The ideals of Taylorism are in sharp contrast to Sennett (2008) and Nonaka and Takeuchi (1995) who all see employees as a valuable source of tacit knowledge in high-quality production. Alternatives to Taylorism have come in several forms. One is HIWS, which we have already mentioned in section 3.2. Another alternative approach is presented below, where, instead of taking technology for granted and adapting the social organisation to the technology, the social and technical dimension are both given room.

3.2. The Norwegian cooperation model

What characterises Norwegian workplaces? The structural and cultural relationships existing between authorities, the organisations of working life and the organisational models within the workplaces can all be described as part of «the Norwegian model» (Levin et al 2012:26f). The term is used to describe three different levels: the societal level, the working life level and the level of the enterprise. The following description of the Norwegian cooperation model is based on Levin et al (2012), unless other references are made.

At a societal level, Norway is a welfare state with a high level of wealth, welfare, education and employment. At the level of working life, Norway is well-regulated, with a high level of organisation for both employers and employees, as well as a high level of employment for

both men and women. In addition, most conflicts of interests are regulated harmonically. At the level of the enterprise, we find the Norwegian cooperation model. This is about relations in the individual businesses, where an important feature is the existence of trust between the parties and a will from both employers and employees to reach agreements.

Norway has not been dominated by one particular theory of management (Strand 2001:103f and Levin et al 2012:111ff), instead context and the manager's own views and training have influenced management at the level of the enterprise. Levin et al (op.cit.) maintain that Norwegian working life culture has many sources, and is influenced by such diverse traditions as US-inspired theories of management, participatory models and the long tradition of management, unions and employees.

Much of the cooperation is about developing the enterprises, according to e.g. Karlsen and Munkeby (1998). The authors further claim (ibid.) that a distinguishing feature of the model – and one which has caused international attention – is the fact that the parties involved have been the driving force behind the model, and that these practices gradually have become institutionalised through acts and agreements.

Enterprises may practice the model in different ways. Nevertheless, there are some distinguishing features that they have in common. Levin et al (op.cit.:190ff) identify six key features of the Norwegian work model. All of them may be said to pave the way for – or be an integral part of – international high involvement literature (HIWS):

1) Acceptance of trade unions

Organisations for employers and for employees respect each other. Compared to other nations, there are relatively few strikes in Norway. This mutual respect and tolerance is the basis for participation and therefore a prerequisite for employee-based innovation processes.

This mutual respect paves the way for several of the processes which Boxall and Macky (2009) see as an essential part of HIWS, such as the willingness of employers to empower their employees, their willingness to share information with them and to develop and make use of the skills and knowledge their employees represent.

2) Conflict and cooperation – simultaneously

The fact that unions and employers respect each other, makes it possible for the parties to cooperate on important issues such as organisational development, even if they disagree on other matters, for instance salaries. Trust between the parties are essential to make this possible. Another factor which contributes to the cooperation, is that the Norwegian state may serve as a mediator between the parties if necessary.

This sort of cooperation depends on the HIWS processes mentioned above: the willingness of employers to empower their employees, their willingness to share information with them and to develop and make use of the skills and knowledge their employees represent.

3) *Trust*

Trust is a foundation in Norway's working life, and part of the daily life in workplaces all over Norway. This makes hierarchical control and detailed work specifications superfluous. Instead those who perform activities themselves take responsibility for development, changes and increased efficiency. There are examples of local trade unions having initiated their own research projects, with the blessing of the management.

This trust also lay the foundations for power sharing, information sharing and knowledge development, all essential part of the HIWS model.

4) *Discreet authority*

National culture permeates the work culture. In Norway, there is less hierarchy than in many other countries. This means that formal leaders often display their authority more discreetly, a vital factor in creating involvement and participation from their employees. This is in keeping with international HIWS theory. For instance, one of the practices often identified with HIWS models is the reduction of status differences (Pfeffer and Veiga, 1999). This entails listening to other people's ideas and has the effect of making people feel important and more committed to the organisation (Pfeffer and Veiga, op.cit.).

5) *Direct communication*

Another characteristic feature of the Norwegian work model is an unbureaucratic and direct mode of communication. Instead of following the line organisation, there is a tradition in Norway for talking to the person one needs to talk to. Levin et al (op.cit.) gives an example of

how a trade union leader and the managing director of a large company had frequent and direct communication. Such dialogues can resolve issues before they become really serious. This is in keeping with HIWS, where sharing information is given high priority.

6) *Independence, autonomy, responsibility and initiative*

In Norwegian working life, employees have traditionally been independent, taken initiatives and cleared up misunderstandings. These kinds of involvement are the basis for incremental innovations. The practices can be linked to the HIWS literature.

3.3 The quality-driven craftsman: skills and tacit knowledge

In this section we will give an account of Sennett's (2008) theory on craftsmen, on how he understands skill and skill development. In his work *The Craftsman*, Sennett (2008) writes about craftsmanship, which he defines as «the desire to do things well for its own sake». The term craftsman is used by the author to denote the human condition of being engaged, and includes manual labourers, but is not used exclusively to them.

Sennett (2008) is concerned with skill development, and how the skills of labourers could – and indeed should – be treated as essential in society at large as well as in organisations. Since skills are a central theme in our study, we have explored Sennett's writings.

Sennett (2008) argues that tacit knowledge, grounded in bodily practices and mind alike, are vital. According to Sennett, there is an intimate connection between hand and head. The mind and the bodily practices are in constant dialogue with each other, thus creating a connection between the practical pursuit of problem solving and theoretical problem finding.

Sennett (2008) claims that in Western civilisation, the intimate connection between hand and head to a large part has been severed, with detrimental results. Below, we will first present theories on tacit knowledge (section 3.3.1), before looking at three problems facing craftsmen in modern society (3.3.2) and some of the skills that quality-driven craftsmen possess (3.3.3).

3.3.1 Tacit knowledge

Nonaka and Takeuchi (1995) brought the term tacit knowledge to a broader readership in the West. They argued that knowledge in an individual and in an organisation is far more than the elements that can be described and measured accurately. By making use of explicit

knowledge alone, Nonaka and Takeuchi (op.cit.) argue organisations miss out on a valuable form of knowledge: tacit knowledge.

Tacit knowledge has two dimensions, according to Nonaka and Takeuchi (op.cit.): first, a technical dimension, by which they mean the know-how or expertise at one's fingertips. Secondly, tacit knowledge has a cognitive dimension. This ties in with Sennett (2008), who sees skill development as a consequence of a dialogue between the hand and the head. Without this dialogue, Sennett (op.cit.) claims, skills are lost to the individual.

The cognitive dimension contains schemata, mental models, beliefs and values. They are all so ingrained that we take them for granted. They shape the way we see the world around us, both the reality of today and our vision for the future. Tacit knowledge is personal and something we take for granted. It is therefore difficult to articulate.

Nonaka and Takeuchi (1995) argue that organisations should be viewed as living organisms rather than cold machines, where subjective insights, intuitions and ideals are of vital importance. They also point out that the most powerful learning comes from direct experience: through trial and error, and that learning happens with body and mind. Sennett (2008) also emphasised that trial and error, body and mind are all involved in the processes of developing high skills. This implies that developing tacit knowledge takes time. Sennett (2008) states that it takes 10,000 hours of meaningful practice to make someone an expert in their field.

Sennett (2008) holds that craftsmen have three abilities, which we interpret as part of the tacit knowledge: first, the ability to localise the problem, through the parallel use of senses and information (visual, aural, tactile, language-symbolic). Secondly, probing and questioning the options, without looking for one solution in particular. Thirdly, opening up, that is to say the ability to make imaginative leaps and to shift from one sphere of habit to another.

Nonaka and Takeuchi (1995) point out that tacit knowledge is individual. If innovation is to take place, several issues need to be addressed, for example: the individuals of the organisation must feel committed to the company, creating new knowledge cannot just come from the outside: there must also be interaction and learning from the inside. Creating new knowledge is not just about getting new ideas, they must be adapted to the values of the person and the organisation.

Because tacit knowledge belongs to the individual and is difficult to communicate, making tacit knowledge explicit can be a challenge. Nonaka and Takeuchi have three suggestions for how tacit knowledge can be made explicit:

First, the use of figurative language and symbolism, which can transcend personal and contextual limitations, and create images and ideas for individuals with other forms of tacit knowledge.

Secondly, there must be a willingness from the individual to share the knowledge and an arena in which to share it, if tacit knowledge is to be spread throughout the organisation and new knowledge to be created. Therefore meetings and team work have an important place in any organisation. Sennett (2008) points out that sociability in a craftsman is essential to create high quality. Being able to communicate, share knowledge and collaborate is of vital importance, Sennett (op.cit.) claims.

Thirdly, ambiguity and redundancy are vital in making tacit knowledge explicit. Both Nonaka and Takeuchi (1995) and Sennett (2008) recommend not being too specific in instructions. Ambiguity and imprecision give the individual or group of individuals the opportunity to use their own creativity, and to use and further develop their own tacit knowledge. Nonaka and Takeuchi (op.cit.) also recommend overlapping functions and groups to ease the creation and transfer of tacit knowledge between individuals and groups in the organisations. In this way as much of the tacit knowledge (and explicit knowledge, for that matter) as possible is spread through the organisation.

The knowledge of every employee is crucially important, according to Nonaka and Takeuchi (1995), but the various groups in an organisation have different roles. The middle managers serve as the bridge between the visions for the future that senior managers offer and the often chaotic sense of reality on the ground.

3.3.2 Three problems for craftsmen in modern society

Sennett (ibid.) presents three main problems for today's craftsmen:

- i) How to motivate people

Institutions have different philosophies for what motivates people. According to Sennett, these either appeal to a sense of collective responsibility (sometimes successfully, sometimes

not), individual competition (in Western capitalism in particular) or collaboration (with high quality as a result). In socio-technical systems theory (e.g. Trist 1981, see section 3.5), work groups and collaboration are emphasised. Our informants saw information sharing and collaboration as important in their enterprises.

ii) How to develop skill

In accordance with Nonaka and Takeuchi's definition (1995), Sennett (2008) maintains that skill is trained practice, and is developed through repetition and hands-on training. When head and hand are separated, the consequence is a lack of skill.

To a good craftsman, resistance may serve as a stimulus to achieve a high-quality result. Creativity and imagination are necessary qualities in the craftsman in order to achieve his goal. This means, for instance, that an error may serve as inspiration. This ties in with Nonaka and Takeuchi (1995), who claim that trial and error is a source of developing tacit knowledge. Perseverance and a toleration of frustration are other necessary skills, according to Sennett (2008: 226). Machines and technology may serve as «arousing tools» (Sennett op.cit.:194), if they appeal to the craftsman's imagination and make his mind and hands stretch a little further. In section 3.5, we write about socio-technical systems. In these work models, Trist (1981) and others claim that there should be a balance between machines (technology) and people (the social), and that the role of machines should be that of complementing people rather than supplanting them. Sennett (2008) here makes a similar claim.

However, technology may also be abused, according to Sennett (2008). If machines are constructed or used to substitute the worker's mind rather than supplement it, the craftsman is deprived of a dialogue between hand and head, and skill may be lost in the process. Taylorism (Taylor 1911) which we present in section 3.4 is an example of how a work model did exactly that: human beings became an extension of the machine.

iii) How to measure quality

There are two different ways of measuring quality. One is based on an explicit, standardised knowledge, such as Fordism or Taylorism (for more on Taylorism, see section 3.4), and the other is based on practical experience and tacit knowledge. Sennett (2008) points out that

extreme forms of standardised knowledge, where the connection between hand and head is severed, is not only demotivational, but can lead to demoralisation and lower quality.

If one takes tacit knowledge seriously, one has to leave some of the judgement to the people who possess the knowledge, namely those who do the actual work. This is what Sennett (2008) proposes. A work model which also recommends workers to use their discretion, is the socio-technical system is (see section 3.5).

3.3.3 What characterises the quality-driven worker?

What characterises the quality-driven worker? Sennett (2008) presents and discusses a number of features that characterises the craftsman. They include professional pride, sociability, an understanding beyond the immediate problem, the importance of sketch and a positive attitude to contingency and constraint. Below, we briefly explain each of these traits.

Professional pride: Sennett (2008:241ff) describes how an intrinsic motivation to produce excellence often turns into an obsession and a relentless pursuit of that excellence: every single object should have the same high quality, no exceptions are acceptable. Both Tesfaye (2013) and Sennett (2008) are concerned about the situation today, where the workers' judgement of quality are often replaced by other criteria, such as design and plans. Loss of motivation and skills can be a result if the pursuit of excellence is hindered.

Professional pride is often used by craftsmen to distinguish themselves from other people or groups of people (Bourdieu 1986, in Sennett 2008:245): «I/we are more motivated, driven harder, more aspirational than others» (Sennett *ibid*: 245).

Sociability: Another skill in the quality-driven worker, is sociability. The ability to relate to others, to discuss with colleagues and to communicate with non-experts are essential qualities to retain and develop skills. Lack of communication can lead to a deskilling process. Nonaka and Takeuchi (1995) also emphasise communication and information sharing to spread and develop tacit knowledge. In Mattias Tesfaye's (2013) book on craftsmanship, he concludes that a lot of the innovation in Denmark is the result of skilled manual workers teaming up, sometimes in collaboration with workers from other professions. Without communication skills and the willingness to share information this would not be possible. The results are often incremental innovations improving processes in the enterprises.

An understanding beyond the immediate problem: Highly skilled craftsmen are in fact experts in their field, with an understanding beyond the immediate problem. In the words of sociologist Douglas Harper: Experts have

knowledge that allows them to see beyond the elements of a technique to its overall purpose and coherence [...] It is the knowledge in which making and fixing are parts of a continuum (Harper 1987:21, in Sennett 2008:248).

The socio-technical systems theory also emphasises the ability of employees to see and respond to the bigger picture, with the use of multiple-skilled workers, the use of teams, and seeing the work activities as a functioning whole rather than as single activities (see section 3.5).

The importance of the sketch: The good craftsman understands the importance of the sketch, and adapts to the specific needs on site. Many of the informant we talked to emphasised the need for planning, but also for being able to change plans according to new information. Socio-technical systems theory also emphasise the use of discretion among workers (see section 3.5), i.e. instead of a standard solution the problem is solved according to its needs. This is in contrast to Taylorism (see 3.4, where solutions are standardised).

A positive attitude to contingency and constraint: The good craftsman places positive value on contingency and constraint, i.e. problems are viewed as opportunities. Many innovations are the result of skilled manual workers seeing problems as opportunities to solve concrete problems in their own workplace, thus improving the production processes in the enterprise (Tesfaye 2013).

To conclude this section: Sennett (2008) argues against technological determinism. There should be a balance between man and machine, and machines neither can nor should replace human beings. In Sennett's (2008:285) opinion, human beings have the capacity to do good work, but needs motivation to do so. A threat against the will to do good work, is emotional mismanagement.

Below we describe two work models. In 3.4 we focus on Taylorism, a work model that represents the technological determinism that Sennett (op.cit.) warns against. In 3.5 we turn our attention to socio-technical systems theory, a work model which seeks a balance between man and machine, which is in keeping with Sennett's (op.cit.) philosophy.

3.5 Socio-technical systems

In this section we describe socio-technical systems theory (STS). Its focus on the balance between the social and technical system, and the importance it places on motivation are in keeping with Sennett's (2008) philosophy of skill.

