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Subcontracting railway maintenance – challenges to safety

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Abstract

In several European countries, national railway operators have been dismantled and partly privatized to create new contractual relations where operations originally performed internally are now outsourced to several companies. Breaking up work across several independent organizational and commercial entities tends to make coordination and control tasks more complex. It is therefore of interest to explore whether increased and specific risks arise when subcontracting arrangements of safety critical work safety are implemented.

This paper focuses on the safety challenges faced by a Danish railway infrastructure manager (InfraMan), which is subcontracting maintenance tasks to other companies. InfraMan has implemented various central elements in managing their subcontractors. The latter are required to present a safety plan as part of their bid, they must be approved if they are to be awarded a contract, and the competencies of their employees working on the railway are controlled and provided by InfraMan. However, this regime faces a number of further challenges, including uncertainties related to the safety plans, contested responsibility for the education program, difficulties in controlling the informal competencies, and a dilemma in options for sanctioning unsafe behavior.

These and other dilemmas faced by the Danish railway company are analyzed as general challenges related to subcontracting and compared to similar experiences in other industries.

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1 Problem

This paper focuses on safety problems associated with both subcontracting and outsourcing. Industries based on subcontracting face challenges in safety management, when interdependent, safety-critical operations are carried out by different companies. Safety must be coordinated across organizational barriers, and actions by employees in one company may affect the safety of employees in other companies. Outsourcing introduces an additional challenge, when particular safety-critical operations are no longer carried out internally but instead performed by another company – thus introducing new layers of organizational and contractual barriers.

What are the consequences for safety in this case, how can challenges be controlled across new organizational barriers, and are there – or should there be – any limitations to the type or number of operations that can be outsourced to another company? This paper examines ‘answers’ to some of these questions that have been developed and implemented by a Danish Railway Infrastructure Manager (referred to as InfraMan), and further explores new challenges arising from these answers.

First, a note on terminology. *Subcontractor* is often used to designate 2nd level suppliers employed by a *main* contractor. The company presented here uses the term *suppliers of safety services*. In this paper I shall generally use *subcontractor* in this general sense of any supplier of safety-related services, preferring this term over ‘supplier’, which has the more general meaning of suppliers of products. Thus, the paper will omit the distinction between contractor and subcontractor.

2 Data

The paper is based on interviews with employees in RailMan (which is a state-owned company responsible for operating nearly all Danish infrastructural rail assets) as well as employees from selected subcontractors. Their answers are based on their own experience and do not necessarily represent official policies expressed by the management of the companies in which they are employed. In addition to the interviews, various written documents from RailMan have been included, notably internal newsletters that are available on the company’s website. In total, 5 interviews (of about 1 hour) have been conducted with 6 persons from Dec. 2008 to Jan 2010. The name of the company and the titles of some internal documents have been changed to preserve anonymity.

3 Background

In Denmark, as in many other Western countries, the railway industry has gone through extensive restructuring and privatization. Previously, all operations were carried out within one large public organization, which has now been split into two state-owned companies: an *infrastructure manager* – in this paper named InfraMan – and a large train *operator* that is operating most of the train services in the country. Several other operators run on the network managed by InfraMan, and some of them compete with the state-owned operator for some of the services. On its part, InfraMan has outsourced development and maintenance to other companies. InfraMan has retained its own maintenance department – here named RailMaint – which carries out general maintenance and competes with external entrepreneurs for larger development projects. Until recently, InfraMan was planning to sell RailMaint as an independent company, which might then be able to bid for external contracts, e.g., in other countries. These plans were given up during 2009 for various reasons, but in many respects the outsourcing of development and maintenance has given RailMaint a status of quasi-subcontractor/supplier that has to bid for contracts in competition with external entrepreneurs.

4 Safety plans and competence management

Railway maintenance involves general safety challenges common to maintenance in other safety critical industries. Work must be carried out in a dangerous environment, and while the work can be protected by ‘track occupations’ that protect particular sections from access by other trains, such isolations are managed restrictively by the infrastructure manager to preserve regularity in

services – comparable to the economic drive to minimize 'outages' in other industries. Outsourcing railway maintenance may pose additional challenges to safety, since the rail network is distributed over a large geographical area, and workers as well as managers employed by the subcontractor may have inadequate local knowledge.

