

# **Articulations of Sustainability Transition Agency.**

## **Mundane Transition Work among Consulting Engineers**

Knut H. Sørensen (corresponding author),

Department of Interdisciplinary Studies of Culture, Norwegian University of Science and Technology, 7491 Trondheim, Norway, email: [knut.sorensen@ntnu.no](mailto:knut.sorensen@ntnu.no),  
phone: +4791897365

Vivian Anette Lagesen,

Department of Interdisciplinary Studies of Culture, Norwegian University of Science and Technology, 7491 Trondheim, Norway, email: [vivian.lagesen@ntnu.no](mailto:vivian.lagesen@ntnu.no),  
phone: +4791172760

Thea Sofie Melhuus Hojem,

Department of Interdisciplinary Studies of Culture, Norwegian University of Science and Technology, 7491 Trondheim, Norway, email: [thea.hojem@ntnu.no](mailto:thea.hojem@ntnu.no), phone:  
+4792056909

The paper has been published in *Environmental Innovations and Societal Transitions*, 2018, <https://doi.org/10.1016/j.eist.2018.02.003>. Check with the journal for the final version.

## **Abstract**

This paper analyses sustainability transition agency among consulting engineers, who exercise considerable influence in a wide spectrum of environmental decision-making through advice, calculations and design. They work in an ambiguous space of governmental requirements, environmental politics, cost considerations, and professional standards. Nevertheless, many consulting engineers engage with sustainability transitions in a mundane and modest way. To a varying degree, they combine four kinds of transition work: (1) sustainable technological problem solving, (2) persuasion work, (3) mediation work, and (4) institutional work. On this basis, we propose a model of sustainability transition agency where sustainable technological problem solving is the core activity as a precondition of necessary sociotechnical change. The three latter kinds of transition work may facilitate and support the core activity. The study also shows that environmental regulations, rules and standards are important to sustainability transition work among consulting engineers, guiding but also providing more space for such efforts.

## **Keywords**

Sustainability transition agency, transition actors, transition work, environmental policy, consulting engineers.

## ***1. Introduction***

Successful sustainable transitions require positive engagement from various professional groups. Not the least, professionals in the private sector influence a wide spectrum of environmental decision-making, while working in ambiguous spaces

shaped by governmental requirements, environmental politics, business considerations, and professional standards. This paper explores how such spaces are navigated with a focus on consulting engineers, asking about their exercise of sustainability transition agency and the effects of governmental environmental policies, including standards and regulations.

Transition actors are people or organisations who are, intentionally or not, agents of change to make society more sustainable (Åm, 2015). Since sustainability transitions also include small steps and nudging, such actors may contribute in modest as well as radical ways. The former may be the most realistic expectation with regard to private sector professionals. Nevertheless, it is important to study the enactment of sustainability transitions in professionals' everyday practices. In this manner, we may better understand the scope and content of such sustainability transition agency and the measures that influence professionals' latitude and choice of action.

We use the concepts of transition actors and transition agency to highlight environmentally relevant strategies and activities of consulting engineers. Moreover, we are concerned with the potentially complex distribution of transition agency, including the varying degree of participation in sustainability transition efforts. We chose to study consulting engineers for a number of reasons. First, they are a fairly large group of private sector professionals (around 11 000 in Norway). Second, and more important, their work has significant and wide-ranging environmental consequences. Consulting engineers engage in projects that shape and reshape the physical qualities of nature and culture, of landscapes and the built environment. Consulting engineering companies contribute importantly to physical planning, construction of buildings (including

structural engineering, electrical engineering, and heating, ventilation and sanitation engineering), construction of infrastructure, transport planning, and water management. In such areas, they provide technological advice, calculations and designs on a contractual basis, serving builders, industrial companies, public institutions, etc.

Consulting engineering companies have to be competitive with regard to quality, costs, and timely delivery as well as in responding to their customers' needs and requirements. According to previous research, these features tend to make consulting engineers conservative in their problem solving (Hojem and Lagesen, 2012; Buch, 2016). We want to reconsider such characteristics. Even modest efforts at more sustainable problem solving may be important, including efforts like improved energy efficiency of buildings, increased use of environmentally friendly materials, more sustainable building practices and waste management, more environmentally friendly transport systems, and improved sustainability of factories, marine installations, etc. Thus, consulting engineers are an interesting case for analysing professionals that may contribute to sustainability transitions and in different ways. Some may do this moderately and mundane, others in more radical ways. We examine this by analysing how consulting engineers participate in and/or modulate sustainability transition efforts.

We use interviews with employees in and managers of consulting engineering companies to illuminate these issues and to contribute to sustainability transition studies by studying the navigation of what we expect to be ambiguous spaces of such private sector professionals' transitions agency. This includes the potentially configurational effects of government environmental policy efforts, with an emphasis on how consulting engineers interpret these efforts. The rest of the paper is structured as

follows: we begin by outlining the theoretical point of departure and the methods underlying the collection of data. Then we present findings. In this part, we first give an overview of the practices of transition agency among consulting engineers. Second, we discuss the role of environmental policy in shaping these practices, before moving onto possible effects of environmental governmentality and professionalism. Finally, we present our conclusions and propose a model of sustainability transition agency.