In the postwar period researchers started to look at alternative modes of organising work, arguing that social and technical aspects of work were both important, and that they were interdependent. The goal was to strike a balance between «the requirements of the social and technical systems» (Trist 1981:9). Eric Trist is a central representative of this school of thought. Together with his colleague Ken Bamforth, (see for instance Trist and Bamforth 1951) he conducted research on the organisation of mines. After several decades of research, Trist listed what he found to be key principles in socio-technical systems (Trist 1981:9). Below, we refer to Trist's list, but in the order used in Levin et al (2012).

- 1) The work system, with activities making up a functioning whole, became the basic unit, rather than single jobs. This makes it possible for the workers to see beyond the immediate problem, one of the qualities Sennett (2008) sees as an important element of skill.
- 2) The work group became central rather than the individual worker. This makes it possible to spread and develop tacit knowledge, through both shared experience and shared information, as recommended by Nonaka and Takeuchi (1995) and Sennett (2008).
- 3) Redundancy of functions rather than redundancy of parts, which tended to develop multiple skills in the individual and immensely increase the response repertoire of the group. This too makes it possible for the individual and the group to develop an understanding of the matter as a whole, rather than fragmented understandings, cf. Nonaka and Takeuchi (1995) and Sennett (2008).
- 4) Treating the individual as complementary to the machine rather than as an extension of it. This coincided with Sennett (2008), who warns against machines taking over, and with Nonaka and Takeuchi (1995) who see the organisation as an organism and not a machine.
- 5) Variety-increasing for both the individual and the organisation, rather than variety decreasing in the bureaucratic mode. Again, this creates more connection between

body and mind for the individuals and groups, something that both Nonaka and Takeuchi (1995) and Sennett (2008) are in favour of.

- 6) Internal regulation by the individual or the group rather than external regulations by supervisors. Here, tacit knowledge is being exploited as recommended by Nonaka and Takeuchi (op.cit.) and Sennett (op.cit.)
- 7) Valuing discretionary rather than the prescribed part of work roles. Here too, tacit knowledge is being exploited as recommended by Nonaka and Takeuchi (op.cit.) and Sennett (op.cit.)

The first five principles refer to the interaction between technology and the social system, i.e., the interaction between the production equipment and the qualifications of the people who do the work (Levin et al 2012:129). The two last principles deal with management issues.

Principles 1-4 are about the degree of Taylorisation (Levin et al *ibid.*:129), whereas principle 5 looks at the level of competence: Is the complexity to increase or decrease? Principle 1 and 2 deal with issues of individual versus system thinking, and of seeing the work as a whole or as disparate activities. Principle 3 is also concerned with dependence of work activities. In a Tayloristic approach, the technical system, i.e. the machines, are the main focus. Workers are trained to do only one activity and can easily be replaced by another individual. An alternative approach is to train individuals to have multiple skills, thereby increasing the area of responsibility for the individual and the group. Principle 4 is about the relationship between the machine and human beings. Does one see machines and human beings as complementary or are machines the main focus, with humans merely extensions of the machines?

Principle 6) is about whether formal leaders lead and organise work or whether the function of leadership is transferred to people who do the actual work. Principle 7 is about whether the work has been defined in detail beforehand or whether the workers have the opportunity to use their discretion.

Trist (1981) maintains that socio-technical systems exist on three levels, all of which are interrelated. The first system is the primary work system, consisting of a subsystem in an organisation. «They have a recognized purpose which unifies the people and the activities» (Trist *ibid.*:11). The second system is the whole organisation. «They persist by maintaining a steady state with their environment» (Trist *ibid.*:11). According to Trist (*ibid.*:40), with higher

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levels of interdependency, complexity and uncertainty in the modern world one should make greater use of human resources than technocratic bureaucracies and its «mechanistic authoritarian control structure» (Trist *ibid.*) allow for. This is because such organisations are unable to absorb turbulence in the environment. The third and last system is the macrosocial system, consisting for example of a whole industry, such as the construction industry.

Chapter 4: Methodological considerations

4.1 The present study: a collaboration with an innovation project at SINTEF

The writers of the present study have an interest in working life and wanted to pursue this topic in our thesis. We were, however, looking for an angle.

We read by chance about an innovation project organised by the research organisation SINTEF (Dragland, 2013). This was a project about how to make the Norwegian work model, with e.g. its high involvement of employees, more explicit and therefore also more understandable to non-Norwegian workers who are unfamiliar with the concept the manufacturing and construction industries.

Both authors have a relationship to the Norwegian work model. As we mentioned in the introduction, we are close relatives. We have a background in a family business, where cooperation between employer and employees and the development of skills in skilled workers were important issues. The issues in the innovation project therefore touched a nerve. This was something we wanted to learn more about.

We got in touch with SINTEF in December 2013. We had two meetings with Hanne O. Finnestrand, who was about to become the head of the project and met some of her colleagues. Here we learnt more of the details on the project.

The title of SINTEF's innovation project is *HPWS.no* (see SINTEF 2014), which is a reference to the international work model High Performance Work System (HPWS), where many of the features connected to a Norwegian working life may be found, such as information sharing and the involvement of employees. The innovation project receives funding from the Research Council of Norway. The goal of the project is to adapt this international system to a Norwegian context and at the same time make the work model more explicit. In addition to SINTEF, there are three companies involved in this innovation project: a construction company, a manufacturing company and a company involved in training and authorisation of highly skilled workers.

The questions this project dealt with were important, we felt. Having ascertained that SINTEF was positive about cooperating with us and that the University of Nordland had no objections, we made the decision to go ahead with a research study connected to the innovation project. Our supervisor Hanne O. Finnestrand is also head of the project.

4.2 A deductive or inductive approach?

The basis for the present study is an ongoing innovation project, which has its own specific goals and theories. These goals and theories colour the study in hand. For instance, a key concept of the innovation project is the work model HPWS, which will be explained more fully in a separate chapter. Therefore, one can claim that the collection and analysis in this study is based on preconceived ideas, i.e. a deductive process. However, we are also open to new ideas and ask a number of open-ended questions to our respondents. This part of the process may be seen as inductive. The study may therefore be said to combine a deductive and inductive approach (Jacobsen 2005).

4.3 Qualitative or quantitative research?

When the aim of a study is to explore and find nuances of a phenomenon, qualitative approaches might best serve that purpose (e.g. Jacobsen 2005). When, on the other hand, the phenomenon is clear and the aim is to find out how much or how often something occurs a quantitative approach is recommended (op.cit.).

In the present study, the aim is to explore the characteristics of a specific phenomenon in specific contexts, i.e. skilled workers in the construction industry in Norway. We have therefore chosen a qualitative approach.

4.4 Data collection

The data collection process went through several stages:

First, we transcribed and studied existing interviews with skilled workers. The interviews had been conducted by SINTEF researchers in connection with the innovation project HPWS.no. and include both Norwegian and non-Norwegian workers in two industries: manufacturing and construction. The data from transcribed interviews has informed our own interviews and provided input to our analysis.

Second, in collaboration with our supervisor we decided to narrow our study down to one industry, the construction industry. We wanted to study one specific topic, namely the skilled workers in the Norwegian construction industry. Norway is an advanced economy with high wages (Levin et al 2012). To have a competitive advantage in a global marketplace, this means that Norwegian industries must minimise their control costs and work smarter. In order

meet these requirements what dimensions of skill do the serious actors of the construction industry consider necessary in skilled workers?

Third, in collaboration with our supervisor we decided to interview leaders and union representatives in the selected industry. We got in touch with a representative from NHO – one of the main organisations for Norwegian employers – and asked a regional leader from the construction division (Ingvill Kvernmo in EBA) to recommend companies that would be likely to have reflections on skilled workers. We also contacted one representative from LO, the Norwegian Confederation of Trade Unions (Roar Aas in the division Fellesforbundet) and asked him to make similar suggestions. We compared the two lists and decided to contact companies that both had suggested in order to make sure that these were reliable companies. Most of the companies were based in central Norway. In addition, we have spent some time in western Norway, and asked our supervisor for a suggestion on a professional company we could get in touch with there.

Four, we contacted four companies. All of them said yes to interviews. Below is a list of the four companies and what position the informants we talked to hold there. All of the companies emphasise that they take their workers seriously and involve them in various ways.

Table 1: Information on informants and companies

Company	Informants
<p><i>Alfa</i></p> <p>A Norwegian division of a Scandinavian contractor. Total number of employees in Scandinavia: 6400. The company takes on apprentices.</p> <p>The company has a reputation in the industry for being professional, being a serious employer and invest a lot in the development of employees.</p> <p>The company is a role model for other companies in the region.</p>	<p>General manager and union representative (interviewed together)</p>
<p><i>Beta</i></p>	<p>Project manager</p>

<p>A Norwegian division of a global contractor with 57,000 employees worldwide. The company takes on apprentices.</p> <p>The company has a reputation in the industry for being professional, being a serious employer and invest a lot in the development of employees.</p> <p>The company is a role model for other companies in Scandinavia.</p>	
<p><i>Gamma</i></p> <p>A roofing and ventilation company with about 40 employees, 6 apprentices.</p> <p>The company has a reputation in the industry for being professional, being a serious employer and invest a lot in the development of employees.</p>	<p>Project manager and union representative (interviewed together)</p>
<p><i>Delta</i></p> <p>A general contractor with 180 employees. Delta takes on apprentices.</p> <p>The company has a reputation in the industry for being professional, being a serious employer and invest a lot in the development of employees.</p> <p>The company has bought a concrete business and is at the time of writing in the process of acquiring permanently employed concreters, based on the experience that permanent staff is an asset.</p>	<p>General manager and union representative (interviewed separately)</p>

In addition, the interviews conducted by SINTEF provided input in our analysis. One of the companies involved in HPWS.no project is a manufacturing company that produces subsea products. We refer to this company in one part of the analysis (6.3).

Five, we conducted semi-structured interviews. Our interview guide (see appendix 1) contained topics related to our research questions. The present study was based on SINTEF's HPWS project and the interviews with skilled workers there. We therefore developed our interview guide in parallel to SINTEF's guide.

All of the interviews took place at the informants' workplace at their own suggestion. We asked the informants whether they wanted to see the interview guide in advance. We did, however, stress that looking at the questions were voluntary and that the questions were merely a starting point for a conversation about skilled workers. Most of the informants wanted to see the guide.

We perceived all our informants as positive towards our study, and in one instance an informant even told us that what we did was immensely important and he would like to read our thesis once we had completed it. How much time they had at their disposal, what they responded to and how much they said, varied. The length of the interviews therefore varies from 35 minutes to 1 hour and 10 minutes. As Tjora (2013:135) observes, many informants expect a traditional interview rather than a conversation. In some interviews, especially when the manager and the union representative were present simultaneously, the interview took more of the form of a free dialogue, where the informants responded to both interviewers and each other. In other interviews we experienced that a traditional question and answer format was expected. When they made statements that were of particular interest to us, or that simply represented new information, we asked them to elaborate. Relevant information that occurred in one interview became the basis for new questions in another interview.

Whether the informants had seen the interview guide in advance, to a certain extent seems to have influenced their response strategy. Some had prepared notes and made very interesting reflections that we would probably have lost out on if we had not given them the opportunity to read the guide beforehand. It did, however, make some of the informants more bound by

the questions, and the order in which we covered the topics. The interview guide, however, contains a question about whether there are topics that we have not covered. Interestingly enough, this also elicited reflections from these informants. Others had not read the guide and talked more on the spur of the moment. Some of them had clearly reflected on these topics in other contexts and one even sent us a presentation he had held to a political audience about related issues. The presentation was relevant for our topics, and we therefore made the decision to make it the starting point for our conversation with him and his colleague.

Six, we transcribed the interviews: we divided them between us and transcribed about half each. Afterwards, we read our colleague's transcription while listening to the interviews. In this way we quality-ensured the transcriptions as well as familiarised ourselves with the material.

4.5. Data analysis

We began our analysis by coding the transcribed interviews. Our method was inspired by Glaser and Strauss (1967). We have not conducted a study in the grounded theory tradition, since we started off by collaborating with a project that already had a theoretical basis. We did, however, want our analysis to be anchored in the collected material as much as possible. Tjora (2012:174ff) also recommends staying close to the text to begin with, to let the material rather than your preconceived ideas guide you in coding and categorisation. We read the transcripts and made notes in the margins of quotes and ideas that attracted our attention, things that told us specifically about the skills of skilled workers or about other matters concerning skilled workers. In the next stage we wrote these quotes onto 135 yellow post-it notes. We had attached a large piece of white paper to the wall, and stuck the post-it notes on the paper.

Then followed a process of categorisation, where notes that belonged more together than others were placed together and given a specific colour. The colours represented different categories. For example, blue represented dynamic skills and pink represented autonomy, a skill that was mentioned frequently by all informants. Some of the categories overlapped, so that one quote or post-it note might be written onto notes of several colours. We then grouped these categories together into more general categories.

At this point we wrote a preliminary chapter 5 on empirical data analysis, where we included all of the post-it notes on the wall. Our goal was to get a further overview of our material. In order to tie the text more directly on to our research question about skills, we decided to exclude notes that did not directly relate to our research question.

In the last stage of the analysis we have selected just a few of those categories, and related these to the theories we see as most relevant. At this stage we have developed concepts about the competence of skilled workers.

4.6 Supplement material: documents, newspaper articles and discussions

In addition to the interviews, we have used various written and oral material to supplement our analysis. For instance, one informant at his own initiative sent us a presentation he had held to a group of politicians. We were in one instance given a guide in participatory planning, which the company has developed for the use in its projects. In addition, we have looked at the company's presentation on their webpages, read articles on skilled workers and on the construction industry, in various regional and national newspapers. We have studied the webpages of the industry (e.g. Byggeindustrien) and have also looked at job advertisements in the industry to see how the skilled workers are presented there.

We have a close relative (father and grandfather) who for many years ran a company closely related to the construction industry. His experiences and reflections have clearly influenced our view on the industry and have given us a historical perspective on the topic we are studying. He has also provided us with written material from the company's history.

While the interviews remain our main source of analysis, the documents and other sources of information mentioned above represent supplementary material.

4.7 Ethical considerations

For ethical reasons we have anonymised the companies and people involved in our study. Because we have union representatives as informants we had to seek approval by the Norwegian Social Science Data Services (NSD), which we have received (see appendix 3). We always made sure that our informants knew the interviews were voluntary and asked them

if they were ok with being recorded, adding information about how the material would be treated.

4.7 Judging the quality of the study

There are several criteria that can be used to deem whether a study is sound or not.

Quantitative studies have one set of criteria, whereas in qualitative studies there are discussions on what criteria are best suited. Guba and Lincoln (1989) argue that since qualitative designs have a fundamentally different starting point, one should not just copy the terms used in quantitative studies. Tjora (2012) argues however that the traditional terms may be used meaningfully in qualitative research. We will here follow Tjora's (op.cit.) terms: reliability, validity, generalisability, transparency and reflexivity.

Reliability: Reliability is about internal logic, and the researchers' engagement in the project as this can influence the outcome. In quantitative studies, neutrality is often an ideal. In qualitative studies, complete neutrality does not exist and the researcher's knowledge and engagement can be seen as a resource. But how the researcher uses his or her knowledge should be made explicit.

Our starting point was that the Norwegian cooperation model and involvement of workers are positive contributions to Norwegian working life. We had selected companies that we knew took the involvement of workers seriously. This in itself influenced the material.

We have no actual experience as employers or employees in the construction industry, although we have some family background in related industries. In the encounters with our informants, we therefore could not ask very specific questions on technical details. However, this also meant that we did not take various practices for granted. This gave our informants the chance to make their tacit knowledge explicit, since they had to explain things to novices in the field. By giving specific examples and using metaphors, they opened up new insights into the world of skilled workers.