An interviewee from InfraMan suggests that the company may have been well prepared for outsourcing – by accident. In 1997, two track workers were killed by a train, and the accident investigation authorities criticized the safety rules in InfraMan as incoherent and difficult to understand (Jernbanetilsynet, 1998). The accident initiated a major rule revision in the company, and in 2003 all safety rules regarding track works were tightened up and consolidated into a specific set of rules. These rules would then be used by the quasi-internal InfraMaint as well as external entrepreneurs.

A central element is the emphasis on *safety plans*. Project managers are required to present a safety plan before carrying out maintenance projects, and external entrepreneurs must include such a plan when making a bid for a contract – and have it approved by safety *coordinators* from InfraMan (InfraMan, 2009). Making the plan will require a safety manager to visit the area where the work is to be carried out, thus making up for lack of local knowledge. InfraMan distinguishes between three categories of projects, and safety plans are required for *larger* as well as *smaller* projects, but not for *immediate* works.

A crucial part of the plan is to decide whether a 'track occupation' is required to perform the work. The workers must thus be protected either by a lookout, or by reserving a section of the track for maintenance (track occupation). A track occupation will of course interfere with normal train operations and must be planned ahead and accepted by another department in InfraMan.

The safety plans must be written by certified 'SR [safety rules] managers' that have received formal education by InfraMan, and this education has been regimented as a reaction to uneven quality in many safety plans (InfraMan, 2010b). And in general, InfraMan controls the competencies of every individual working on the railway by requiring them to take specific courses to perform various functions: to work in the track, or in areas in close proximity, or to drive a vehicle on the tracks. Workers must update their qualifications by retraining once a year, and in order to be accepted for examination they – or their employer – must document sufficient experience measured in the number of full work days within a certain period.

Besides this management of individual qualifications, external entrepreneurs must be approved and registered by InfraMan (InfraMan, 2010b). And the vehicles employed by entrepreneurs must be certified at various degrees for different types of work.

5 Challenges to management of subcontractors

After this presentation of the central elements in InfraMan's management of their subcontractors, the paper will present a number of issues that have arisen with some of them.

5.1 Safety plans

Inspections have revealed several occasions where managers have worked without a safety plan, either because no plan had been worked out, or because the manager had not read the plan. In both cases, the workers had not been instructed in the plan as required (InfraMan, 2009). As already mentioned, InfraMan has also been dissatisfied with the quality of some of the safety plans.

Sometimes the question arises whether 'they really think that a piece of paper can enhance safety' (InfraMan, 2009), but one of the company newsletters explains that the safety lies not primarily in the plan itself, but in the work required to make it: visiting the area and becoming aware of potential hazards. Nevertheless, some incidents and interviews with subcontractors suggest a number of general issues related to the safety plans – issues that for most parts are already being addressed.

5.1.1 Plans for smaller projects?

Some subcontractors question why they should make the safety plans themselves, and whether this task should not rather be performed internally in InfraMan. This question thus concerns the outsourcing of actual *safety management* – is it possible, or should this function rather be insourced (to some degree)? However, a safety manager from a larger subcontractor indicated in an interview that he does not agree with this concern, and, in another interview, an employee in

InfraMan argues that it would be difficult for his company to maintain a large staff of safety managers that could be deployed to any part of the country to make safety plans for external projects.

Nevertheless, this complaint may come from primarily smaller subcontractors and may thus be related to the relative greater amount of resources required to make safety plans for smaller projects. Thus, the complaint suggests an issue concerning the value of safety plans for the middle category of smaller projects. As already mentioned, safety plans are now required for both larger and smaller projects, but not for immediate works, and InfraMan is already considering whether this limit should be raised, primarily in reaction to requests from InfraMaint.