## ***2. The making of transition actors: theoretical perspectives***

The most prominent approaches within the fast-growing field of sustainability transitions studies see innovation as a particularly critical activity for change, albeit in different ways (Markard et al., 2012). For example, the highly influential multi-level perspective (MLP) analyses transitions as the outcome of interaction between three levels: landscape, regime and niche (Rip and Kemp, 1998; Geels, 2002; Schot and Geels, 2008). Socio-technical regimes impose a logic of and provide direction to incremental socio-technical change along established pathways of development, which makes socio-technical systems difficult to transform (Markard et al., 2012). To achieve sustainability transitions, MLP scholars argue, one needs to find ways of reorienting or producing radical changes in such regimes. Many consider protecting and nurturing sustainable innovations through strategic niche management to be the main strategy of change. MLP scholars also focus on the landscape level since activities here may facilitate or prevent changes in the socio-technical regime.

Governments are key actors with regard to sustainability transitions (e.g., Kemp et al., 2005). Not the least, they set goals and timelines for improvements, using a mix of policy instruments. Often, discussions of the effects of such instruments distinguish between market-based instruments like taxes and non-market-based measures, which in the environmental context may comprise direct environmental regulations, active technology support, and public R&D support. In this paper, such classifications are not important. Our concern has been to identify the environmental policy instruments and governmental sustainability goals that the interviewed consulting engineers emphasised in their accounts of their work. Furthermore, we explore what they say about the effects of these policy efforts.

Fischer and Newig (2016) review the role of actors in sustainability transitions studies. They present four different actor typologies: systemic, institutional, governance and intermediaries. Moreover, actors may be supporters or opponents of transitions. As an example of a systemic typology, Fischer and Newig propose an interpretation of MLP where they distinguish between niche and regime actors. They argue that both categories of actors have limited agency. Niche actors cater for technological innovation that the regime may adopt, but they depend on government policy. According to Fischer and Newig's review, regime actors tend to oppose transition, but they may become supportive if they see the transition to be in their own interests.

Much of the literature that discuss agency with respect to sustainability transitions focuses on the role of actors as builders or transformers of socio-technical systems (Farla et al., 2012). Actors' interests and expectations may be important to such engagement (Bakker, 2014). Geels et al. (2016) provide a comprehensive analysis of

system building strategies in their study of low carbon energy transition pathways in German and the UK, highlighting the importance of agency in shaping such pathways. Fuenfschilling and Truffer (2016) helpfully suggest the concept of institutional work to describe agency in developing socio-technical systems.

This paper also takes inspiration from Shove and Walker's (2007) call for greater attention toward the actors that are involved in the everyday politics of transition processes. Our focus on consulting engineers represents an attention to mundane, potentially incremental acts of transition agency among professionals. This does not imply that we dismiss the importance of institutional work (Fuenfschilling and Truffer 2016). While government policies influence professions, professions may participate in the development as well as the enforcement of such policies (Abbott, 1988; Suddaby and Viale, 2011).

As noted above, Fischer and Newig (2016) suggest studying niche and regime actors. However, we find their system topology limiting. Instead, we pursue an interactional approach, which emphasises sense making and actors' practices as the outcome of relations to other humans and non-humans (e.g., Law 1994; Latour 2005). Thus, we analyse what consulting engineers say they do, the meaning they attach to their work, their accounts of the diversity, distribution and content of the involved agency, and how they describe their interaction with other human and non-human actors. In the context of this paper, other actors are primarily customers and other participants in construction processes, the government, and new technologies.

Thus, we consider the terrain of sustainability transitions as “flat”, meaning that we study interactions horizontally and without privileging a priori any actor (Jørgensen, 2012; Sørensen, 2015; Åm, 2015). Drawing on this perspective, we address three forms of possible transition agency among consulting engineers: innovation, everyday activities, and efforts to change the socio-technical conditions or context of their work. With respect to innovation, we examine if the interviewed consulting engineers report such activities, and, in case, what kind. This includes looking for accounts of governmental policies or other initiatives that may provide shielding and nurturing of environmental innovations.

Regarding everyday activities of consulting engineers, we analyse how they say they manage sustainability issues in mundane contexts. Previous research suggests that consulting engineers tend to emphasise the advantages of re-using designs and the importance of containing costs to be competitive (Koch, 2004; Ryghaug and Sørensen, 2009; Hojem and Lagesen, 2012; Buch, 2016). However, this does not mean that they oppose sustainability transitions. By analysing their accounts more closely, we focus on diversity as an indication of potential for change.

We also look for efforts of consulting engineers to change the conditions of their work: their institutional work. Houmb (2012) show that The Association of Consulting Engineers, Norway (RIF) is engaged in influencing policy-making and the setting of standards. RIF is an industrial association with companies as members, not individuals. In this paper, we examine if interviewees said that they had participated in initiatives to influence standard setting and policy-making.

Transition agency may be a response to governmental policies but it may also emerge as environmentally oriented self-governance among consulting engineers. We ask if consulting engineers are so-to-speak self-made transition actors in the context of governmental environmental discourses. This line of thought draws on Michel Foucault's argument that modern societies indirectly discipline their citizens by internalizing perceptions of 'normal' behaviour (e.g., Foucault, 1977; Dean, 1999).