Validity: Validity deals with the question of whether the answers are related to the questions we ask. According to Kvale (1997, in Tjora 2013), there are two ways of judging this in interpretive research: pragmatically and communicatively. The pragmatic evaluation is related

to action research and whether the research led to improvements. Our study is not action research, so this is not relevant to us.

Communicative judgement is about how we communicate with academia, by for instance actively seeing our research in relation to theories, methods and other research in the field. Tjora (2013) suggests that we can strengthen our validity through openness about our research practice.

In our study, we relate our research to several theories on work and workers as well as to research on workers and the construction industry. We also relate our research to qualitative methods described in literature on methodology. In addition, we have a supervisor who is an experienced researcher, and with whom we discuss our methods, theories and material with.

Generalisation: Quantitative studies generalise on a statistical basis. Qualitative studies must reflect differently on generalisation. There are many discussions on how this should be done. Guba and Lincoln (1989) suggest transferability, which Tjora (2013) does not agree on, among other things because it represents a narrowing down of the forms of generalisation possible in qualitative research. Tjora (ibid.) suggests three forms of generalisability in qualitative research: naturalistic, moderate and conceptual, of which conceptual generalisability is the one he recommends.

Naturalistic generalisation means making detailed enough reports on the research for others to judge whether the study is transferable to other cases. Tjora (2013) presents some weaknesses in this form of generalisation, among them that the «thick descriptions» necessary rarely can be provided for practical reasons. Even though we have provided a description of the construction industry and some description of the companies, it is doubtful whether we manage to match the requirements of naturalistic generalisation.

Moderate generalisation means a detailed account of how various results are to be interpreted, for instance how the finds are connected to the setting of the research project. An alternative but similar approach is posited by Kvale (1997, in Tjora 2013), who operate with the term «analytic generalisation»: can the finds in one study tell us something about what

will happen in another situation? Our descriptions of the setting and the findings might tell readers something about how skill could be understood in other businesses in the construction sector.

Conceptual generalisation is about presenting the finds in the form of typologies, models, concepts or metaphors that may have relevance beyond one's own empirical data. To ensure relevance beyond the data that the reserachers themselves have collected, earlier research and theories are used to create more generalisability. One asks questions such as: what is it about, more generally? Are there any concepts that capture key features or findings? In our research, we have developed concepts regarding skill dimensions in skilled workers, in dialogue with literature and in discussions with our supervisor. We argue that the skill concept in socio-technical theory should be developed to include tacit knowledge (see chapter 6.6 and chapter 7).

Transparence: Transparence is about giving an insight into the research process, for instance choices that have been made and problems that have occurred. In the present thesis we have reported on the development in our project in as conscientious manner as possible.

Reflexivity: Reflexivity is about reflecting on our own interpretations. For instance, we have explained how our own background and attitudes have affected our research angle, and how our backgrounds may have affected the interview situation. In this way we have wanted to increase the credibility of the study.

Chapter 5: Empirical data and analysis of skill

In this chapter we present an overview of our empirical data on skill. We have explored how skill in skilled workers should be understood in the light of future demands in the construction industry. Through a process of coding and categorisation of the interviews with managers and union reps we have ended up with 6 main categories and several subcategories.

Since the categories seem interconnected and dependent on each other, we find it difficult to regard each of these traits as separate skills. Instead we have come to regard them as interdependent dimensions of high quality skill.

The dimensions of skill fall into six main categories: the technical dimension (5.1), the social dimension (5.2), the dimension of understanding the totality and value creation (5.3), the innovative and dynamic dimension (5.4), the dimension of motivation and professional pride (5.5) and the dimension of responsibility and autonomy (5.6).

5.1 The technical dimension of high quality skill

The informants emphasise that there is an increased demand for a certificate of completed apprenticeship. This is viewed as a starting-point from which to develop. Skilled workers need to have technical knowledge and be able to deliver quality.

5.2 The social dimension of high quality skill

5.2.1 Mastering languages and interaction

Languages: According to our informants, the skilled worker must master Norwegian. English should be mastered too, at least to a minimum.

Interaction: Skilled workers must be able to interact with each other, and should have the ability to both lead others and be teamplayers.

Plans and drawings: A skilled worker must be able to understand plans and drawings.

IT knowledge: A skilled worker must have IT knowledge:

Increasingly, there are tools for both planning and following up (the project manager at Beta). In one company, the union rep told us that tablets used for ordering materials had made the work processes more efficient and had contributed to increased autonomy for the workers.

5.2.2 Who does a skilled worker communicate with?

According to our informants, skilled workers communicate with management (both formally and informally, and usually more with their immediate superiors than with senior managers), skilled workers from the same enterprise (both formally and informally), skilled workers from other enterprises and professions (both formally and informally), customers (communication with customers varies according to size and type of project)

5.2.3 What characterises the communication between skilled workers and management?

Communication between skilled workers and management is perceived as all-important, both for the productivity of the project and for health and safety reasons.

There are different communication arenas and ways of communicating according to management levels. For instance, a leader of a building site will communicate more frequently with the skilled workers than a managing director .

The skilled worker and the manager have different roles:

The manager's task is to say *what* should be done and *why*, or to communicate why one wants something done [...] And then the skilled workers are involved in *how* this should be done (the manager at Alfa)

Both managers and skilled workers are expected to put forward their point of view.

5.2.4 What characterises communication between skilled workers, either in their own enterprise or across disciplines and enterprises?

Our informants report that skilled workers must communicate with other skilled workers, both from their own profession and across disciplines. Both formal meetings and the communication occurring in informal settings are considered important. Below, we give three examples of communication situations skilled workers should master. Example 1 tells us of the importance placed on informal communication. Example 2 tells of the importance placed on communication across disciplines and example 3 tells of the importance placed on formal communication between skilled workers.

Example 1: The importance placed on informal communication

Coffee and seemingly trivial talk in the barracks are important. It's important for the work environment. Many things are clarified [...] The more a team bonds, the more their work flows (general manager in Delta).

Example 2: The importance placed on communication across disciplines

Communication across disciplines is either informal (at the building site) or formal (at meetings). An example of formal communication across disciplines is the team leader meetings organised by Delta. All the team leaders involved in a project bring with them their 2-week plans. At the meeting they are expected to coordinate these plans.

Example 3 The importance placed on formal communication between skilled workers

Skilled workers also communicate in formal meetings. In one enterprise the skilled workers meet every Monday, with the team leader as the organiser:

It's the team leader who prepares the Monday meeting. We try not to have a chairman, instead the skilled worker can make suggestions. But the team leader organises the meeting, so that it actually takes place, and he is also the one to make a summary after the meeting. (the manager at Alfa).

5.2.5 What characterises the communication between skilled workers and the customers

For some enterprises and departments of enterprises, communicating with the customer is both desired and important:

I have the contact with the customer, ask them what they want and then we make an order. And then we get the production going earlier (the union rep at Gamma).

In other enterprises, however, the skilled worker and the customer do not communicate much. If they communicate, it may be unplanned and can therefore create problems, i.e. misunderstandings.

5.3 The dimension of understanding the totality and value creation of high quality skill

Both managers and union reps express a trust in skilled workers' competence and overall understanding. This manifests itself in managers giving overall information and plans to skilled workers, so that they can lay their own plans and be as autonomous as possible, which in turn gives the worker an understanding of the totality and value creation:

We receive relevant information about what we are supposed to do, and make our own plans from then on (the union rep at Gamma).

Our informants express the attitude that skilled workers understand what is profitable and creates value. The union rep at Gamma gives an example of how values are created in the enterprise where he works:

You try your very best to follow up customers. And it pays, because if they are satisfied, you might get work from their neighbours as well, they may have talked with each other. This way we gain more work. So it has to do with our reputation, that we deliver quality (the union rep at Gamma).

5.4 The innovative and dynamic dimension of high quality skill

Our informants view both dynamism and creativity as important dimensions of skill in the skilled worker.

First, skilled workers must be able to solve complex problems and be versatile when doing so.

The project manager at Gamma illustrates this, as he points to the union rep at his side:

People like *him* [...] are working on buildings and solve all *kinds* of problems that require an *enormous* versatility to be able to solve, and if you make a single mistake it can cost hundreds of thousands of kroner, with water running down several floors. Taking on that responsibility! (the project manager at Gamma).

Second, the construction industry is dynamic and demands skilled workers who develop their skills. One leader told us that professional requirements change all the time. The consequence is that skilled workers must

develop further [their basic competence] and familiarise himself with new requirements on how to do things (general manager at Delta)

For instance, IT competence is now considered necessary. The project manager at Beta concludes:

Technology increases the efficiency in daily life and makes the skilled worker more independent (the project manager at Beta)

Third, our informants state that planning is an important part of the skilled worker's competence. They also tell us of a great deal about what planning requires, what it involves and lastly what consequences planning has. Below we will briefly go into these three elements:

What planning requires: According to our informants planning requires access to information and overall plans, as well as practice, the ability to evaluate and the time to make plans.

The union rep at Alfa can serve as an example of the importance placed on practice :

You have to practice, don't you. Because you may have written down what you are supposed to do, but then things can happen that we really also need to keep in mind (the union rep at Alfa).

He also stressed the importance of evaluation:

At the same time we have to evaluate ourselves – going back. That's really the first thing we do. What went wrong last week? And then we gain experience from that. And when we have done that, we plan fourteen days ahead (the union rep at Alfa).

What planning involves: According to our informants, planning involves working with plans in their head and create a picture, to look ahead, to follow the overall work schedule, to cooperate and coordinate with other skilled workers, both from one's own profession and across professions.

The union rep at Alfa illustrates the planning of skilled workers thus:

Most skilled workers begin to think when they drive to work, on what they are going to do during the day. They plan their own day (the union rep at Alfa).

The consequences of planning: Efficiency and a sense of well-being

An example of efficiency:

Those who are good at this [planning 2 weeks ahead] usually are the most productive and have the best results, because they think two steps ahead all the time [...] they are really busy, but it doesn't look like it, because things are working smoothly without any hiccups.

5.5 The dimension of professional pride and motivation of high quality skill

According to our informants, skilled workers have professional pride. They must be interested and engaged in their work and feel committed to the company where they work.

The manager at Alfa stresses commitment and engagement in workers throughout our interview:

Example 1:

When we have engaged, involved and motivated everyone, I am convinced that we are just as efficient as modules and with a much safer quality (the manager at Alfa)

Example 2:

You have to be present in mind and body, you have to enjoy your work, otherwise there is a risk of injury, illness, absence and everything. And constructing buildings is such a fantastic job to do. No one sees as much of what they do as a skilled worker. (the manager at Alfa)

5.6 The dimension of responsibility and autonomy of high quality skill

According to our informants, skilled workers take responsibility and are autonomous, and this ability increases in importance.

The project manager at Beta tells us what elements he sees as central in the autonomous skilled worker:

The ideal skilled worker plans, executes, controls and corrects himself (the project manager at Beta)

The increased importance of autonomy is mentioned by several informants. We give two examples:

Example 1:

Beyond the profession, the requirements are increasingly harder. More and more is demanded. One has to be independent. They must be able to work without anyone telling them what to do. They have to be teamplayers. They must be able to lead others. They work in teams. An increased demand for working without direct orders (the general manager at Delta).

Example 2:

Another requirement which is more important now than ever before, is the ability to quality assure one's own work. And in my view this requirement will rise in importance (the project manager at Beta).

Chapter 6: Dimensions of skill: Dealing with complexity

6.1 Dimensions of skill

One of the main characteristics of the construction sector is a high level of complexity, both structural and dynamic (Dainty et al 2006, see also chapter 2 on the construction industry). For instance, the industry is project-based, meaning that many activities are temporary in nature, each project bringing with it new and unique features. The construction industry is even more complex and difficult to manage than other project-based sectors (Dainty et al op.cit). For instance, even when standard designs are used, individual sites and conditions will provide unique features. In addition, each construction project involves a unique combination of people and companies who have to collaborate.

How can we understand skill in such a complicated, changing and uncertain environment? In chapter 5 we identified and organised our empirical data on skill. Through a process of coding and categorisation we ended up with 6 main categories, and several subcategories. Since the categories seemed interconnected and dependent on each other, we found it difficult to regard each of these traits as separate skills. Instead we have come to regard them as interdependent dimensions of high quality skill.

Our informants seemed to view the skill of the skilled worker as composed of several of these dimensions. For instance, producing a high technical quality cannot rely on technical understanding alone: A skilled worker must couple the technical understanding with an ability to cooperate and communicate with others, as well as cope with the uniqueness each project provides.

The following figure shows all the 6 main dimensions in place.

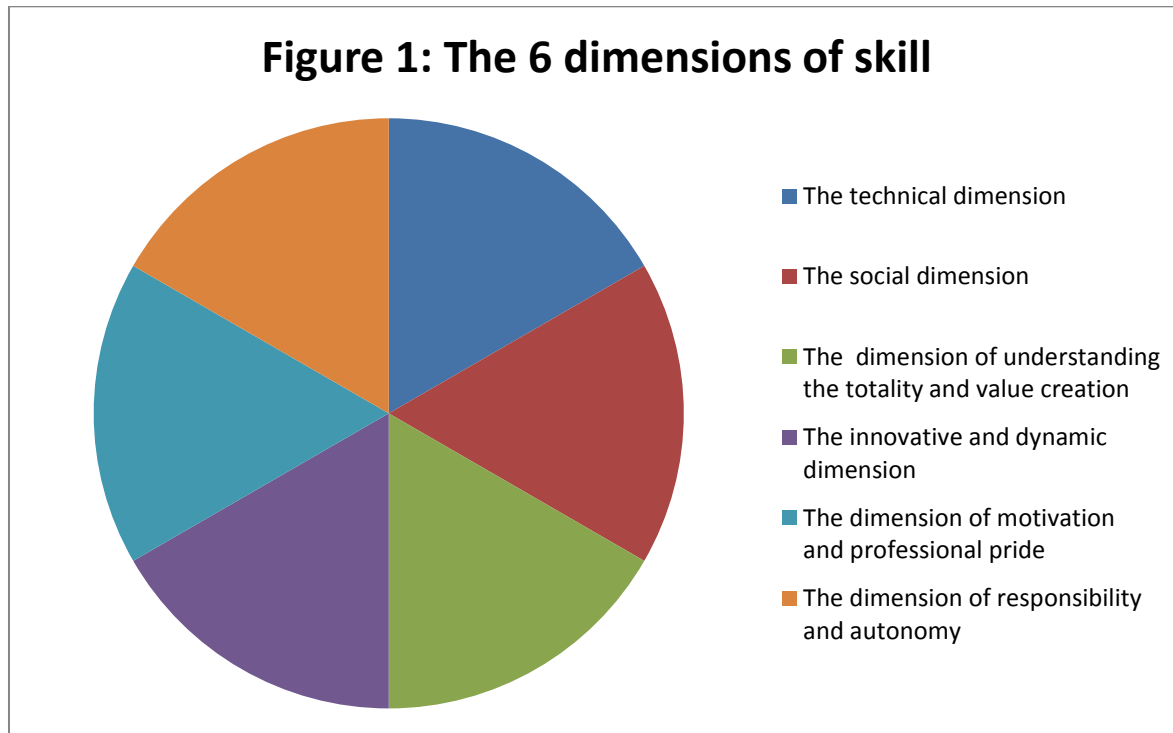


Figure 1: The 6 dimensions of skill

In our analysis we concentrate on four of the main dimensions of skill: the technical dimension (6.2), the social dimension (6.3) the dynamic and creative dimension (6.4) and the dimension of motivation and professional pride (6.5.). The reason for this choice is that the technical dimension may be seen as the foundation of the profession. However, technical expertise is developed and used in a social context. As we will demonstrate, the social dimension is in fact an integral part of producing high technical quality. In addition, being able to handle changes (having dynamic and creative skills) is an important part of high quality skills in general – and is especially important in a dynamic industry such as the construction industry. Motivation and professional pride have been chosen because they are the prerequisite for developing the other dimensions: without motivation there will be no technical development.