Thus, workers from InfraMaint have at several occasions been revealed by inspections as working without safety plans (InfraMaint, 2008), and InfraMaint has reacted by arguing that the plans are not very useful for smaller projects. Their employees already know the area, and weather and visibility conditions in the area can have changed significantly since the required visit, making the knowledge gained by that visit useless. InfraMan is sympathetic to the argument, but such change in the rules have to be accepted at several levels, including the railroad authorities. And even though the argument presented by InfraMaint is based on the specific competencies of a quasi-internal department – local knowledge – and thus may not be extended to subcontractors, it nevertheless emphasizes the general issue concerning the ‘banality’ limit for safety plans: how useful are they for smaller projects, and if they are, who should make them?

5.1.2 Flexible requirements

An interviewee from a larger subcontractor does not object to making safety plans, but finds it problematic that the requirements from InfraMan are not very specific, but allows for a variety of solutions. Whether the particular plan is approved by InfraMan, depends on the individual safety coordinator involved, and this makes it difficult to manage the resources required. He can accept the intention behind the flexibility, since it allows the various entrepreneurs to find their own solutions, which might be better than envisioned by InfraMan, e.g., in acquiring a more optimal use of resources. But he finds the approval process not very transparent and depending on the individual coordinator. Moreover, it may have substantial economic consequences, if the subcontractor makes a plan that requires 3 SR managers at the location, and is then told that 10 will be necessary. He would like to be able to contact the relevant coordinator before making a bid for a contract, but they are unwilling to provide extra information to specific entrepreneurs, since it would compromise the bidding process. Obviously, this problem is insignificant for smaller projects, but may make a substantial economic difference for larger ones.

Thus, this issue illustrates that the *flexibility* in requirements for safety plans, and the lack of *transparency* in the approval process combine to be a source of uncertainty in the bidding process.

5.1.3 Subcontracting safety plans

The aforementioned issue of uncertainty associated with the safety plans may also be amplified when some subcontractors choose to further outsource the safety management by buying this particular service – safety plans for the project – from another specialized company. This allows an entrepreneur to make a bid for a contract without having employed their own InfraMan-certified ‘SR manager’. In Denmark, several companies have thus specialized in making safety plans for railroad contracts.

There are both advantages and disadvantages to this particular extra interface, since allows for specialization, but also creates an incentive for the safety provider to exaggerate the safety requirements and thus expand the safety budget. Interviews confirm that the specialized safety providers sometimes present very ambitious safety plans, and their client – the ‘main contractor’ – finds it difficult to estimate the necessity of these requirements before SR coordinator from InfraMan has approved the proposal.

This dilemma can be explained by the *Transaction Cost Theory*, since the *uncertainty* associated with the safety plans as well as the *specific assets* required – the certified SR managers – makes it less suitable for market regulation (Nunez, 2009; Williamson, 1990). The company buying the safety plan when bidding for a InfraMan contract will find it difficult to compare services and prices, increasing the risk of inflated prices.

Interviews provide an illustrative example which has been modified to preserve confidentiality and emphasize aspects of relevance to the issues discussed in this paper: a subcontractor bidding for a contract had on its part subcontracted the safety plan to a third party, which delivered a plan requiring 5 SR managers (to be delivered by that third party). InfraMan approved the plan and the contract, but commented that 3 would have been sufficient. The subcontractor then decided to

employ only 3 SR managers for the project (thus reducing payment to the third party, while presenting the same over-all price to InfraMan). When carrying out an inspection during work, IM safety inspectors found only three SR managers, while the contract had promised 5 – and this episode resulted in a legal disagreement over a few millions of Euros.

5.2 Competencies and experience

A number of issues concern the education system employed by InfraMan to manage the competencies and qualifications of track workers.

One issue concerns the responsibility for the education. Presently, education and examination is managed by InfraMan, but this renders the company vulnerable to critique from some external entrepreneurs arguing that examinations are not transparent and may be used by InfraMan to favor specific companies. For instance, companies with employees that have failed an examination mobilize various complains, often referring to this education monopoly, and sometimes go via legal institutions to demand openness about exam results. Such openness would undermine the present education system, since InfraMan would no longer be able to reuse material. InfraMan has sought to counter the monopoly critique by 'outsourcing' education to another provider, but was unsatisfied with the service provided and re-internalized education (InfraMan, 2010b). They are currently negotiating to pass this responsibility to public authorities.