We analyse possible effects of an environmental governmentality by studying how interviewees argue with respect to their navigation of sustainability issues. We are particularly interested in whether they explain actions to participate in or to modulate sustainability transitions with or without reference to instruments of governance. Do they consider such transition agency a 'normal' practice? In this context, it is important to note that professionals like consulting engineers are "trusted workers" (Whalley, 1986), meaning that they have considerable – albeit varying (Abbott, 1988) – autonomy in their work.

To summarise, the paper analyses the navigation of the assumed ambiguous space of consulting engineers' transition agency by using an interactional approach. In this manner, the paper explores the concepts of transition actor and transition agency, also by considering the configurational effects of government environmental policy efforts. This includes environmental governmentality. We pursue four questions that may be interrelated: (1) How do consulting engineers account for their everyday efforts with respect to environmental concerns, and how does transition agency play out in these accounts? (2) Do they report about engagement in innovation activities? (3) Do they participate in efforts to influence governmental policy-making and standard setting that

may affect their work? (4) Is the transition agency of consulting engineers an effect of governance instruments and/or environmental governmentality?

### **3. Method**

We chose a qualitative approach to respond to our research questions since we needed data about sense-making and concrete practices. First, we interviewed representatives, usually CEOs or managers, of 40 consulting engineering companies in Norway about how they and their companies engaged with environmental issues. We experienced the interviewees as well placed to account for the practices of their companies. The companies engaged with a wide range of environmentally relevant issues like physical planning (like nature conservation or urban densification), construction of buildings (energy efficiency, sustainable materials, sustainable building practices), transport planning (sustainable transport), and water management (biodiversity, toxicity). The majority of the employees of the companies held engineering degrees – building engineers, heating, ventilation and air conditioning (HVAC) engineers, electrical engineers – but there were also architects, biologists and planners.

We collected this set of data through structured telephone interviews, one interview per company. The firms varied in size. Fourteen (35 %) had less than 10 employees, sixteen (40 %) between 10 and 100 employees, while ten companies (25 %) had more than 100 employees. This distribution is reasonably representative of an industry with many small enterprises, but also with some large firms. The majority of the companies worked with construction and buildings, some specialised in HVAC, some in project management, etc., while the large ones covered many areas.

There could be a bias stemming from interviewing people in management positions and only one from each company. For example, there could have been disagreements about these issues internally in the companies and conflict of interest between managers and other employees. However, we interviewed people from quite many consulting engineering companies and our impression is that the managers had a good overview of relevant features of the company. Moreover, many of the questions we asked pertained to company policies. Thus, the sample of interviewees seems appropriate to our inquiry.

Second, we did an in-depth investigation of four consulting engineering companies, interviewing a total of 15 people. These interviews were done face to face and focused on the same topics as the telephone interviews, but with a greater focus on details regarding the practices of the companies. Third, to explore further how consulting engineering companies try to influence government policies and standards, we have explored relevant web sites, in particular the home page of the Directorate of Quality of Buildings (<https://dibk.no>).

All interviews were taped and transcribed in verbatim. We have translated the quotes used in the paper into English. The analysis of the data was inspired by grounded theory methodology based on open coding (e.g., Strauss and Corbin 1990). Our coding focused on identifying practices and points of view that could be included in the fairly open concept of sustainability transition agency as well as observations pertaining to environmental policy instruments and their effects on the practices of consulting engineers. We present the results in the rest of this paper, beginning with how the

interviewed consulting engineers accounted for their everyday practices and transition agency with respect to sustainability.

#### ***4. Sustainability transition agency in the practices of consulting engineers***

As noted, consulting engineers engage in a variety of tasks in their everyday practice, in particular calculations and drawings related to planning, design, and construction. For example, they may calculate fresh air requirements and energy consumption, or traffic: ‘I did calculations of capacity in alternative designs of crossings with traffic lights, roundabouts, estimates queue lengths ... that become input to [calculating] CO<sub>2</sub> emissions and such things. So this is a very typical task’ (consulting engineer, large company). In such ways, consulting engineers may engage in *sustainable technological problem solving*. This was the most prominent form of transition agency that we observed in the interviews.

Consulting engineers who worked explicitly with sustainability issues, like environmental classification of buildings or building waste management, clearly engaged in this form of transition agency. One interviewee from a small company provided an example. She did environmental assessment according to the system of the Norwegian foundation Eco-Lighthouse: ‘Then you get the number of tons of [CO<sub>2</sub>] emissions because you put in square meters [of the building], you put in number of employees, you put in kilometres driven, you put in diesel, you put in yearly consumption of petrol, you put in air travel, waste – what you recycle in kilos, litres,

and so on'. In principle, all interviewees recognised that sustainable technological problem solving was a relevant form of transition agency. However, many found it challenging to realise this in their everyday practices.

In the interviews, we found five issues that were important to understand the conditions and practices of transition agency among consulting engineers: (1) the role of customers and the interaction between them and the consulting engineers, including customers' cost concerns and their knowledge about environmental issues and regulations, (2) project management, (3) the effects of policy instruments like legal regulations, (4) innovation or change practices, and (5) professional autonomy, the level of interest in environmental issues, and institutional work to influence standards and regulations. We begin by addressing the first two issues.