In 6.6 we will discuss theoretical implications, and look at how STS and skills theories can complement each other.

When we choose to separate the categories in this chapter, it is primarily to create a focal point for our analysis. In the real world, skilled workers must have as many of the dimensions in place as possible to be able to handle the complex nature of the construction industry.

6.2 The technical dimension of skill

In this section we look at the technical dimension of skill. This we do by first looking at the importance for quality (6.2.1). We continue by exploring tacit and explicit knowledge (6.2.2) and argue that the workshop is a place for developing knowledge, in particular tacit knowledge, by receiving training from a master (6.2.3). In 6.2.4 we see how versatility, i.e. an understanding of complexity, is an important aspect of skill in the construction industry. We claim that this is developed through intense training and modified repetition. Finally, in 6.2.5 we make some concluding remarks on the technical dimension of skill.

6.2.1 The importance of delivering quality

Our informants stress the importance of skilled workers delivering quality, thus developing technical skills to a certain standard. This ability seems to have gained importance in later years. For instance, the project manager in Beta has observed an increased demand for a certificate of completed apprenticeship. In Gamma, both the project manager and the trade union representative identify the need for delivering high quality based on knowledge. This they connect to the current market situation with its fierce competition on price. The project manager at Gamma says:

We are far too expensive [to compete on price], which is why we have to compete on other things, which really means [delivering] quality that people are willing to pay extra for (the project manager at Gamma).

STS theory (Thorsrud and Emery 1969) is about enabling workers to use their head and hands, with a set of principles for accomplishing this (e.g. Trist 1981).

6.2.2 Tacit and explicit knowledge

Development of high technical skill requires two forms of knowledge, namely explicit and tacit knowledge (Nonaka and Takeuchi, 1995 and Sennett 2008). The union rep at Delta states that:

Skilled workers feel in their bodies what is profitable.

Theories on tacit knowledge agree with him. If skill development of a high degree is to take place, technique must become ingrained in one's body as well as one's mind. Here is Sennett's formulation on what happens when skill has reached a certain level:

At its higher reaches, technique is no longer a mechanical activity; people can feel fully and think deeply what they are doing once they do it well (Sennett 2008:20).

To reach this high level takes considerable time and effort; 10,000 hours of meaningful practice is frequently mentioned (e.g. Sennett 2008). This is the level that skilled workers have to reach if they are to deliver the high quality our informants deem necessary.

STS theory does not discuss tacit knowledge at any great detail. However, the theorists stress the need for content in jobs and for the need to experience learning and variation in the workplace (e.g. Thorsrud and Emery 1969).

6.2.3 Workshop: a place of authority and of gaining skill through meaningful repetition

An important aspect of tacit knowledge is that it is personal and taught through a process of trial and error (Nonaka and Takeuchi 1995). Sennett (2008:53ff) sees the workshop as the place in which to develop this tacit knowledge, by receiving training from a master. A workshop is defined as «a productive space in which people deal face to face with issues of authority» (Sennett op. cit.:54). The master's authority and his or her right to command is based on skill, and apprentices and journeymen are there to develop these skills. Sennett (opcit.) argues that the functions of workshops exist even today, although the days of the medieval workshops, with the master and apprentices sharing a home are long gone. We interpret the companies of the construction industries as workshops where high technical skills are developed. The project manager and the union rep in Gamma talk about skill development in apprentices. The project manager tells us that for a while apprentices were not assigned to one particular craftsman. The apprentices worked with different craftsmen based on who needed an extra hand. This, says the project manager was poor training. However,

Gamma has now developed a system where apprentices are assigned to one specific craftsman for at least 6 months.

The union rep at Gamma then describes his own process of becoming a skilled worker, where he first learnt his basic skills by staying with one highly skilled worker for a longer period of time. After that he worked with other skilled craftsmen, which created more variation in his specific profession, which he sees as an important part of a more in-depth understanding of this profession. In this example skill development is directly connected to experience, as both Sennett (2008) and Nonaka and Takeuchi (1995) emphasise.

Because everyone has their method. At least, that was how it worked in my training, I learnt *that* thing from one craftsman and then I was with someone else, and then suddenly he had a completely different method for the same thing. But then I might develop my *own* method, taking a bit from that one and a bit from that one [...]. Because it could be that *this* person does one thing in a complicated way, while another person does it in an easy way, and then: OK! One picks a little and sees what suits you. So it's quite good to get variation.» (the union rep in Gamma)

When STS emphasises the work group as a central way of organising work, the group may function as a workshop recommended by Sennett's (2008).

Skill is trained practice, claims Sennett (2008:37). It is about increasing complexity through repetition, where each repetition contains a new element, a change or a modification (ibid.:272), and as a craftsman practices, he or she also feels deeply and makes judgements on the quality based on his or her personal standard (ibid.:48).

6.2.4 Versatility through tacit knowledge

As we saw above, an understanding of the complexity of a craft involves a great deal of practice and experience. The construction industry is particularly complex, according to Dainty et al (2006). This can be illustrated by a quote from the interview with the representatives from Gamma. The project manager stressed that ideally skilled workers should be what he called «*potatoes*», i.e. the skilled workers should be allrounders who can solve «all kinds of problems that require an enormous versatility». We will discuss the creative and dynamic skills of skilled workers more fully in 6.4.

The versatility of skilled workers and their in-depth knowledge of technical complexity can be used to the advantage of both employers and employees, as illustrated below. Delta has created its own technical standard – within a more general standard defined by the industry.

Much of the Delta standard has been developed by the company's skilled workers, and adapted for their specific needs and skill:

A framework can be made from either steel or wood. Ours has gradually become a mix. The problem with wood is that it dries and starts to twist and bend. Wood, you see, is never dead. Steel is, but then steel is more difficult to handle in other ways. So now we have come up with a mix [between steel and wood], and this solution in many ways comes from suggestions made by skilled workers. Especially kitchen walls, if you have a wood standard that twists, you get a bump in the wall and that's completely hopeless when you install kitchens» (the trade union rep in Delta).

The ability to create this technical solution stems from technical knowledge of several materials, as well as from knowledge of the processes involved in making the product and of the functions of this product. In other words, the skilled workers in Delta have demonstrated a highly developed understanding of the technical complexity inherent in the materials that made up the framework as well as the function of the framework. This understanding is derived from trained practice.

STS is a theory and work model designed to take both social and technical elements into consideration (Trist 1981). One of the key principles cited by Trist (op.cit.) is that one should see the work system as a whole rather than focus on single jobs. The innovation in the example above could only see the light of day because they have a profound insight into a whole process, rather than separate jobs and activities.

However, there is very little emphasis in STS on how versatility can be accomplished. According to Sennett (2008) repetitive, but modular training is necessary.

6.2.6 Concluding remarks on the technical dimension of skill

Luhmann (1995:127-129) states that trust in a social system is an important way of reducing complexity. Trust is a key characteristic in the Norwegian cooperation model (Levin et al 2012) and paves the way for skilled workers to develop and use tacit skill. Making use of the skilled workers' ability to handle technical diversity is only possible if trust exists between employers and employees.

In other words, employers must allow their workers the scope to enhance and exploit their skills. In the companies we visited, trust seemed to be present on both sides. This can be illustrated with a statement made by the union rep at Delta:

Skilled workers feel in their bodies what is profitable. And we get acceptance for that (the union rep at Delta).

In this section we have discussed how delivering quality is important for skilled workers today and in the future and we have explored tacit knowledge in particular.

Our informants argued that versatility, i.e. an understanding of complexity, is an important aspect of skill in the construction industry. According to Sennett (2008), such complexity is increased through repetition, where each repetition contains a new element, a change or a modification.

In the next section, 6.3, we will look more closely at social skills and the necessity to create common cognitive ground.

6.3 The social dimension of skill

In this section we concentrate on the social dimension of skill, and communication in particular. First we look at how autonomy and group focus have increased the importance of communication and interaction among skilled workers (6.3.1). Second we look at the importance of being able to communicate with many different people and in different settings. We also explore the particular challenges posed by intra-organisational communication (6.3.2). Third we look at the challenge of creating a collective cognitive ground (6.3.3). In 6.3.4 we make some concluding remarks on the social dimension of skill.

6.3.1 Autonomy and groups

«Communication is often the key to whether a project goes well or not» (the union rep in Alfa). This is confirmed by research on communication in construction projects (e.g. Dainty et al 2006). The independence of skilled workers and their ability to perform tasks traditionally associated with management is part of the Norwegian cooperation model (Levin et al 2012). Both STS (Trist 1981) and skills theory (Sennett 2008) place importance on collaboration.

According to our informants, skilled workers must be able to plan, implement, evaluate and make corrections themselves. This is seen as imperative in today's competitive market. In the words of the general manager of Alfa:

What is required from the skilled worker today, which is an advantage of a permanent employee, is that he will discover mistakes as they occur. He will discover mistakes in the planning or solutions. He will discover mistakes others have made [...]. He will make

mistakes himself and the ability to deal with that and do something about it, is important (the manager at Alfa).

Although autonomy and responsibility are placed on individuals and groups, this does not mean an absolute autonomy (Sennett 2008:80 and Thorsrud and Emery 1969:215-217). A perceived limit can be illustrated by the project manager at Beta:

The skilled workers don't *decide*, the project leader does that. But they influence, by arguing their case and convincing the project leader to support a particular solution (the project manager at Beta).

This example also shows how important the communication dimension is to skilled workers.

Many of our informants report that the skilled workers must have the ability to work in teams. An increased focus on autonomy and groups also means an increase in lateral and vertical communication (Trist 1981). Trist (ibid.) argues that an increased focus on multi-skilled workers, groups and collaboration will enhance the ability to cope with complex organisations and interdependence.

Increased autonomy also entails a focus on the ability to plan and to evaluate plans, a topic which we will cover in more detail in chapter 6.4. However, in this chapter we will emphasise how these factors affect the importance our informants place on communication. In Alfa, each piecework group meets one day a week to discuss their plans and to evaluate the week before:

It's the team leader who prepares the Monday meeting. We try not to have a chairperson, instead the skilled worker can make suggestions. But the team leader organises the meeting, so that it actually takes place, and he is also the one to do the minutes after the meeting (the manager at Alfa)

This example also illustrates the importance placed on team leaders in Norwegian companies. Røsdal and Ørstavik (2011) also point to the important role team leaders have in the Norwegian construction industry. In section 6.3.2, below, we will see how important this role becomes in intra-organisational communication.

Discretion is emphasised as part of the autonomy both in STS (Trist 1981) and skills theory (Sennett 2008). Since tacit knowledge is highly personal – and consequently norms on what constitutes high quality is personal – it is important to create a common cognitive ground, so that quality judgements are shared in both a company and in a project. This is the topic in 6.3.3 below.

6.3.2 Interacting and communicating with many different people

The social complexity of the construction industry is illustrated by the number of people skilled workers should be able to communicate and interact with, according to our informants. Skilled workers must be able to communicate with their managers, their piecework team, other people in their profession and skilled workers from other professions. In some companies and departments, the ability to communicate with the customer is also seen as imperative.

In construction projects, an essential function of communication is coordination (see for example Dainty et al 2006 and Røsdal and Ørstavik 2011). Many of our informants stress this function as all-important. The union rep at Alfa explains the coordination process in this way:

We agree on a production line in an early phase of the construction project, deciding who is to go in *first* and *last* (the union rep at Alfa).

However, even in the companies with a great awareness of the importance of coordination and communication, problems may occur:

But sometimes it can be neglected: we don't talk with them well enough» (the union rep in Alfa).

At the time of the interview, the company was working on improving the communication process in a particular section of a construction project, namely the coordination between concrete and digging. Coordination is connected to planning, which is dealt with in chapter 6.4.

An awareness of the communication process and the various elements it contains, is a useful way of enhancing and developing communication skills. A much-referred to model of the communication process (see for example Huczynski and Buchanan 2007), is a model where a transmitter codes his or her message and sends it, after which a recipient receives and decodes the message, before giving feedback by coding and sending a new message to the original transmitter. In various parts of the process, there are perceptual filters and noise. Tacit knowledge on the side of both transmitter and recipient will influence the communication process and what new knowledge will emerge from the interaction.

When a skilled worker has to communicate with an individual from either his or her own profession, another profession in the industry or the customer, it makes the communication

process more efficient if he or she has tacit and explicit knowledge about the other person's expectations.

Interaction in multidisciplinary settings. Skilled workers, and team leaders in particular, have to interact across professions.

In Delta, for instance, the *team leaders* from different companies meet regularly to coordinate their two-week plans. Dainty et al (2006) point out two challenges in these kinds of settings: first that each profession contains its own jargon or semantics and second, that the different actors might not have the same interests. Both of these factors might contribute to noise in the transmittance and reception of messages. If the team leader meetings in Delta are to be successful, the interlocutors must have tacit knowledge of how to handle these challenges. They must, for instance, know what terms might mean different things in different professions, and therefore might create mistakes. To illustrate the problem, Dainty et al (2006) give a list of words that mean one thing to an architect and another to engineers. Below is an extract from the list (ibid.:29).

Table 2: Differences between the jargon used by architects and mechanical and electrical engineers (from Dainty et al 2006:29)

<i>Term</i>	<i>To an architect</i>	<i>To an engineer</i>
Air-conditioning	Any cooling system – probably comfort cooling	One particular system that is cooled, heated, humidity-controlled and ducted. Not comfort cooling
Contractor	Builder	Plumber or electrician
Natural ventilation	Windows	The passive passage of air-through grilles, chimneys, stacks and exposed mass
Pipe size	The actual size of the pipe with everything else included, such as insulation	The mean diameter of the pipe – excluding insulation thickness

Although these exact terms are from the English language, these examples illustrate the kind of difficulties that might arise in intra-organisational encounters, and which team leaders must be able to handle.

6.3.3 The importance of creating a common cognitive ground

Both STS (e.g. Trist 1981) and skills theories (e.g. Sennett 2008) emphasise the use of discretion. There is agreement among our informants that skilled workers must produce to a high standard. But what is quality? And whose judgements decide what high quality looks like? The answers to these questions may not always be as straightforward as they may seem, as an example from a manufacturing company may illustrate. The company, which is part of the HPWS.no project, produces subsea products. Two different welding standards existed in one company. One standard was produced by permanent staff. In this standard, the importance was on robustness, how they look is not important. Another standard was produced by hired skilled workers from Eastern Europe. They had experience with welding ships. Because the seams on ships are visible, it is vital to polish the seams and make them look good as well as be robust. This double quality had become tacit knowledge with the Eastern European workers, and was something they brought with them when working on subsea products.

In one of our interviews, a project manager stresses the need for skilled workers to produce to a quality that people are willing to pay extra for. In the case of the welders, the finish was an irrelevant quality that the company's clients were unwilling to pay extra for.

Trivial talk is seen as an essential part of the interaction between skilled workers. This may be one method in which to create a common cognitive ground:

Coffee and seemingly trivial talk in the barracks are important. It's important for the work environment. Many things are clarified [...] The more a team bonds, the more their work flows (general manager in Delta).