The problem of inadequate transparency and those associated with passing on responsibility for education seem to stem from the concern that education – and re-education – should imply more than a simple formal examination. InfraMan is concerned that the examination in itself cannot guarantee all the competencies required: *routine and experience*, *local knowledge*, and perhaps even *individual qualities* such as risk perception.

Thus, InfraMan emphasizes the importance of routine and experience and controls for this by requiring that the employers document the work days performed by workers that participate in the courses. They are worried that many applicants do not seem to have the required experience and find that the entrepreneurs focus too narrowly on formal exams and certificates (InfraMan, 2010b; InfraMan, 2009).

Furthermore, some roles require adequate local knowledge, notably by vehicle drivers and SR managers – since lack of local knowledge may cause dangerous misunderstandings over track occupations. Even though this may not be part of any examination, it is relevant when controlling the competencies of employees proposed for a specific contract.

Finally, InfraMan would also prefer to know some safety-relevant individual qualifications, such as risk perception and attitude to safety rules. Such qualifications may be difficult to control in examinations, but they might prefer to implement additional controls if a license has been withdrawn due to rule violation, and the worker is then sent for re-examination.

On their part, however, subcontractors – other than those complaining over particular examinations – find parts of the education system inflexible. Some find it difficult to keep track of the need for (annual) re-education. They also complain that dates for courses are sometimes re-scheduled, with possible economic consequences for the subcontractor. For instance, a certificate for driving a vehicle terminates after a year when not renewed in time, and until re-education is completed, a worker is not allowed to drive a vehicle on the tracks. This may force a worker to take re-education after, say, 11 months or less to avoid being without certificate, and this will reduce the time available to capitalize on the investment. This problem may be more severe for employees in small companies, whereas larger companies with several certified workers may have more flexibility.

RailMan tightened the rules for annual re-education a few years ago as a reaction to a tendency among subcontractors to forget it, and a web-based booking system has been implemented to making booking and scheduling easier for the users (InfraMan, 2010b). Nevertheless, subcontractors have in general often been unable to provide the required documentation of work hours to have their employees accepted for a course. This particular problem may also stem from the ambiguous employment status of many railway workers (see below).

Entrepreneurs also ask for greater flexibility in certifications, e.g., when InfraMan for some reason withdraws a certificate for an employee. That employee is completely excluded from working on the railway, until he has been re-examined, and an interviewee employed by an entrepreneur do not understand why the culpable employee could not at least retain part of his certificate and be allowed to perform some simpler tasks until reexamination.

5.3 Dilemma in sanctioning – companies or individuals?

This latter example points to a crucial dilemma faced by InfraMan when finding – on inspection – that workers employed by a subcontractor are violating safety rules. This dilemma was emphasized by an employee from InfraMan who worried that repeated violations and unsafe behavior by subcontractor employees might to some extent be InfraMan's own fault, as long as they have not implemented proper sanctions. The argument is thus that sanctioning is an essential means to regulate subcontractor behavior, but this leads to the dilemma already hinted at: should InfraMan sanction the employer by withdrawing that company's approval and stop their work, or should they sanction the individual employee by withdrawing his certificate? Several arguments seem to point towards the second solution.

If InfraMan terminates or stops the work performed by the company, the service cannot be delivered on time, and this will also have negative consequences for InfraMan. They may try to extract fines from the subcontractor for not delivering on time, but the subcontractor may object that it was not his decision to stop the work. This is one reason that it is easier to sanction individual employees. However, how can that be fair when particular rule violations often occur as a reaction to impossible conditions (Lawton, 1998) that may even be caused by inadequate planning further up the hierarchical 'food chain'? To this objection, the InfraMan employee argues that his company – the ordering part – cannot be expected to spend extensive resources on investigating internal processes and decisions within the subcontractor, and may also find it very difficult to get access to that information.