The most prominent aspect of the interviewees' accounts of their work was, unsurprisingly perhaps, that their customers framed the contracts and thus the conditions of calculation and design efforts. Most interviewees argued that they had limited possibilities to go beyond what customers wanted, for example with regard to developing greener designs: 'Then it is the question of what we actually *can* do. We depend on our customers, since we don't generate the projects' (CEO, medium-sized company). If consulting engineers wanted more emphasis on sustainability, they had to persuade their customers. Most interviewees found this to be challenging, since they thought that their customers mainly were concerned with the cost of the assignment and the resulting construction:

The challenge is in a way to persuade ... It all comes down to money, no matter how you twist and turn it. It is about convincing actors in the building industry or those who are going to pay the bill that it is sensible to use that particular material because it pollutes the building site less or because it causes minimal pollution during production. But it's not easy. Because the person commissioning a building wonders why he or she should spend [substantially more money] per square meter to use that specific material. Some might think about it, but it is still a small percentage of those who build who do (CEO, medium-sized company).

In such ways, interviewees explained that the concern to keep costs as low as possible hampered environmentally friendly problem solving. This does not mean that for example greener designs always were more expensive, but that interviewees tended to see cost issues in general as an obstacle to improved sustainability of their calculations and designs beyond legal and functional requirements. Still, it is important to note, as the above quote suggests, that many of them said that they really wanted to provide more sustainable designs and thus to be sustainability transition actors. They would try to persuade their clients to allow them to engage in sustainable problem solving, for example by considering less polluting materials or more energy efficient alternatives. We call this second form of transition agency *persuasion work*. As expected, some also found such work to be too difficult to do in a successful manner:

Of course, the budget is important, and then the environmental aspects fade into the background. It's like – you've to wrap up the project at the right time and at the right cost. And then, the right cost often equals the lowest

possible costs. And environmental issues and costs are often, at least within our trade, antagonistic (assistant manager, medium-sized company).

There were actually two cost issues; one related to the engagement of the consulting engineers and the other to the total construction costs. The first encouraged re-use of calculation procedures and designs, the other invited a focus on the economy of alternative problem solving. In general, the interviewees described their customers as less concerned with environmental issues, which was a challenge to their persuasion work. Several also introduced their customers' lack of competence in the environmental area as a major obstacle, since this meant that the customers did not know what to ask for. One interviewee reflected around this problem in the following way, while stating a clear motivation to be a sustainability transition actor: 'Environmental knowledge is not in demand, but you know we do use it – when such issues are raised, illuminated. But, like, there are few [customers] who are able to ask for or demand it. Among contractors, among other actors – I think there is a very low level of competence, so the demand [for environmental knowledge] is small, but it is welcome when it is expressed!' (project manager, medium-sized company).

What Koch (2004) calls 'the tyranny of the project' represented another potential hurdle. This concept emerges from consulting engineers experienced lack of ability to make changes in a contract when it has been signed. The interviewees complained that they entered construction projects at a stage when the main issues had already been decided and were difficult to alter. However, on a more positive note, some interviewees claimed to experience an increasing demand for environmental knowledge.

One project manager told that: ‘There is a demand from our customers, so such issues become a natural part of projects’. These interviewees believed that there was a growing market for environmentally focused services. This invited transition agency with respect to sustainable problem solving, even if interviewees could be worried about deficiencies in customers’ procurement competence and their strict cost focus.

Another manager, when asked if there was an increasing demand for environmental knowledge among costumers, responded: ‘No, I can’t call it an increase. But there’s more focus on it today, especially from public clients. Within the private market, there is not so much focus on it. (...) They won’t pay for it’ (CEO, medium-sized company). Actually, several interviewees claimed that there was a difference between public and private customers with regard to environmental concern. A regional manager in a large provider of services to the building industry told that ‘Public clients are increasingly aware [of environmental concerns], while private builders tend to emphasise economic rather than environmental considerations.’

Another interviewee observed that: ‘Many of the public clients have environmental requirements, while some of the private; they try to get away [with less sustainable problem solving]’ (CEO, large company). The finding that public customers were more active than private ones in asking for sustainable problem solving could reflect political signals that buildings owned by public authorities should be at the forefront with respect to sustainability. However, Norwegian authorities have not launched clear policies to such ends (Sørensen, 2017).

When we asked who typically would request environmentally friendly knowledge and technology in a project, a common response was:

That's usually the project manager. But the outcome depends on the requirements made by our customer with respect to such issues. Yes, we should take care of it [environmental issues], but there is no point in imposing a Rolls Royce design on someone who isn't willing to pay for it' (team manager, medium-sized company).

Many interviewees considered project management as important to their possibility to exercise transition agency, but less so than customers. One of them explained that if the project had an environmentally motivated project manager, it was easier to negotiate the inclusion of environmental concerns:

(I)t's related to the individual. It can make a big difference if the builder is professional and employs a project manager who is concerned with [environmental issues]. But if we meet a builder where the project manager is a bit weak and they have hired a professional project management company, then what's important is the budget (assistant manager, medium-sized company).

Overall, we received a diversity of responses regarding the conditions of exercising transition agency. Some were optimistic:

I feel we've a great deal of influence, since it's up to us to take the initiative because the customer isn't familiar with all the options. Of course, you may

have a very concerned customer who knows what he wants, but most customers, I think, are people who own a piece of land, or a builder who wants to have something developed. He leaves a lot to the consultants, to the architects and the planners (CEO of a large company offering physical planning services).