The general manager refers to two aspects: the here and now coordination and the more long-term bonding and creation of collective norms and values.

In this subchapter we will discuss the creation of collective norms and values. Nonaka and Takeuchi (1995:14) argue that creating a common cognitive ground among employees is an essential way of facilitating the transfer of tacit knowledge. Nonaka and Takeuchi (1995) emphasise frequent dialogue and communication as a way of creating this. The daily coffee

sessions in Delta, with their «seemingly trivial talk» can be seen as a part of the process of creating a common cognitive ground.

The skilled workers need to solve the issues according to the collective norm of the company. This is in keeping with Sennett (2008) who claims that craftsmen's sociability include the ability to think in larger chunks of time and to be able to view a problem from more than one angle.

How do we develop collective quality judgements? Collective norms and values are necessary in an organisation, among other things to produce the high quality our informants agree is essential to survival in today's competitive market. At the same time, Nonaka and Takeuchi (1995) and Sennett (2008) stress that tacit knowledge, which includes values, is developed by individuals and not organisations, although tacit knowledge has a social element to it. The transition from individual tacit knowledge to collective knowledge is through collaboration and communication.

6.3.4 Concluding remarks on the social dimension of skill

In this section we have seen that our informants stress both a high degree of autonomy and the ability to work in group, within the company as well as with other actors. The team leader has an essential role as a coordinator in group based on his or her own profession and in intra-organisational groups. Tacit knowledge on how to handle different ways of communicating and differing interests are needed. In addition, skilled workers and the rest of the project organisation need to create a common cognitive ground on what constitutes relevant quality, if the skilled workers are to use their discretion.

6.4 The dynamic and creative dimension

Because of the dynamic nature of the construction industry, skilled workers need to have the ability to handle planned as well as unexpected changes that can occur in a project. In addition they need to handle changes in the profession and involvement in new projects. In 6.4.1 we will look at three types of changes our informants think that skilled workers in the construction industry should be able to handle. In 6.4.2 we will take a closer look at creativity and the ability to find and solve problems, dimensions emphasised by our informants. In 6.4.3 we make some concluding remarks.

6.4.1 The dynamic dimension

In this section we explore three types of changes that the skilled workers in the construction industry should be able to handle: the dynamics inherent in a project, the various changes in the profession and involvement in new projects.

Skilled workers must be able to handle the dynamics inherent in a project. This means handling both planned changes, such as the different stages of a project and unexpected situations that are bound to occur. Unexpected situations will be treated in the next subchapter, under creative skills (6.4.2).

Skilled workers must be able to understand the different stages of a project, for instance the existence of the two main stages, planning and implementation. This is in keeping with STS where one of the principles is that work should be organised around work systems rather than isolated activities (Trist 1981:9).

First, skilled workers are expected to have skills in understanding overall plans and drawings, and on the basis of these form their own plans in collaboration with their team and with other professions. We also note how important communication and interaction skills are, which we covered in greater detail in chapter 6.3. All of our informants stressed the importance of planning skills. In the words of the union rep at Alfa:

Most skilled workers begin to think when they drive to work, on what they are going to do during the day. They plan their own day (the union rep at Alfa).

The informants mentioned the existence of plans with different time horizons, for instance 8-week plans and 2-week plans. Plans with a longer time horizon are usually more overall plans that skilled workers have to understand, whereas plans with a shorter time horizon are either plans that the skilled workers make themselves or make considerable contributions to.

Several informants express that the ability to plan requires practice, in other words there is a high degree of tacit knowledge involved. Two of the companies had tried to involve subcontractors in their participatory planning systems. However, the managers of both companies reported problems.

Delta had introduced planning meetings. The planning meetings have a two-week time horizon, and the focus is on making activity plans to ensure that everything happens in the right order – for instance that heating cables are installed before casting. In these meetings

information is shared between team leaders from different companies involved in the same project. Delta had decided not to work with subcontractors that were unable to conduct the team leader meetings.

Second, skilled workers need to have an awareness of the difference between a plan and the implementation of it. Sennett (2008) states that «[t]he good craftsman understands the importance of the sketch – that is, not knowing quite what you are about when you begin». In other words, being able to adapt to the realities on the ground is important to achieve a high quality result.

Skilled workers must be able to handle a changing profession. This means, among other things, keeping up-to-date on the development of equipment, technology and laws. Several informants mention this, among them the general manager at Delta. He states that professional requirements change all the time and that the skilled worker must

develop further [their basic competence] and familiarise himself with new requirements on how to do things (general manager at Delta).

The introduction of IT in the construction industry was mentioned by several informants mention as important. The project leader in Beta points out that IT skills in skilled workers and the implementation of it technology render skilled workers more independent. This is confirmed by the union rep at Gamma, who gives us an example of how he can now order new material on his tablet, if he discovers that he needs material while working on site. The process of ordering has become simpler and faster for him. This is an example of how development in technology can be used to the advantage of both company and skilled workers: the skilled worker and the IT technology complement each other, rather than the individual being an extension of the machine. This is therefore in keeping with one of the principles of STS (Trist 1981).

Skilled workers must be able to handle involvement in new projects at regular or irregular intervals. This means that skilled workers must be able to handle new situations continuously, as each project has some unique features (Røsdal and Ørstavik 2011). It also means that skilled workers need to be able to cope with different types of constructions and people. According to Sennett (2008), high quality skill means that the craftsman has developed flexibility through long-term experience and intense training.

In the next subchapter we will look more closely at the dimension of creativity. We will that our informants find it important for skilled workers to find and solve problems.

6.4.2 Creative skills

«The good craftsman places positive value on contingency and constraint» (Sennett 2008:262). Our informants see the ability to find problems and solve them as essential qualities in skilled workers. Below, we give an example of creativity and innovation at Gamma. This excerpt shows a dialogue that took place between the project manager and the union rep:

The project manager in Gamma says that in their company skilled workers find new ways of doing things all the time when things are not according to the book:

The project manager: [skilled workers find new ways of doing things all the time here] when things are not according to the book. And of course, you should have a pretty wide idea bank at your disposal.

The union rep: You use the basic principles, but you have to think fresh, a bit different. We experience this quite often, especially with fasteners. It might be a window fastener, but then the facade is a bit different and then you have to use a another solution on that [...]. The basic principle is that it is supposed to be tight. So you must make it tight. But ...

The project manager: ...you must be creative to solve the task.

The union rep: Yes, exactly. You have to think a little and *find* a solution.

Learning theoreticians Argyris and Schön (1978) distinguish between learning to correct mistakes according to a predefined norm (single-loop learning) and learning to change norms in order to solve a problem (double-loop learning). Nonaka and Takeuchi (1995:44-46) see the process of double-loop learning as an important part of knowledge creation, but criticise the view that this process is a special and difficult task. Instead, they argue that «double-loop learning is a daily activity for the organization» (Nonaka and Takeuchi op.cit:46). All of the informants we talked to saw the need for skilled workers to be creative and solve problems. The exchange above, between Gamma's project manager and union rep, is just one of several examples our informants gave us on the creativity of skilled workers.

The prerequisite for the creativity our informants see in skilled workers is built, according to Sennett (2008:274ff) on three abilities, namely to localise, to question and to open up. The first ability – to localise – involves having the high technical skills and the experience to examine the material with many different parts of the brain active at the same time. This is

about making the matter concrete, according to Sennett (ibid.). At this stage a problem is localised. In other words, creativity is also about problem-finding. The second ability – to question – is about being able to reflect on the matter in hand, to consider different options by using his or her curiosity and by suspending decision. The third and final ability is about opening up and making imaginative leaps. Here the craftsman shifts habits or spheres, and this stimulates fresh thinking.

Imperfect tools or other forms of resistance may serve as ways of creating knowledge, thus expanding the «idea bank» of skilled workers, an expression used by the project manager in Gamma.

Another example of resistance creating organisational knowledge, can be seen in the development of Delta's technical standard. This has mainly been created by skilled workers. Improvements and developments in the standard often start out as frustration, we are told by the general manager in Delta. The union rep gives us an example of a framework that has made its way into the Delta standard:

A framework can be made from either steel or wood. Ours has gradually become a mix. The problem with wood is that it dries and starts to twist and bend. Wood, you see, is never dead. Steel is, but then steel is more difficult to handle in other ways. So now we have come up with a mix [between steel and wood], and this solution in many ways comes from suggestions made by skilled workers. Especially kitchen walls, if you have a wood standard that twists, you get a bump in the wall and that's completely hopeless when you install kitchens (the union rep in Delta).

A form of resistance is identified (the bump in the wall caused by wood): this leads to a process of creativity, where two different materials are explored and combined in a new way unique to Delta. Sennett (2008) describes processes of how imperfect tools or resistance in general can lead to imaginative leaps. One part of the process is about creating a connection between two seemingly different domains (op.cit.:210), whereby something that one did not know about beforehand, can be created through the use of tacit knowledge to these domains. It is not unlikely that such a process was present in the creation of the framework.

The creativity that our informants report in skilled workers also reflect the psychological work demands listed by Thorsrud and Emery (1969:19), such as the need to experience content in the job, to be able to make decisions and the need to learn.

6.4.3 Concluding remarks on the dynamic and creative dimension

In this section we have explored how the continuous changes in the construction industry, reported by our informants, makes it necessary for skilled workers to be dynamic. Our informants also report that the complexity of the industry makes it necessary for skilled workers to be able to identify and solve problems. STS theorists (Thorsrud and Emery 1969) have as their starting point that man and machine are complementary, and that people have the need to be independent and make decisions in their job.

In the construction industry, this means that skilled workers must have the ability to be flexible and creative, i.e. have high quality skill. This can only be developed through long-term practice, with meaningful repetition (Sennett 2008).

6. 5 Motivation and professional pride

Our informants stress that skilled workers should be motivated and have professional pride, for reasons such as health and safety, productivity and quality. This subchapter is divided into four sections. First, we interpret our material in the light of two forms of motivation: extrinsic and intrinsic (6.5.1). Second, we turn our attention to two forms of commitment: decision and obligation, where we also touch upon Herzberg's (1966, 1968) two factor theory and the psychological work demands of STS (6.5.2). In the third section (6.5.3) we explore professional pride; how it may manifest itself and why pride matters in skilled work. Section 6.5.4 contains concluding remarks on this subchapter.

6.5.1 Extrinsic or intrinsic motivation?

Scholars often make a distinction between intrinsic and extrinsic motivation (e.g. Huczynski and Buchanan 2007). We will discuss these two kinds of motivation below in relation to our material. Let us first briefly define the two concepts: Intrinsic motivation means being motivated by rewards controlled by the individuals themselves, whereas extrinsic motivation means being motivated by external rewards.

Intrinsic motivation: To Sennett (2008), what identifies a true craftsman is «the desire to do something well for its own sake» (ibid.:9). This desire or motivation, he claims, is a basic human impulse.

Intrinsic motivation means that the reward is controlled by the individuals themselves, in the form of a feeling of satisfaction and accomplishment (ibid.). It is this sort of motivation that Sennett (2008) refers to when he talks about doing something well for its own sake.

Several informants stressed motivation in skilled workers as highly important. Here is one example:

You have to be present in mind and body, you have to enjoy your work, otherwise there is a risk of injury, illness, absence and everything. And constructing buildings is such a fantastic job to do. No one sees as much of what they do as a skilled worker (the manager at Alfa).

The manager at Alfa talks about the meaning and enjoyment that work itself creates, in addition to the fact that skilled workers also have another reason to feel motivated, namely the visible results of their work. The statement quoted above exemplifies how important intrinsic motivation is considered among our informants.

Our informants' thinking is also in keeping with the STS theory, where many – though not all – of the psychological needs emphasised are connected to intrinsic motivation. For instance, one of the principles is that tasks should make up a meaningful whole (e.g. Trist 1981 and Thorsrud and Emery 1969). Through an understanding of the work unit, motivation is created.

Extrinsic motivation: Several informants refer to the system of piecework as a motivational factor. Piecework means being paid per piece of work instead of per hour. Below is an example from our interview with the general manager at Delta, where a connection is made between pay and motivation:

The people out here are on piecework based on Fellesforbundet's [the union's] wage agreement. It's important for them to work smart, that they find *good, rational* solutions within the standards, of course. The less time they use on a work task, the more they earn. They get a basic salary, so their wages are never reduced if they use longer time than their wage agreement stipulates, but they have ample opportunity to gain a huge increase (the general manager at Delta).

From this example we see that the general manager makes a connection between working hard – and smart – and the piecework contract. Thus pay – an extrinsic reward – is perceived and used as a motivational factor.

The project manager at Beta points out that the whole industry is, in fact, characterised by piecework. This also affects the traits skill workers need to possess, they must be able to respond to this kind of extrinsic reward:

To a varying degree [skilled workers must...] have the ability to work on performance-linked pay. The industry is characterised by piecework. (the project manager at Beta).

Many of our informants perceive a lack of status as a problem for skilled workers in the construction industry. The project manager at Beta sees a development of performance-linked pay as one of several measures, which can contribute to raising the status:

I think that in the future it is important to hold on to and further develop performance-linked pay, piecework. It's a very good motivator and it raises the status of the profession. If you handle it in the right way, you get very motivated skilled workers who do a very good job. So maintaining that and maybe developing the system further in the time to come; I think that will contribute to raising the status of the profession (the project manager at Beta).

Although pay is performance-based, it is not based on individual performances. Rather, the piecework is connected to a team performance, which requires collaboration. Many of our informants stress the importance of collaboration and coordination.

Both STS (e.g. Trist 1981) and skills theories (e.g. Sennett 2008) emphasise group work and collaboration as motivational factors. We cover more aspects on interaction, collaboration and communication in chapter 6.3. We will concentrate on the fact that performance-based motivation is linked to groups. This can be illustrated by the quote below, from our interview with the general manager at Delta. The topic of piecework came up after we had asked the interviewee about career opportunities for skilled workers:

After they have obtained their certificate of completed apprenticeship and become a permanent employee, they become a part of the piecework team. We don't have fixed teams, but they are almost fixed. We have to move and adapt to the size of the projects. When they have worked in these teams for a while, some distinguish themselves as leaders (the project manager at Delta)

Employees work in piecework teams and hence, the motivation for performance is through group work.

6.5.2 Commitment: duty and enjoyment

According to Sennett (2008:177-178), there are two forms of commitment: decisions and obligations. Decisions is about whether we find something worth doing and therefore make a decision to do it, whereas obligation is about doing something in order to fulfill a need determined by someone else.

Safety and health: The manager at Alfa expresses an idea that motivation is important for safety reasons as well as health in general. We will argue that both forms of commitment are at play in his statement:

You have to be present in mind and body, you have to enjoy your work, otherwise there is a risk of injury, illness, absence and everything. And constructing buildings is such a fantastic job to do. No one sees as much of what they do as a skilled worker (the manager at Alfa).

When the manager at Alfa stresses that «you have to enjoy your work», this may be linked to the first form of commitment: decision. A skilled worker makes the active decision to do something because he or she finds it a worthwhile and enjoyable activity.

Sennett (2008) connects obligation – the second form of commitment – to repetition and alertness. The author makes the argument that rhythm is a way of organising obligation: we do something again and again. In turn, this repetition creates persuasion. That is not to say that the repetition is boring, on the contrary, the repetition is perceived as meaningful: «we are alert rather than bored because we have developed the skill of anticipation» (Sennett *ibid.*:177). We argue that the presence of body and mind emphasised by the manager at Alfa, may be seen in this perspective.