These arguments thus balance towards sanctioning individual employees rather than their employers, and this approach matches the general tendency in InfraMan to control individual competencies rather than company approvals. Other industries face similar dilemmas, and for aircraft maintenance in Europe, for instance, a similar solution has been found – in that case managed by European authorities rather than a particular company (Haas, 2008). It has been argued that certifying companies rather than individuals runs the risk that such companies may be tempted drain expenses spent on safety education during economic crises (Savage, 1999).

This emphasis on individual competencies has various implications for the railway industry. Certified railway workers generally constitute a *critical resource* (Pfeffer & Salancik, 1979; Nunez, 2009) for subcontracting companies, since providing an employee with a required certificate may represent substantial investments. Some companies are rumored to contact rail workers with job offers when they have passed exams (financed by other companies). On the other hand, rail workers have often worked in the industry all their life and will have difficulties earning similar salaries in other industries. Thus, they are only a critical resource *within* the industry and can find employment in different related companies – often simultaneously – as long as the industry is expanding and faces growing investments.

5.4 Controlling working hours

Rail workers are often employed by different companies either simultaneously or at alternating periods, and this is probably due to at least two conditions: on the one hand their aforementioned role as a critical resource; and on the other hand the fact that maintenance work is organized in projects with a limited time span, which in turn may lead several companies to draw on the same 'pool' of certified workers.

This ambiguous employment status of individual rail workers makes it difficult for the alternating employers to control and document the work hours. This situation creates at least two problems. On the one hand, companies may find it difficult to provide the required documentation when their employees apply for re-examination. On the other hand, inspections carried out by InfraMan often reveal that subcontractor employees exceed the allowed number of work hours, thus increasing the risk of safety-critical fatigue. In response to these violations of work hour limits, InfraMan may threaten subcontractors with withdrawal of the *company's* 'license' to operate on the railway (InfraMan, 2010b). This is an occasion where InfraMan considers sanctioning the employer – and not the employee. However, such problems with excessive work hours may also arise when individual workers are working for different subcontractors in the same period, a problem that was also identified in the UK (Cullen, 2001).

5.5 Track protections

A final issue concerns the track occupations that are so vital to guarantee the safety of track workers. InfraMan generally reports a variety of safety-critical problems related to track occupations: people working in unprotected sections either due to deliberate risk taking, or to

misunderstandings over the location; work teams exchanging track occupations without informing station managers; several work teams working within the same section without clear responsibility for terminating the occupation.

To focus on one of these problems: inspections have repeatedly revealed employees from InfraMaint performing minor maintenance works – greasing the points – without any protection, neither lookout nor track occupation (InfraMaint, 2008). These incidents can be explained by unauthorized risk taking as well as a reluctance to engage unnecessarily with the ‘bureaucracy’ of track occupations. In this case, the employees are recommended to either opt for track occupations during night-hours – with less traffic – or to use a lookout on the condition that the track can be evacuated immediately. But the problem illustrates a general dilemma: track occupations are acquired at the cost of daily train services, and they are managed restrictively by the relevant department in InfraMan. This department is responsible for the railroad capacity offered to train operators who on their part often complain over delays caused by InfraMan. This department has other priorities than the department that is responsible for maintenance and development – and acquires such services from either InfraMaint or external subcontractors. Thus, an employee in InfraMaint argues, track workers are often caught in a dilemma between two different departments in InfraMan.

In general, InfraMan is concerned that the subcontractors do not use the track occupations efficiently, since they are often reserved at short notice, and 40 % of all track occupations are not utilized (InfraMan, 2010a). InfraMan regards this as the result of inadequate planning and have stated that in the future they will favor bids that demonstrate better planning of track occupations.

6 Discussion

This paper has examined the methods employed by InfraMan to face the challenges posed by subcontracting and outsourcing: *safety plans*, *approval of companies* and *control of employee competencies*. These methods are also employed in other industries, and the challenges faced by InfraMan when deciding on solutions and implementing them turn up dilemmas that are similar to those found in other industries, for instance, construction and oil & gas.

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