Other interviewees, particularly from small companies, voiced more gloomy and defensive attitudes: ‘Then there is the question of what we actually can do (...). We don’t exercise any influence with respect to the attention given to environmental issues in the project. So what we can do is keep track of ourselves. We’re only humans, so ... Maybe we don’t have that much to contribute’ (CEO, small company).

As we have learnt, the interviewees considered customers to have a strong influence on their practice and their options with respect to catering to environmental concerns. In most cases, they saw this influence as constraining their transition agency due to customers’ cost concerns and their lack of environmental knowledge. Project management and contractual issues were also important. Despite difficulties, many interviewees were motivated to engage with sustainability transition activities and some claimed to take initiatives to this effect, in particular by engaging in persuasion work. The space of action was constrained but offered possibilities. What role did governmental policy play to motivate consultant engineers and facilitate their transition agency?

## ***5. Environmental policy and the space for transition agency***

One might expect that customers' cost concerns would make them sensitive to market-based policy instruments aimed at promoting environmentally oriented problem solving. However, the interviewed consulting engineers did not mention any such policy instruments, like the Norwegian carbon tax, making their customers asking for more sustainability-oriented services. However, a few mentioned a government programme that offered economic support for 'model buildings'.

The interviewees' accounts suggested so-called non-market based instruments to be more effective. Such measures, above all building codes, made more sustainable technological problem-solving mandatory. This helped them exercise transition agency like persuasion work. It should be emphasised that in particular the building codes had become considerably stricter just before we conducted the interviews. Many interviewees also expected the codes soon to become even more exacting and include a requirement of so-called passive house standard of energy efficiency. They considered such standards as crucial and much more so than environmental concerns in general because they produced a demand for improved sustainability of their deliverables: 'In the inquiries from our customers, they include some demands with regard to the environment, where they want such issues [regulations] to be taken care of. Whether it's a road or a pipe-line project, there'll be some regulations regarding to the environment' (CEO, large company). Environmental regulations modified cost concerns, since such requirements had to be met.

Accordingly, if customers knew about relevant regulations, we were told that they were concerned with fulfilling them, sometimes even willing to go beyond them. A consulting engineer in a small company put it this way: ‘We recognize that [the demand for environmental expertise] is on the increase now because it has become a requirement from the authorities.’ Accordingly, environmentally relevant regulations provided space for sustainability transition agency. Moreover, meeting regulations and standards meant that the consulting engineers had to sort out what were relevant requirements and find ways to meet them.

Much of the work with respect to regulations involved calculation. Interviewees provided several examples of this. One employee from a large company told about their work with mapping polluted grounds: ‘You do some environmental risk assessment related to spreading [of toxins] and such things. Then you use calculation tools based on hydrogeological principles and spreading to water and such. In other such environmental risk assessments, you look at the risk of emissions and the danger regarding what may become exposed, and then you use more general risk analysis and methods’.

To meet building code requirements regarding energy efficiency, several interviewees told that they used a standard software package to calculate, for example, the effect of alternatives regarding insulation, energy quality of windows, heating system, and air change. A consulting engineer in a large company described his work like this: ‘I build the body of the building visually, as you were to build it in reality. Then you calculate; change the qualities of windows, doors, walls, roof, humans present, energy supply, and ventilation. Then, one simulates different kinds of maintenance from expected use and

from what is supposed to be in the buildings'. In the end, the calculations would also serve as proof that relevant requirements were met.

It is important to note that adherence to regulations and standards was not a straightforward issue: 'I believe it is very important to avoid spreading of environmental toxins (...). And of course, there are some laws, rules and guidelines that we shall adhere to. But in practice, this is a rubber band. The control of the authorities is not always good enough' (consulting engineer, large company). This interviewee also emphasized his persuasion work, trying to make customers choosing alternatives that were environmentally more ambitious.

Furthermore, when customers lacked knowledge about relevant regulations and standards, the interviewed consulting engineers said they would inform about the requirements, making sure that they were met. Still, as we have already seen, the interviewees had to act as mediators (Latour, 2005) because regulations and standards need interpretation. Moreover, usually, there was more than one way to meet the requirements. We consider *mediation work* as a third, important form of transition agency.

One kind of mediation work was to clarify the meaning of relevant texts: 'Many times, we wonder what they [the authorities] really meant. What is the correct reading [of a particular technical standard or a legal document]? And then, several of us may stand and discuss, and then agree that in our company, we understand it like that. (...) But you

do not always grasp that there is room for interpretation before you have plummeted out with both legs' (consulting engineer, large company).

Another kind of mediation work was to identify alternative ways of meeting the requirements of relevant technical standards and legal regulations. This also provided space for transition agency. For example, some interviewees told that when they mediated standards and regulations, they used this as an opportunity to challenge their customers to opt for more ambitious alternatives: 'One thing is that there are statutes and regulations that you are supposed to follow. Because there are really a lot of them, right? But, there are other matters, too, like to challenge them [the customers] with respect to available options – simply to be a little pushy' (consulting engineer, large company). He continued by pointing to the potential importance of thinking long-term rather than short-term. This could be relevant with respect to both economic and environmental considerations.