Another motivation theory we find highly relevant in this example – and in other examples from our material – is the so-called two factor theory. The psychologist Herzberg (1966, 1968 in Huczynski and Buchanan 2007) explained motivation as two different factors: motivators and hygiene factors. Motivators lead to high levels of satisfaction when present, whereas the presence of hygiene factors do not create a high level of satisfaction. Instead they cause dissatisfaction when removed.

When the manager at Alfa talks of enjoyment and presence of body and mind, he clearly refers to a high level of satisfaction, in other words motivator factors.

Below, we will list Herzberg's motivator and hygiene factors (see Huczynski and Bychanan 2007:258) to put the example above in context. Next, we will argue that these factors have much in common with the psychological demands found in STS. If these psychological demands are not fulfilled (Thorsrud and Emery 1969), stress and illness may result.

In the table below, we list both motivator and hygiene factors.

Table 3: Motivator and hygiene factors (from Huczynski and Buchanan 2007:258)

Motivator factors (job content)	Hygiene factors (organisational context)
Achievement	Pay
Advancement	Company policy
Growth	Supervisory style
Recognition	Status
Responsibility	Security
The work itself	Working conditions

The obligation to do something – and the motivation it creates in us – can be reflected in for example the factor *the work itself*, i.e. finding meaning in the work creates motivation in the individual.

Much of the STS philosophy is about how to create a meaningful and therefore motivating workplace. The psychological demands found in STS can be said to contain much of the same philosophy and way of thinking as Herzberg's theory:

Thorsrud and Emery (1969:19) list 6 psychological work demands, which we refer to below. Many of the demands correspond to Herzberg's motivator factors.

6 Psychological work demands¹:

- 1) The need for content in the job
- 2) The need to learn something in the job
- 3) The need to make decisions in the job
- 4) The need for recognition in the workplace
- 5) The need to see the connection between the work and the outside world
- 6) The need to see the job as compatible with a desirable future

To remind the reader of what the manager at Alfa stated, we repeat it below:

You have to be present in mind and body, you have to enjoy your work, otherwise there is a risk of injury, illness, absence and everything.

The STS theorists and practitioners Thorsrud and Emery (1969) agree with the manager at Alfa about the importance of engaging workers, among other things to prevent illness and injuries. According to Thorsrud and Emery (ibid.:22), stress – resulting from a lack of the psychological demands being fulfilled – can easily lead to errors being made, accidents occurring or illness developing. They therefore propose measures specifically designed to prevent stress, such as a connection between work tasks, job rotation or physical proximity.

Productivity and quality: Our informants view motivation as a factor in creating productivity and quality, despite the fact that pre-fabricated elements are also used in the production.

However, the use of elements have its potential drawbacks. Below, a dialogue between the union rep and manager at Alfa, illustrates the dilemmas involved. Is there a contrast between skill and motivation on the one hand and standard elements on the other? The discussion cited below is on the use of modules, in particular in the bathroom:

Union rep: There is tough competition and there is pressure to get the best price in order to win the tender. The fact that we procure elements and bathroom podsⁱⁱ and stuff, simple and cheap solutions from other countries – in my opinion that's a threat to our profession. Then the skilled Norwegian worker loses the *competence* on the *bathroom*. But I do see that we have to win the tender. But if we isolate this and think about the profession, I see this as a threat.

Manager: But you have to be open to changes. You can't walk backwards into the future. But of course, one has talked about modules for the last one hundred years and has sort of not quite got it right yet. But the fact is, on some projects, if you don't use bathroom pods, you are just not *in*.

Union rep: No.

Manager: There are advantages and drawbacks. The bricklayers in particular are concerned about the drawbacks. They, after all, lose the competence on tiling. Another drawback is that it is more difficult to change a pre-fabricated bathroom afterwards. But the advantage is that it is cheaper, and logistically it is an advantage because a *big* activity is being lifted into place, before you go on building. It's more efficient and faster. And we do actually need productivity growth. At the same time we see that...we change some projects where possible. It might be planned with elements, but then we see that building on site is cheaper. Then it can take a longer time. In that sense it can be cheaper. But not every house can be built with modules, and we have to keep the competency of building houses and then it is important to focus on productivity, that we are competitive. And I actually think we are competitive, when we get it right. When we have engaged, involved and motivated everyone, I am convinced that we are at least as efficient as modules and with a safer quality.

In the exchange of opinions between the union rep and manager at Alfa, above, standardised solutions and skill seem to be contrasted. The manager's conclusion is that, although pre-

fabricated elements are a necessity, the company does need engaged, involved and motivated workers, and that they on many occasions can be just as efficient – and safer – than elements.

In other words, the manager argues that productivity and quality may often surpass standard solutions when skilled workers are motivated. This is in keeping with both STS (e.g. Trist 1981) and skills theories (Sennett 2008), that advocate a balance between man and machine, i.e. a skilled worker who is also motivated to use his or her skill – rather than perceiving the individual as an extension of the machine.

This view is particularly relevant in an industry which is characterised by many unique features. For instance, when pre-fabricated elements are used this must usually be followed by some form of adaptation to the actual sites (Dainty et al 2006). In addition, there are different clients with each new project, and they may have individual requirements, rendering standard elements insufficient.

To Sennett (2008) the commitment needed to perform a craft in fact constitutes the craftman's technical skill: «the person able to perform a duty again and again has acquired a technical skill, the rhythmic skill of a craftsman» (ibid.:177-178).

6.5.3 Professional pride and identification with the company

According to our informants, professional pride and identification with the company are necessary qualities in a skilled worker. In this section we explore professional pride before we look at identification with the company. We conclude the section by looking at two dangers connected with pride: a lack of pride on the one hand and obsession as a result of pride on the other.

Professional pride: Our informants perceive professional pride as an important aspect in skilled workers. According to the manager at Alfa, skilled workers have good reason to be proud and motivated:

You have to be present in mind and body, you have to enjoy your work, otherwise there is a risk of injury, illness, absence and everything. And constructing buildings is such a fantastic job to do. No one sees as much of what they do as a skilled worker (the manager at Alfa).

In this example the manager expresses the attitude that constructing buildings is a fantastic job, because skilled workers can actually see the result of their efforts. In other words, the skilled worker can take pride in their work. Skilled workers in the construction industry see

the result of their effort. From this, a sense of achievement can be attained. Herzberg (1966, 1968) identifies achievement as one of the motivator factors.

The union rep at Alfa states that it is important for skilled workers to become union members and be shaped:

It's important to be in the trade union and receive good wages and work conditions. That's the basis, in my opinion. It's to do with how you are shaped (the union rep at Alfa).

We interpret this as part of professional pride, where both motivator factors and hygiene factors may be involved. Being *shaped* may refer to acquiring various norms on how the Norwegian cooperation model is practiced in the industry and in the specific company. By emphasising union membership, the union rep also emphasises a collective professional norm – and pride connected with this – rather than individual norms.

The shaping of a professional norm implies that tacit knowledge is involved. Joining the trade union, it is implied, leads to tacit knowledge on professional norms. This is in keeping with skill theorists (e.g. Sennett 2008) who view values, norms and even ethical considerations as part of tacit knowledge.

An example of a professional norm is here expressed by the union rep at Delta:

And when he [the skilled worker] has finished the job, he sweeps the floor before he leaves (the union rep at Delta).

According to the union rep, the skilled worker needs to be focused on the totality, not just on the actual production. Therefore a skilled worker has not finished his job before this part is also done. He contrasts this behaviour with observations on hired skilled workers who do not take extra responsibility for such things as floor sweeping. According to Sennett (2008) one of the characteristic features of professional pride is a tendency to contrast oneself with others.

A similar point was made in a speech held by a skilled worker – an electrician – back in 1966. Part of the speech was directed to the apprentices of the company in which he worked. The speech was made by a veteran employee at a party arranged by the company in 1966. The will to do a good job and do it properly are emphasised by the veteran skilled worker:

To those who have just started in the profession, I want to say: If you are going to compete for the best jobs, it depends entirely on you. A strong organisation or a good apprenticeship act will not help you. Of course, these are important measures to create a well-functioning educational situation. No, it is the will to do a good job that counts, no loose bolts, no faulty

connections. Do not leave behind just a little bit here or a little bit there when you leave. Even though the speed may not be so high to begin with, it will gradually increase. But the demand for good work must not be relaxed (skilled worker in 1966).

The union rep at Gamma shows professional pride, when he emphasises both the independence and creativity in highly skilled workers. In the quote below, he tells us of the process involved in becoming a skilled worker:

Because everyone has their method. At least, that was how it worked in my training, I learnt *that* thing from one craftsman and then I was with someone else, and then suddenly he had a completely different method for the same thing. But then I might develop my *own* method, taking a bit from that one and a bit from that one (the union rep at Gamma).

This quote illustrates how professional pride may emerge when skilled workers are trusted, given responsibility, can make decisions on the job and are given content in the job, cf. motivator factors (Herzberg 1966, 1968) and psychological work demands, cited by Thorsrud and Emery (1969).

Identification with the company: Our informants stress that there is a connection between professional pride in general and identification with the workplace:

In terms of productivity, quality, most things, it's clear that it's extremely important that we have skilled workers who know their job, who master the language and who identifies with the company, who has permanent employment (the manager at Alfa).

Sennett (2008) stresses that employers, in order to maintain loyal workers, must create motivation and show loyalty in return. Below follows two examples of company identification. Both are from Gamma, where the union rep used the pronouns *we* and *us* when talking about the company.

In the first example, the union rep mentions the company's high reputation:

Since the market is as tough as it is, we try to be good at delivering quality. Gamma is a well-known name. It's a big name in the city. They know what they get when they call us. So that's very important.

In the second example, the union rep makes a point of how technologically advanced the company is:

We are far ahead [technologically]. For instance we use tablets to register working hours, so the company is technologically state-of-the-art.

These examples of identification can be seen as illustrations of one of the psychological demands formulated by STS (Thorsrud and Emery 1969, see above in 6.5.1): The need to see the connection between the work and the outside world.

Lack of pride: Our informants are all concerned about a lack of respect for their profession and for the industry as a whole. Below, the union rep at Delta see the lack of respect as an undermining of those that already work in the profession:

Right here skilled workers have status [...]. But in Oslo there is hardly a Norwegian left at a building site anywhere. There are a lot of cowboy builders there. This undermines the construction business as such, but it also undermines those who want to work with craft. They don't *want* to work in an environment like that, nor do they get *respect* for working in professions like that. So status is important (the union rep at Delta).

In the introduction we illustrate how a lack of respect for artisanal skill has created an over-emphasis on design over craft. Examples of this tendency in modern, western society can be seen in for instance the 8 House in Denmark and a student house in Bergen. Both have received international accolade for their designs, while containing massive construction problems. In Bergen the result would have fatal if the faults had not been discovered quite by chance.

6.5.4 Concluding remarks on motivation and professional pride

In this subchapter we have explored motivation and professional pride, and found that this dimension of skill is perceived as a basis for high quality performance. Our informants stressed the importance of intrinsic motivation and motivator factors as a means of preventing injuries and illness and as a means to create productivity and high quality. The ability to be motivated through performance-linked pay in the form of piecework, i.e. an extrinsic reward, was also emphasised. Both professional pride and the ability to identify with the company were viewed as important ways of creating high quality. Permanent employment was perceived as a prerequisite for accomplishing motivation.

Our informants saw motivation as an ability to be present in body and mind, to find enjoyment in work and in so doing to produce high quality. These aspects tie in with Sennett (2008) and Tesfaye's (2013) emphasis on tacit knowledge, where the development of high technical skills is connected to meaningful, alert repetition. Sennett (2008: 160) speaks of a willingness to dwell in error, and that this is the road to high technical skill. Sennett (2008:295) also states that craftsmen take most pride in skills that mature.

The fact that motivation is an important dimension of skill for our informants, reflects several features in the Norwegian cooperation model, such as a trust between employers and employees and skilled workers having a great degree of independence and responsibility.

6.6 What do the theories say about skill?

The construction industry is characterised by dynamic and structural complexity. How can we understand skill in such a complicated, changing and uncertain environment? When our informants spoke of the various skills and abilities of the skilled worker, we saw that there was an interdependence between them. In the beginning of this chapter we therefore argued that it made sense to view the various abilities of the skilled worker as dimensions of a totality rather than as disparate skills.

To our informants, skills are embodied («skilled workers feel in their bodies what is profitable», the union rep in Delta) and take time and focus to develop (in Gamma the project manager and union rep talk about the advantages of assigning an apprentice to one single craftsman for a longer period of time, for these reasons).

Skill, according to Sennett (2008) involves a process of knowledge development, a time-consuming process of trial and error. When we try out something, we feel and know what we are doing. We also pass judgement on the result of our trial, and adjust what we are doing on the basis of that judgement. In this way we constantly expand our knowledge.

Skill as depth: Skill is trained practice, according to Sennett (2008). High quality skill evolves over time, through a pattern of repetition and variation. This we call depth. Through this depth, the ability to handle complexity, both structural and dynamic, develops.

Skill as breadth: The STS model suggests organising work in a way that enhances and makes use of workers' multiple skills, to the advantage of both employers and employees. Skills are, in other words, seen as breadth. In STS, however, there is very little focus on what skill actually entails (except that they are broad), and how skills are developed. Trist (1981:32) does mention that «people change over time and learn through experience», but there is little reflection of this in the actual principles set out in STS.

We find both STS and skills theory as meaningful ways of analysing our material. However, after having analysed our material in relation to both STS and skills theory, we saw that STS to a very little degree reflect the depth of skill.

We therefore suggest that STS could be developed further by including depth and the use of tacit knowledge as one of its principles. People should be allowed to develop their skill over time, by a meaningful and ever-expanding repetition of activity, in accordance with how tacit knowledge is developed.

We conclude our analysis by a widening of our model to encompass the depth of skill.

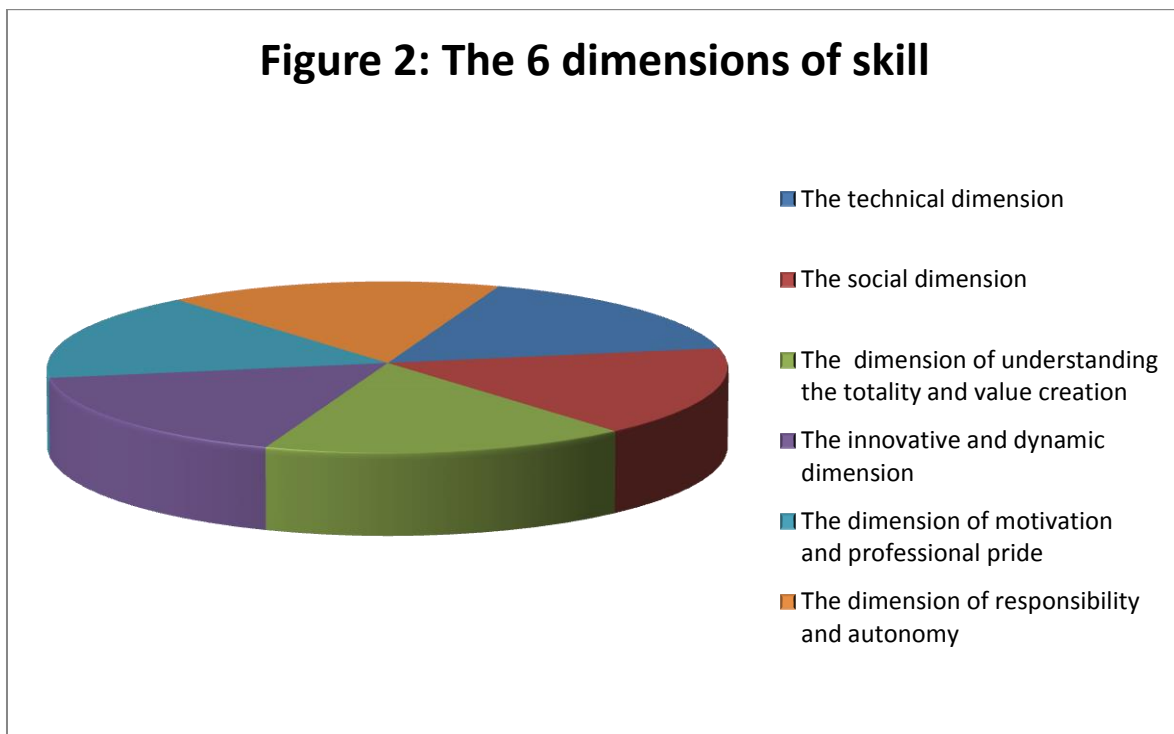


Figure 2: The 6 dimensions of skill revised

Chapter 7: Conclusion

Our informants see the skilled worker as a necessity in the construction industry: In the words of the manager in Alfa:

We also need the wisdom of the hands, and we need the theoretician who meets the practitioner. And if we lose the practitioner, we will have shot ourselves well and truly in the foot (the manager in Alfa)

In this thesis we have studied what skills skilled workers of the future need to have in the construction industry. This we have done by interviewing managers and union reps working in professional companies in the industry.