It is notable that the interviewees did not talk explicitly about innovation as part of their work, possibly because they considered using this concept making too much of what they thought of as modest and mundane efforts. Moreover, they tended to understand innovation in the building area and other consulting engineering fields as developing new technologies, like new materials. Rather, the consulting engineers described their mediation work in terms that we interpret to represent incremental inventions, since they seldom shared the results outside the company.

The incremental feature of changes towards improved sustainability was also a backdrop of interviewees' complaints that they found it difficult to be creative in their work when re-use of existing designs was expected. One interviewee reflected that: 'I believe that it's healthy to have a mix of copying and being innovative. But you don't need to invent gunpowder every time. Then you lose the advantage of learning from experience' (consulting engineer, large company).

Thus, when we suggest describing the practice of transition agency among consulting engineers as mostly mundane, it is because they operated in a context where small-step changes were most frequent. When we see the consulting engineers as engaged with sustainability transition agency, their accounts emphasise incremental everyday efforts to provide for improved environmental qualities, not radical change. While environmentally oriented policy instruments were important to such mundane sustainability transition agency, they did not result in much visible innovations among consulting engineers. However, mediation work was widespread.

Thus, consulting engineers are vital to realise the policy goals underlying environmental standards and regulations and we should recognise the positive effects of their transition agency. In particular, their sustainable technological problem solving and their persuasion and mediation work were important, even if it was mundane and the interviewees tended to be modest about their achievements. When we asked about their engagement with environmental concerns, their responses tended – as we have seen – to provide excuses why they did not do more. Could this have been an effect of sustainability-oriented governmentality, which suggested that they ought to have contributed more?

## ***6. Governmentality, professionalism and transition agency***

We suggested earlier that we might observe governmentality with regard to sustainability through the interviewed consulting engineers' accounts of issues pertinent to 'proper' professional conduct. Was interest in and knowledge of sustainability an integrated part of the professional role of the interviewees? Were they self-governed sustainability transition actors? We ask these questions also to reflect further about the conditions of consulting engineers to exercise transition agency.

With respect to professional autonomy, our data suggest that the situation was ambiguous. The importance of business considerations was evident. The interviewees emphasised their professional responsibility to meet customers' needs and requests but also to make sure that their problem solving was technologically sound and in accordance with relevant standards and legal frameworks. Such accounts suggest a modest if any effect of environmental governmentality.

Still, clearly, the interviewees knew that environmental issues were important, even if their emphasis varied. Notably, some told us that younger engineers were more environmentally concerned: 'Yes, definitely, young engineers are much more interested in this [environmental issues] and have a greater focus on it than those of us who've been in the business for a while.' In response to a follow-up question about the reason for this, the interviewee replied that: 'I think that has to do with the fact that after a

while, after having done quite a few projects, you have acquired experience with designs that work, and you'll want to continue using these instead of being maybe as innovative as one should be.' In the long run, it might not be realistic to be an innovative transition actor, give or take professional autonomy. To many interviewees, it appeared to be more important to be good at the 'traditional stuff' than to have advanced environmental knowledge and skills in sustainable problem solving. They tended to present the professional qualities of consulting engineers as being technologically knowledgeable, legally skilful, and cost aware.

Nevertheless, a substantial number of the interviewees said that they personally were concerned with environmental issues: 'Yes, I even think about it in my spare time!', exclaimed a team manager in a small company. Some also told that they felt a moral responsibility to provide sustainable problem solving, which could be a source of frustration:

I try to be engaged in environmental issues generally, in relation to buildings. And to the extent I'm able to influence the customer to give attention to environmental issues, I will. But usually, we get involved in projects that already are decided with regard to environmental issues (consulting engineer, small company).

In such manner, many interviewees made disclaimers with respect to being responsible for providing environmentally friendly outcomes. They argued that it was their customers or public authorities that should be held accountable:

Yes, I think, in a way, the politicians and the whole apparatus around them, their advisors [carry the main responsibility]. They are the ones who need to be focusing on doing something [...]. Yes, that's what I think. [Politicians should act on] the framework, the big picture, but that's not something we can do anything about in our company, other than to observe and try to provide our input where we're able to do so (CEO, medium-sized company).

Overall, the majority seemed to find it easier to sway customers rather than politicians, since, as one consulting engineer noted: 'we engineers don't have that much interaction with politicians.' However, we were given a few examples of *institutional work* (Fuenfschilling and Truffer, 2016), a fourth form of sustainability transition agency aiming to influence technical standards and legal regulations. They came mainly from interviewees in the large companies, who emphasised how they worked together with consulting engineers from other companies through the previously mentioned Association of Consulting Engineers, Norway (RIF) and its specialist committees. A particular focus was building codes:

(B)ut I see that [the present energy in buildings] standard is insufficient with respect to many areas related to equipment. And it does not bring on board

data processing centres, the cooling of data processing centres and outdoors, like melting of snow and such things. There are defects. And we work to change that (consulting engineer, large company).

The same interviewee also told she had been on the national news arguing the need to make building standards stricter to improve sustainability.

The interviewees engaged in institutional work told that hearings were a major channel of influence, like with respect to building codes. When we looked at the organisations that responded to the hearing about the most recent proposal for revising building codes (TEK17), we found that 13 consulting engineering companies had provided comments (<https://dibk.no/byggereglene/horingar/hoyringar/forslag-ny-byggteknisk-forskrift>).

This group included most of the large consulting engineering companies in Norway.

To summarise, many interviewees were concerned with environmental issues. All of them were aware that addressing such issues were a relevant part of their work. We interpret this as an effect of environmental governmentality – that it was ‘normal’ to consider sustainability as part of their job. The effect may be modest because the interviewees tended to deny responsibility with respect to sustainable problem solving and many questioned their own capacity to generate changes, due to what they considered their limited professional autonomy.

Quite a few were not eager to engage in persuasion work to convince customers to choose sustainable alternatives that went beyond legal requirements, in particular those working in small companies. They voiced a very pragmatic approach, like the one

expressed by a self-employed consulting engineer: ‘I’m not rigid. I’m more of a working guy. I’m not a politician [...]. I don’t try to sway my clients. If they’ve decided to go for a, so to speak, traditional design, then that’s fine by me.’ Others appeared to be more proactive and positive. Such differences reflect the ambiguity of the space of sustainability transition agency as well as the diversity of practices.

## ***7. Conclusion: Sustainability transition agency and transition work among consulting engineers***

This paper has explored the concepts of sustainability transition actors and sustainability agency with respect to a group of professionals working in the private sector: consulting engineers. They play a vital role in the shaping of the physical structures of modern society, contributing to the design of the built environment and other infrastructure. Previous research suggests that this group tend to make conservative choices. Thus, we expected them to exercise mundane and moderate sustainability transition agency. Our findings confirmed this expectation and also suggested promising new ways of theorising such agency.

Context was clearly important to the exercise of sustainability transition agency among the interviewed consulting engineers, above all environmental policy articulated through regulations, rules and standards. These measures shaped the engineers’ space of action and facilitated sustainability transition agency but not in a uniquely defined manner. In particular, customers introduced ambiguity in the way they framed enquiries and assignments, putting varying emphasis on cost containment and presenting different levels of ambition regarding sustainability.

We observed several levels of activity in dealing with sustainable issues, indicating diversity with respect to professional standards regarding environmental issues. Quite a few of the interviewees were clearly reactive in their approach, others were hesitant, and some mentioned more pro-active strategies in response to our questions. Thus, the sustainability transition agency of professionals like consulting engineers should not be considered a matter of either-or. Rather, such agency is an assemblage of practices where the engagement with environmental concerns and the actual pursuit of sustainable problem solving vary substantially. At the same time, instead of focusing on such differences, it is more fruitful to understand sustainability transition agency as exercised through the four kinds of transition work that we observed in the accounts of our interviewees: (1) sustainable technological problem solving, (2) persuasion work to induce customers to go for more sustainable options, (3) mediation work to clarify the ways in which regulations, rules and standards might be met, and (4) institutional work (Fuenfschilling and Truffer, 2016) to influence governmental policies and regulations, rules and standards to become stricter.

Sustainable technological problem solving is the core activity in our proposed model of sustainability transition agency; such problem solving is the key to necessary sociotechnical changes. Persuasion, mediation and institutional work were potential support actions that could help shaping the assignments and the contracts that the consulting engineers negotiated, while experience from sustainable technological problem solving were helpful to exercise the other kinds of transition work. Furthermore, institutional work could facilitate persuasion and mediation work if it resulted in stricter environmental regulations, rules and standards. A few interviewees

also mentioned their experiences from persuasion and/or mediation work as a resource to engage in institutional work.

Thus, we may see sustainability transition agency as exercised through four potentially reinforcing forms of transition work within a context where environmental governance measures are very important but not the only feature of concern. From the accounts of the interviewees we learn that the sustainability transition agency of consulting engineers vary according to resources, competence, interpretation of professional standards, and attitudes. For example, large companies seemed more pro-active than small ones, and a high level of environmentally relevant knowledge was considered helpful to see alternative ways of solving problems. While environmental governance through direct, non-market based instruments was described to us as the most effective measures to encourage and facilitate transition work, there are clearly additional possibilities like improving the knowledge of and the motivation for engaging with environmental issues.

What about innovation, usually considered vital to sustainability transitions? Such work was seldom mentioned. When interviewees talked about finding new ways to solve problems in an environmentally friendly way, they usually described this as part of their everyday activities and with incremental, not radical properties. There were rare mentions of shielded spaces of creative problem solving, like a governmental programme supporting so-called model buildings and instances where customers were interested in sustainable designs on an unusually ambitious note. However, this seemed to have modest if any effects outside the companies engaged in such projects; the outcomes were not clearly mainstreamed (Sørensen, 2015). Still, in our proposed model

of sustainability transitions agency, innovation work may be added as a sub-category of sustainable technological problem solving.

## ***Acknowledgements***

Research Council of Norway has supported the research (grant no. 183575). We are grateful for very useful comments from the editor and two anonymous reviewers.

## ***References***

Abbott, A., 1988. The system of professions. The University of Chicago Press, Chicago.

Bakker, S., 2014. Actor rationales in sustainability transitions – Interests and expectations regarding electrical vehicle recharging. *Environmental Innovations and Societal Transitions* 13, 60-74, DOI: 10.1016/j.eist.2014.08.002.