7.1 Summary of the results

In this thesis we have looked at what skills managers and union reps in the construction industry see as essential in skilled workers today and in the foreseeable future. We did so by exploring three dimensions of skill: technical skills, social skills and dynamic and creative skills. The most striking feature in our material is the sheer amount of differing skills that skilled workers in the construction industry need to possess: they have to be versatile, communicative, social, independent, team leaders, team players, creative, dynamic, motivated and with a high degree of technical professionalism.

In our analysis we saw that the Norwegian model provides a basis for developing skilled workers who take responsibility for their own work as well as others'. This is because a high degree of trust exists between employers and employees in Norway in general (Levin et al 2012) and in the companies we visited in particular. Trust has the quality of reducing complexity, according to Luhmann (1995: 127-129). In the construction industry, we see examples of a reduced complexity among other things through managers entrusting skilled workers with information, thereby enabling the workers to be independent. An example of trust in the form of sharing information, can be seen in the statement made by the project manager of Gamma:

I usually hand out most of the information I have. I want them [the skilled workers] to be as independent as possible (the project manager in Gamma)

This trust is also the foundation for allowing skilled workers to solve problems as they arise. In short, without trust most of the skills our informants see as necessary could not evolve or exist.

Another theory that provided a perspective for our analysis, is STS. STS provides a philosophy on how to balance the technical and social elements present in the construction industry. This balance will create both more motivated and skilled workers, according to STS theory (e.g. Trist 1981). One of the principles of STS is multiple skills in workers, another principle is grouping work tasks together to make up work systems. Our informants see skilled workers and machines as complementary, rather than workers being extensions of machines, which is in keeping with the STS philosophy. We see this manifested in a number of ways. For instance, all our informants stress a demand for what the project manager in Gamma terms «enormous versatility» in skilled workers. In addition, our informants see a need for workers to be dynamic (for instance to be able to both plan and implement plans) and creative (solve new problems as they arise). Our informants refer to the implementation of IT and the IT skills that need to be developed in its wake. This new technology, our informants claim, makes skilled workers more independent. This is in keeping with STS, where technology should be adapted to the demands of the workplace and workers, rather than the other way around.

STS literature (Thorsrud and Emery 1969: 19) cites psychological needs in the workplace, e.g. the need for learning in the job and the need for making decisions. When our informants expect skilled workers to solve problems as they arise, problems they may never have encountered before, this is also in keeping with STS. When solving problems, skilled workers have to make their own decisions about what the problem is about and how it is to be solved. This is also learning on the job. Having such advanced skills in workers makes sense in an industry with so many interdependencies and constant changes occurring.

Our analysis also included theories on skill (e.g. Sennett 2008). Skills theorists (ibid.) argue that skills develop through experience, through a dialogue between body and mind. This takes time and demands motivation from the individual. By exploring materials, and sensing and thinking about them as he or she does so, the craftsman gets a continuously improved knowledge of the material and of the processes involved in craftsmanship. Our informants see dynamism, versatility and problem-solving skills as essential in skilled workers of the future. According to skills theorists, these skills are developed in the above-mentioned way.

7.2 Summary of the research

In this thesis we have explored how we can understand skill in the construction industry, in the light of future demands. We have looked at what dimensions of skill managers and union reps see as essential in skilled workers today and in the foreseeable future. In the introduction we see that there is a concern both in Norway and in many other countries about skilled workers. One concern is about the lack of people to solve important societal tasks, such as building houses and roads. Another and deeper concern is about what lack of skills do to people on a more cognitive level. Sennett (2008) and others argue that developing skills involve both hands and head, and that skills anchor the individual in the material world as well as shaping our relationship with other people.

In our study, we directed our attention at skills of skilled workers in the construction industry, one of the largest and most important industries in Norway, in terms of both value creation, employment and turnover. The industry is characterised by projects and a high degree of complexity, both structural and dynamic.

We grounded our analysis in three theoretical perspectives: the Norwegian cooperation model, STS and theories on skill development. The Norwegian cooperation model was used as a framework, since this is the context in which our informants operate. STS is a work model which we found relevant since it focuses on the relationship between man and machine. With its complex nature, there is an intricate relationship between the social and technical elements, which we wanted to explore. The theories on skill development were of particular relevance, since skill was our primary topic.

We presented our results and made a preliminary analysis, i.e. set up some categories and subcategories in chapter 5. In our analysis (chapter 6) we explored three dimensions of skill: technical skills, social skills and dynamic and creative skills. We also argued that the theory on STS and skill development in many ways complement each other.

7.3 Significance of research

We will look at two points that have caught our attention during the work with the present thesis. The first point is about the need for skills in the construction industry and how this should be handled in education, and the second point is about skill development in general

and how society to a large degree seems to have lost the interest and ability in developing skill.

7.3.1 Skill and the education of skilled workers in the construction industry

One thing that is striking in our research, is the versatility and depth of skills that vocational skilled workers need to acquire and develop, according to our informants. We discussed the concept of depth in the concluding part of the analysis. Skills theorists state (e.g. Sennett 2008) that skills are developed in a dialogue between body and mind and is the result of trained practice. This means that theory alone is not enough. Theories should be complemented with specific practice. How does this tie in with the educational system in Norway?

Norway has had a reform of upper secondary education with a significant broadening of courses. Nyen and Tønder (2014) refer to how the first year in construction education is an introduction to 22 different professions, and that the second year in construction technique covers as diverse professions as carpenters, bricklayers, scaffolders and concrete finishers.

The Federation of Norwegian Construction Industries has criticised the educational reform for being too broad (Hanisch and Leegaard 2012). The Federation argues that it does not want less theory, but that they see it as necessary to tie the theory in with specific professions from day one.

This criticism is in keeping with theories on skill development, where specific practical experience and long-term training are seen as important factors in establishing high-quality skills. And from our interviews, high quality skills are what construction workers need to develop in order to compete in the fierce market.

However, collaboration is an important aspect in construction projects. Dainty et al (2006) point to communication challenges emerging as a result of the diverse professions in construction not being able to communicate well with each other.

Based on our research, we therefore recommend that construction education should be specific from day one, but that it should also include developing an understanding of the other professions involved in construction processes.

7. 3.2 Vocational skills versus academic skills

Our informants saw a need for a heightened prestige of the skilled workers in construction. One of the psychological demands of work emphasised by STS (Thorsrud and Emery 1969:19), is the need for workers to experience a connection between work and the surroundings, to experience a sense of usefulness and value from society. Sennett (2008) also emphasises a sense of pride. Our informants reflected on the lack of prestige (for instance the focus in media on crime and foreign workers were mentioned by several informants as causing loss of prestige). They saw lack of prestige as one of the main problems in recruiting enough skilled workers. Nyen and Tønder (2014) also point to the academisation of society as a challenge for vocational education.

At the moment we see a split in how skilled work is valued in society. On the one hand media and politicians say we need more skilled workers and that the lack of prestige gives cause for concern. On the other hand, as the general manager of Delta – the traditional craft skills are very invisible in today's society.

7.3.3 Skill in society: more than the construction industry

As Sennett (2008) and others have pointed out, developing skills is about more than producing enough construction workers, it is about creating people who are grounded in the material world. We therefore recommend more focus on practical skills in general in society. We let blogger and woodworker Doug Stowe, get the last word in this section:

Without the opportunity to learn through the hands, the world remains abstract, and distant, and the passions for learning will not be engaged (Doug Stowe 2006)

7.3.4 Skill and permanent employees

Many companies have chosen to outsource the work done by skilled workers to either unskilled workers or non-Norwegian hired, temporary workers. A number of these companies now report on problems. It may be worth examining whether dimensions of skill can contribute to an explanation. The companies may have lost dimensions of skill that have not been talked about before.

Media and the industry sometimes refer to challenges with non-Norwegian workers (e.g. Dragland 2013). We have not investigated nationality in our thesis, but our findings may suggest that long-term employment may be as important as nationality in acquiring the relevant dimensions of skill.

7.4 Theoretical implications

The construction industry is characterised by dynamic and structural complexity. How can we understand skill in such a complicated, changing and uncertain environment? When our informants spoke of the various skills and abilities of the skilled worker, we saw that there was an interdependence between them.

To our informants, skills are embodied and take time and focus to develop. Skill, according to Sennett (2008) involves a process of knowledge development, a time-consuming process of trial and error. When we try out something, we feel and know what we are doing. We also pass judgement on the result of our trial, and adjust what we are doing on the basis of that judgement. In this way we constantly expand our knowledge.

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We therefore suggest that STS could be developed further by including depth and the use of tacit knowledge as one of its principles. People should be allowed to develop their skill over time, by a meaningful and ever-expanding repetition of activity, in accordance with how tacit knowledge is developed.

We therefore widened our model to encompass the depth of skill.

7.5 Further research

We see that there are several perspectives in this research that could each be followed by further research. We here mention three possible research areas.

First of all, the construction industry has many unique features, among them the project-based nature (Dainty et al 2006). International literature on the construction industry point to a lack of a relevant production theory for the construction industry (see for instance Koskela and Howell 2008 in Røsdal and Ørstavik 2011:12). With every new project there are different actors involved and there is always on-site production requiring unique solutions even when pre-fabricated elements are used (Dainty et al 2006). It therefore makes sense to develop STS theory and practice for the needs of this unique industry, using the concept of tacit knowledge as one of the elements. The skilled worker and his or her skills could be a competitive advantage and play an important part in the time to come. As the project manager of Beta asserts:

I think that if the skilled worker is aware of his advantages and plays to them, I think his future looks bright. But I think it requires an awareness.» (the project manager in Beta)

Our second suggestion for further research: the construction industry needs recruitment and higher prestige. One research area is looking at factors contributing or hindering prestige and recruitment in this industry.

Our third suggestion for further research concerns skills i society. Skills are a necessity in society, not just for recruitment to the construction industry, but for the development of individuals in society. One of our informants, the general manager of Delta, mentioned the lack of arenas for young people today of discovering their practical skills, for instance children do not build houses in trees anymore or at least not as much as they used to. How do we go about creating a skills society?

We will end this thesis by quoting one of our informants about the advantages of being a skilled worker. Skilled workers see the result of their work, which creates pride and meaning. In the words of the manager at Alfa:

«It's a fantastic job, building a house. No one sees as much of the work he does as a skilled worker.»

References

- Aftenposten (2011): Yrkesfag i krise. *Aftenposten*, 18 October 2011, [online], available: <http://www.aftenposten.no/meninger/kommentatorer/madsen/Yrkesfag-i-krise-6281826.html> [accessed 23 November 2014].
- Argyris, C. and Schön, D. A. (1978): *Organizational learning: A theory of action perspective*. Reading, Mass.: Addison-Wesley.
- Bourdieu, P. (1986): *Distinction: A social critique of the judgement of taste*. London: Routledge and Keegan Paul. Translation Robert Nice.
- Boxall, P. and Macky, K. (2009): Research and theory on high-performance work systems: Progressing the high-involvement stream. *Human Resource Management Journal*, 19 (1), pp.3-23.
- Byggeindustrien (2015) [online], available: <http://www.bygg.no/> [accessed 1 May]
- Bråten, R. T. and Sved, B. (2014a): Byggfaget kjemper for ryktet sitt. *Adresseavisen*, 5 September 2014, pp. 2-3.
- Bråten, R. T. and Sved, B. (2014b): -Alle skal ikke være leger eller advokater. *Adresseavisen*, 8 September 2014, p.7.
- Dahl, S. G. and Haakaas, E. (2014): -Å stoppe kriminelle innen byggebransje blir vår viktigste oppgave. *Aftenposten*, 13 November 2014, [online], available: <http://www.aftenposten.no/nyheter/iriks/--A-stoppe-kriminelle-innen-byggebransje-bli-vaar-viktigste-oppgave-7778559.html> [accessed 9 March 2015]
- Dahl, S. G. and Haakaas, E. (2014): Siktet for grov kriminalitet, pusser opp for regjeringen. *Aftenposten*, 27 March 2014, [online], available: <http://www.aftenposten.no/nyheter/iriks/Siktet-for-grov-kriminalitet---pusser-opp-for-regjeringen-7515309.html> [accessed 8 May 2015]
- Dainty, A., Moore, D. and Murray, M. (2006): *Communication in construction. Theory and practice*. New York: Taylor and Francis
- Dragland, Å. (2013): Kulturkrasj påvirker bunnlinja. *Gemini*, 6 November 2013, [online], available: <http://gemini.no/2013/11/kulturkrasj-pavirker-bunnlinja/> [accessed 12 November 2013]
- Finne and Nilssen (1998): De selvstyrte gruppene ved Siemens i Trondheim. Nilssen, T. (ed.): *Mot et bedre arbeidsliv – en IFIM-antologi*. Bergen: Fagbokforlaget. pp. 59-79.
- Friberg, J. H. and Eldring, L. (2011): *Polonia i Oslo 2010. Mobilitet, arbeid og levekår blant polakker i hovedstaden*. Fafo report 2011:27. Fafo, [online], available: http://www.fafo.no/~fafo/media/com_netsukii/20218.pdf [accessed 1 December 2014].