Buch, A., 2016. Ideas of holistic engineering meet engineering work practices. *Engineering Studies* 8:2, 140-161, DOI: 10.1080/19378629.2016.1197227.

Farla, J., Markard, J., Raven, R., Coenen, L., 2012. Sustainability transitions in the making: a closer look at actors, strategies and resources. *Technol. Forecast. Soc.* 79 (6), 991–998, DOI:10.1016/j.techfore.2012.02.001.

Fischer, L.-B., Newig, J., 2016. Importance of Actors and Agency in Sustainability Transitions: A Systematic Exploration of the Literature. *Sustainability* 8, 476, DOI: 10.3390/su8050476.

Foucault, M., 1977. *Discipline and punishment: The birth of the prison*. Allen Lane, London.

Fuenfschilling, L., Truffer, B. 2016. The interplay of institutions, actors and technologies in socio-technical systems – An analysis of transformations in the Australian urban water sector. *Technol. Forecast. Soc.* 103, 298-312, DOI: 10.1016/j.techfore.2015.11.023

Geels, F.W., 2002. Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study. *Research Policy* 31 (8/9), 1257–1274, DOI: 10.1016/S0048-7333(02)00062-8.

Geels, F.W., Kern, F., Fuchs, G., Hinderer, N., Kungl, G., Mylan, J., Neukirch, M., Wasserman, S., 2016. The enactment of socio-technical transition pathways: A reformulated typology and a comparative multi-level analysis of the German and UK low-carbon electricity transitions (1990 – 2014), *Research Policy*, 45: 896-913, doi: 10.1016/j.respol.2016.01.015.

Hojem, T.S., Lagesen, V.A., 2012. Doing environmental concerns in consulting engineering. *Engineering Studies*, 3, 2: 123-143. DOI: 10.1080/19378629.2011.585161

Houmb, J. W. 2012: «Det er ingeniører som kan redde verden!» RIF – en miljøorganisasjon? Unpublished master thesis, Department of Interdisciplinary studies of culture, Norwegian University of Science and Technology, Trondheim.

Jørgensen, U., 2012. Mapping and navigating transitions – the multi-level perspective compared with arenas of development. *Research Policy*, 41 (6): 996–1010, DOI: 10.1016/j.respol.2012.03.001.

Kemp, R., Parto, S., Gibson, R.B., 2005, Governance for sustainable development: Moving from Theory to Practice. *International Journal of Sustainable Development* 8 (1-2): 13-30.

Koch, C., 2004. The Tyranny of Projects: Teamworking, Knowledge Production and Management in Consulting Engineering. *Economic and Industrial Democracy* 25 (2), 277-300. DOI: 10.1177/014383104042492.

Latour, B., 2005. *Reassembling the Social. An Introduction to Actor-Network Theory*. Oxford University Press, Oxford, UK.

Law, J. 1994. *Organizing Modernity: Social Ordering and Social Theory*. Blackwell, Oxford, UK.

Markard, J., Raven, R., Truffer, B., 2012. Sustainability transitions: An emerging field of research and its prospects. *Research Policy* 41, 955-967, DOI: 10.1016/j.respol.2012.02.013.

Rip, A., Kemp, R., 1998. Technological change, in: Rayner, S., Malone, E.L., (Eds.), Human choice and climate change. Vol. II, Resources and technology. Battelle Press, Columbus.

Ryghaug, M., Sørensen, K.H., 2009. How energy efficiency fails in the building industry. *Energy Policy*, 37(3), 984-991. DOI: 10.1016/j.enpol.2008.11.001

Schot, J., Geels, F.W., 2008. Strategic niche management and sustainable innovation journeys: theory, findings, research agenda, and policy. *Technology Analysis & Strategic Management*, 20 (5), 537-554, DOI: 10.1080/09537320802292651.

Shove, E., Walker, G., 2007. CAUTION! Transitions ahead: politics, practice, and sustainable transition management. *Environment and Planning A*, 39, 763-770, DOI:10.1068/a39310.

Solli, J. (2013). Navigating standards - constituting engineering practices - how do engineers in consulting environments deal with standards? *Engineering Studies*, 5(3): 199-215. DOI: 10.1080/19378629.2013.857674.

Strauss, A., Corbin, J.M., 1990. *Basics of Qualitative Research: Grounded Theory Procedures and Techniques*. Sage, Thousand Oaks, CA.

Suddaby, R., Viale, T., 2011. Professionals and field-level change: Institutional work and the professional project. *Current Sociology* 59 (4), 423-442, DOI: 10.1177/0011392111402586

Sørensen, K.H., 2015. From 'alternative' to 'advanced': Mainstreaming of sustainable technologies. *Science & Technology Studies*, 28 (1), 10-27,

Sørensen, K.H., 2017. Virker de? Virkemidler for energieffektivisering med vekt på bygninger [Do they work? Instruments for energy efficiency with an emphasis on buildings]. Downloaded from <https://www.ntnu.no/documents/7414984/1275356549/VirkerDe.pdf/5347ca1c-824b-4d6c-b553-8e344281e437>

Whalley, P., 1986. *The social production of technical work*. The SUNY Press, Albany, New York.

Åm, H., 2015. The sun also rises in Norway: Solar scientists as transition actors. *Environmental Innovation and Societal Transitions*. 16: 142-153, DOI: 10.1016/j.eist.2015.01.002.