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- Glaser, B. G. and Strauss, A. L. (1967): *Discovery of grounded theory: Strategies for qualitative research*. Chicago: Aldine.
- Goldeng, E. and Bygballe, L. (2013): *Bygg-, anleggs-, og eiendomsnæringens betydning for Norge – oppdatering 2013*. BI Norwegian Business School. Research Report 1/2013.
- Guba, E. G. and Lincoln, Y. S. (1989): *The fourth generation*. Newbury Park CA: Sage
- Hanisch, E. and Legaard, J. (2012): *Fagutdanning for fremtiden – for byggenæringen i Norge. Juni 2012*. Oslo: Byggenæringens Landsforbund (BNL). BNL report no 6 2012.
- Harper, D. (1987): *Working knowledge: skill and community in a small shop*. Chicago: University of Chicago Press.
- Herzberg, F. (1966): *Work and the nature of man*. New York: Staples Press.
- Herzberg, F. (1968): One more time: How do you motivate employees? *Harvard Business Review*, 46 (1), pp. 53-62.
- Huczynski, A. A. and Buchanan, D. A. (2007): *Organizational behaviour*. Harlow: Prentice Hall/Financial Times. Sixth edition.
- Jacobsen, D. I. (2005): *Hvordan gjennomføre undersøkelser? Innføring i samfunnsvitenskapelig metode*. Kristiansand: Høyskoleforlaget Norwegian Academic Press.
- Karlsen, J. I. and Munkeby, I. (1998): vekst og fall eller fall og vekst? Nilssen, T. (ed.): *Mot et bedre arbeidsliv – en IFIM-antologi*. Bergen: Fagbokforlaget. pp.37-57.
- Koskela, L. and Howell, G. (2008): The underlying theory of project management is obsolete. *IEEE Engineering Management Review* 36(2): pp. 22-34.
- Kvale, S. (1997): *Det kvalitative forskningsintervju*. Oslo: Ad Notam Gyldendal.
- Levin, M., Nilssen, T., Ravn, J.E. and Øyum, L. (2012): *Demokrati i arbeidslivet. Den norske samarbeidsmodellen som konkurransefortrinn*. Bergen: Fagbokforlaget.
- Loosemore, M.; Dainty, A. R. J., and Lingard, H. (2003): *HRM in construction projects: Strategic and operational approaches*. London: E&FN Spon Press.
- Luhmann, N. (1995): *Social systems*. Stanford CA: Stanford University Press.
- The Ministry of Trade, Industry and Fisheries (2012-2013): *Report no. 39 to the Storting. Mangfold av vinnere*.
- NHO (2015): Stort behov for fagarbeidere. 19 February 2015, [online], available: <https://www.nho.no/Politikk-og-analyse/kompetansebarometer/stort-behov-for-fagarbeidere/> [accessed 9 May 2015]

Head and hands: A study of skill in skilled workers in the construction industry
Annika Odland and Anniken Simonsen Odland
MBA HHB Bodø BE 323E
Spring 2015

Nonaka, I. and Takeuchi, H. (1995): *The knowledge-creating company. How Japanese companies create the dynamics of innovation*. New York: Oxford University Press.

The Norwegian Labour Inspection Authority (2013): *KOMPASS Tema nr. 4 2013 – Tilstandsanalyse i bygg og anlegg. Kunnskapsunderlag for Arbeidstilsynets satsing i 2014-2015*. Trondheim: The Norwegian Labour Inspection Authority

Nyen, T. and Tønder, A. H (2014): *Yrkesfagene under press*. Oslo: Universitetsforlaget.

Pauwels, F., Van Peteghem, J. and Ramioul, M. (2012): WP7 report construction Belgium. *Work and life quality in new and growing jobs*. HIVA, WP7,4 January 2012.

Pfeffer, J. and Veiga, J. F. (1999): Putting first for organizational success. *The Academy of Management Executive*, 13 (2), pp.37-48.

Røsdal and Ørstavik (2011): *Kommunikasjon i byggeprosjekter*. Oslo: NIFU.

Sennett, R. (2008): *The craftsman*. London: Penguin Books.

Sintef (2014): Fremtidens fagarbeider, [online], available: <http://www.sintef.no/projectweb/hpws/fremtidens-fagarbeider-2014/>, [accessed 5 September 2014]. A conference arranged by Sintef in connection with the project HPWS.no

Sjøberg, J. (2014): Unge mener yrkesfag har lav status. *Aftenposten*, 18 September 2014, [online], available: <http://www.aftenposten.no/okonomi/Unge-mener-yrkesfag-har-lav-status-7707459.html> [accessed 9 May 2015]

Skarbøvik, S. F. (2012): *Innovation and learning in construction companies*. Unpublished master's thesis, University of Oslo.

Statistics Norway (2014): Bygge- og anleggsvirksomhet, strukturstatistikk, 2013, foreløpige tall, [online], available: <http://www.ssb.no/bygg-bolig-og-eiendom/statistikker/stbyggan/aar-foreloepige/2014-11-05?fane=tabell&sort=nummer&tabell=203601> [accessed 6 December 2014] Comment: Norwegian statistics on the construction and property sector, 2013, preliminary numbers.

Stowe, D. (2015): *The wisdom of the hands*, [online blog], available: <http://wisdomofhands.blogspot.no/> [accessed 2 May 2015]

Stowe, D. (2006): *The wisdom of the hands*, 16 October 2006, [online blog], available: <http://wisdomofhands.blogspot.no/> [accessed 1 November 2014]

Strand, T. (2001): *Ledelse, organisasjon og kultur*. Bergen: Fagbokforlaget.

Støre, J. G and Bals, J. (2014): *I bevegelse. Veivalg for det 21. århundret*. Oslo: Cappelen Damm

Head and hands: A study of skill in skilled workers in the construction industry
Annika Odland and Anniken Simonsen Odland
MBA HHB Bodø BE 323E
Spring 2015

Taylor, F. W. (1911): *The principles of scientific management*. New York and London; Harper and Brothers Publishers. [online], available: <https://archive.org/details/principlesofscie00taylrich> [accessed 5 November 2014] 2

Tesfaye, M. (2013): *Kloge hænder – et forsvar for håndværk og faglighed*. København: Gyldendal

Thorsrud, E. and Emery, F. E. (1969): *Mot en ny bedriftsorganisasjon. Eksperimenter i industrielt demokrati, fra Samarbeidsprosjektet LO/NAF*. Oslo: Tanum

Tiller (2014): Frykter fremtiden for bygg. *Adresseavisen*, 10 April 2014, pp 20-21.

Tjora, A.(2012): *Kvalitative forskningsmetoder i praksis*. Oslo: Gyldendal Akademisk. 2nd edition.

Torvatn, H. and Finnestrand, H. O. (2011): WP5 Sector report Norway: construction – expanding on migrant workers. *Work and life quality in new and growing jobs*. July 2011.

Trist, E. L. (1981): *The evolution of socio-technical systems. A conceptual framework and an action research program*. Toronto: OntarioQuality of Working Life Centre.

Trist, E. L. and Bamforth, K. W. (1951): Some social and psychological consequences of the Longwall method of coal getting. *Human Relations*, 4, pp.3-38

Virke (2013): *Virke Bygg og anlegg 2013. Rapport 2013*. Virke, the Enterprise Federation of Norway.

West, K. (2015): UK needs plumbers, builders and engineers as skills crisis hits economy. *Guardian*, 10 February 2015, [online], available <http://www.theguardian.com/business/2015/feb/10/uk-plumbers-builders-engineers-skill-crisis-economy> [accessed 20 April 2015].

Åkernes, H. L. (2014): Skandale i Bergen, suksess i utlandet. *Stavanger Aftenblad*, 11 November 2014, [online], available: http://www.aftenbladet.no/nytte/bo/Skandale-i-Bergen_-suksess-i-utlandet-3558380.html [accessed 9 May 2015]

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Appendices

Appendix 1:

The following photo shows the use of post-it notes with different colours in the analysing process as described in the method chapter.



Photo 2: The analysing process

Appendix 2

Appendix 2 shows the interview guide

Appendix 2a: Interview guide in Norwegian

Innledning

Muntlig informasjon om undersøkelsen.

Informantene vil anonymiseres.

Bakgrunnsinformasjon

1. Hvor lenge har du jobbet i denne bedriften?
2. Utdanning og yrkesbakgrunn
3. Har du hatt andre stillinger her?

Kompetanseutvikling

4. Hva kreves av en god fagarbeider i dag og i årene fremover?
 - a. Faglig?
 - b. Krav utover selve faget?
5. Har bedriften disse fagarbeiderne i dag?
6. Hvilke utviklingsmuligheter har fagarbeiderne i dag?

Lønnsom kommunikasjon

7. Hvordan foregår en vanlig arbeidsdag for fagarbeiderne i din bedrift? (i grove trekk)
8. Jobber fagarbeiderne i faste team eller varierer dette? Kan de lånes til andre arbeidsoppgaver?
9. Hva slags informasjon får fagarbeiderne om arbeidet de skal utføre? Hvor mye? Når får de denne informasjonen?
10.
 - a. Hvilke muligheter har fagarbeiderne for å komme med idéer, foreslå endringer, komme med innspill og tilbakemeldinger?
 - b. Får fagarbeiderne tilbakemelding på sine forslag, og hvordan foregår i så fall dette?
11. Diskuterer ledelsen i bedriften hva en god fagarbeider er? Diskuterer folk i bransjen fremtidens fagarbeider? Hva diskuteres?
12. Hvor mye kommuniserer fagarbeidere i bedriften
 - a. på tvers av yrkesgrupper og faggrenser?
 - b. med ledelse?
 - c. med utenlandske kolleger?
 - d. med kunder?

Ansvarskompetanse

13. Hva har fagarbeiderne mulighet til å bestemme selv i arbeidshverdagen og hva kan de ikke bestemme selv? (valg av verktøy, metode, prosess, rekkefølge på oppgavene).
14. Finnes det eksempler på at medarbeidere har kommet med idéer til produkter eller prosesser?

Trusler mot fremtidens fagarbeider

15. Hva er trusler mot eller hva hindrer utviklingen av fremtidens fagarbeidere?

16. Er det andre ting vi ikke har spurt om, men som du synes det er viktig å ta med under temaet fremtidens fagarbeider?

Appendix 2b: Interview guide in English translation

Interview guide

Introduction

Information about the study.

Informants will be made anonymous.

Background information

1. How long have you worked in this company?
2. Education and work background
3. Have you had any other positions here?

Competence development

4. What is required from a skilled worker today and in the years to come?
 - a. Professionally?
 - b. Requirements beyond the specific profession?
5. Does the company have these skilled workers today?
6. What opportunities do skilled workers have today?

Efficient communication

7. What does a normal day at work look like for the skilled workers in your company (in general terms)?
8. Do the skilled workers work in permanent teams or does this vary? Can they be borrowed to other tasks?
9. What sort of information do the skilled workers get about the work they are going to do? How much? When do they get this information?
10.
 - a. What opportunities do skilled workers have for coming up with ideas, proposing changes, and giving feedback?
 - b. Do the skilled workers get feedback on their suggestions, and how do they receive the feedback?
11. Does the management of the company discuss what qualities a skilled worker should have? Do people in the industry the skilled worker of the future? What is being discussed?
12. To what degree do skilled workers in the company communicate
 - a. across professions?
 - b. with management?
 - c. with non-Norwegian colleagues?

- d. With customers?

Competence in taking responsibility

13. What decisions can skilled workers make in their daily work and what decisions can they not make? (choice of tools, method, process, the order of tasks).
14. Are there any examples of skilled workers coming up with ideas for products or processes?

Threats against the skilled workers of tomorrow

15. What are the threats or what are the barriers against the development of the skilled workers of tomorrow?
16. Are there other topics we have not asked you about, that you find important when talking about the skilled worker of the future?

Appendix 3

Norwegian Social Science Data Services (NSD)

ⁱ Our translation

ⁱⁱ *Bathroom pods* = translation of *badekabin*

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7465 TRONDHEIM

Vår dato: 02.02.2015

Vår ref: 41713 / 3 / MSS

Deres dato:

Deres ref:

TILBAKEMELDING PÅ MELDING OM BEHANDLING AV PERSONOPPLYSNINGER

Vi viser til melding om behandling av personopplysninger, mottatt 20.01.2015. Meldingen gjelder prosjektet:

<i>41713</i>	<i>Fremtidens fagarbeider i bygg- og anleggsbransjen</i>
<i>Behandlingsansvarlig</i>	<i>Universitetet i Nordland, ved institusjonens øverste leder</i>
<i>Daglig ansvarlig</i>	<i>Hanne Olofsson Finnestrand</i>
<i>Student</i>	<i>Anniken Simonsen Odland</i>

Personvernombudet har vurdert prosjektet, og finner at behandlingen av personopplysninger vil være regulert av § 7-27 i personopplysningsforskriften. Personvernombudet tilrår at prosjektet gjennomføres.

Personvernombudets tilråding forutsetter at prosjektet gjennomføres i tråd med opplysningene gitt i meldeskjemaet, korrespondanse med ombudet, ombudets kommentarer samt personopplysningsloven og helseregisterloven med forskrifter. Behandlingen av personopplysninger kan settes i gang.

Det gjøres oppmerksom på at det skal gis ny melding dersom behandlingen endres i forhold til de opplysninger som ligger til grunn for personvernombudets vurdering. Endringsmeldinger gis via et eget skjema, <http://www.nsd.uib.no/personvern/meldeplikt/skjema.html>. Det skal også gis melding etter tre år dersom prosjektet fortsatt pågår. Meldinger skal skje skriftlig til ombudet.

Personvernombudet har lagt ut opplysninger om prosjektet i en offentlig database, <http://pvo.nsd.no/prosjekt>.

Personvernombudet vil ved prosjektets avslutning, 22.05.2015, rette en henvendelse angående status for behandlingen av personopplysninger.

Vennlig hilsen

Katrine Utaaker Segadal

Marie Strand Schildmann

Kontaktperson: Marie Strand Schildmann tlf: 55 58 31 52

Vedlegg: Prosjektvurdering

Dokumentet er elektronisk produsert og godkjent ved NSDs rutiner for elektronisk godkjenning.

Avdelingskontorer / District Offices:

OSLO: NSD, Universitetet i Oslo, Postboks 1055 Blindern, 0316 Oslo. Tel: +47-22 85 52 11. nsd@uio.no

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Kopi: Anniken Simonsen Odland annikasio@hotmail.com



Prosjektvurdering - Kommentar

Prosjektnr: 41713

Formålet med prosjektet er å undersøke hvilke ferdigheter og krav som vil stilles til fagarbeidere i bygg- og anleggsbransjen i Norge i fremtiden og hvilke utfordringer som eksisterer for å utvikle fremtidens fagarbeider.

Ifølge prosjektmeldingen skal utvalget informeres muntlig om prosjektet og samtykke muntlig til deltakelse. For å tilfredsstille kravet om et informert samtykke etter loven, må utvalget informeres om følgende:

- hvilken institusjon som er ansvarlig
- prosjektets formål / problemstilling
- hvilke metoder som skal benyttes for datainnsamling
- hvilke typer opplysninger som samles inn
- at opplysningene behandles konfidensielt og hvem som vil ha tilgang
- at det er frivillig å delta og at man kan trekke seg når som helst uten begrunnelse
- dato for forventet prosjektslutt
- at data anonymiseres ved prosjektslutt
- hvorvidt enkeltpersoner vil kunne gjenkjennes i den ferdige oppgaven
- kontaktopplysninger til forsker, eller student/veileder.

Det behandles sensitive personopplysninger om medlemskap i fagforeninger, jf. personopplysningsloven § 2, punkt 8 e).

Personvernombudet legger til grunn at forsker etterfølger SINTEF sine interne rutiner for datasikkerhet. Dersom personopplysninger skal sendes elektronisk eller lagres på mobile enheter, bør opplysningene krypteres tilstrekkelig.

Forventet prosjektslutt er 22.05.2015. Ifølge prosjektmeldingen skal innsamlede opplysninger da anonymiseres. Anonymisering innebærer å bearbeide datamaterialet slik at ingen enkeltpersoner kan gjenkjennes. Det gjøres ved å:

- slette direkte personopplysninger (som navn/koblingsnøkkel)
- slette/omskrive indirekte personopplysninger (identifiserende sammenstilling av bakgrunnsopplysninger som f.eks. bosted/arbeidssted, alder og kjønn)
- slette lydopptak