

COUNTERFEIT, FRAUDULENT AND SUB-STANDARD MATERIALS: THE CASE OF STEEL IN NORWAY

Nina Eklo Kjesbu¹, Atle Engebø², Ola Lædre³ and Jardar Lohne⁴

Abstract: The international construction industry is subject to several types of crime. Among the least researched is the exposure to counterfeited, fraudulent and sub-standard (CFS) materials. The study presented in this paper examines the presence of these materials in the Norwegian construction industry and the characteristics of the construction industry that render it vulnerable. A survey was sent out to different stakeholders within the industry, collecting experiences and knowledge about these types of materials. More than half of the respondents (9 of 17) stated that they pose a threat to the industry to a high or very high degree. To investigate the presence of these steel products, 3 semi-structured in-depth interviews were conducted with key actors. The data shows the occurrence of these materials in the industry. The interviewees all believed that CFS steel products exist in the Norwegian construction industry, and examples were given of the occurrence of it. The interviewees believed that the industry is vulnerable to this threat because it is easily accessible for temporary and dishonest actors, and it has a high degree of trust combined with a certain lack of controls. Further work can result in recommendations for possible countermeasures.

Keywords: materials, steel, construction industry safety, quality assurance, supply chain management

1 INTRODUCTION

Bertelsen and Koskela (2002) conceptualize production from three views: transformation, flow and value generation (TFV), with the crucial contribution from the theory being "its attention to modelling, designing, controlling and improving production from all these three points of view". Counterfeit, fraudulent or sub-standard (CFS) products threaten the whole production process, undermining all three elements alike. According to Howell (1999), some of the essential features of lean construction are to optimize the delivery process, maximizing performance for the customer at the project level, design of product and process, and the application of production control throughout the life of the product from design to delivery. Engebø et al. (2016) points out that counterfeit materials can threaten lean delivery of projects, and uses assorted steel products as an example. The essential features of counterfeit, sub-standard or fraudulent (CFS) steel products in

¹ MSc Student, Department of Civil and Environmental Engineering, NTNU- Norwegian University of Science and Technology, Trondheim, Norway. nkjesbu@gmail.com +4799582750

² Research Assistant, Department of Civil and Environmental Engineering, NTNU – Norwegian University of Science and Technology, Trondheim, Norway. atle.engebø@ntnu.no

³ Associate Professor, Department of Civil and Environmental Engineering, NTNU – Norwegian University of Science and Technology, Trondheim, Norway. ola.ladre@ntnu.no

⁴ Research Scientist, Department of Civil and Environmental Engineering, NTNU – Norwegian University of Science and Technology/Klima 2050, Trondheim, Norway. jardar.lohne@ntnu.no

Norway are though not fully explored. Equally, in the international research literature, little can be found concerning such products. Simultaneously, there are examples of both unethical and unlawful conduct in the Norwegian construction industry (Lohne et al., 2017). Therefore, this article will examine the presence of CFS steel products in the Norwegian construction industry. The research questions addressed are the following:

- 1) Do CFS steel products exist in the Norwegian construction industry?
- 2) Which key characteristics of the construction industry make it especially vulnerable to these materials?

Because steel products are under an extensive control regime, it is here defined that a breach with the CE marking (compulsory for steel construction products), implies that a product can be CFS. Because of that, the CE regime and the legislations around steel products are investigated in this article. The analysis is limited to load-bearing steel products.

2 METHODOLOGY

In order to investigate the research questions, a literature review related to steel, certificates and laws in the construction industry, a survey on CFS materials, and three semi-structured interviews were carried out. Additionally, a literature review on the characteristics of the construction industry was conducted.

After the literature review on characteristics – limited to research articles on the construction industry – a survey was conducted with different stakeholders in the industry. The survey questions were based on interviews previously done by the Construction Industry Institute (CII) (Minchin et al. 2014). The questions specifically targeted routines for quality control, and experiences with “fake materials”, which in this case was used to describe CFS materials. Although the survey did not specifically target steel, it provided valuable information about the phenomena in general. The survey was done as an online questionnaire, and was sent out to stakeholders in the industry in two rounds. In the first round, 33 possible respondents were contacted. In the second round, it was sent to 44 new possible respondents. In both rounds, the stakeholders who did not respond during the first week received a reminder. In total, 20 respondents answered the survey.

Three semi-structured interviews with senior professionals within the Norwegian industry (producer, purchaser and non-governmental certification parties) were carried out to supplement the findings in the survey. A common interview guide was developed and sent to the interviewees before the interviews. In addition to the questions listed in the interview guide, follow up questions were asked and other subjects were discussed when initiated by the interviewees, just as suggested by Yin (2013). The interviews were conducted at the offices of the interviewees, and the conversations were taped using a voice recorder application. Afterwards, the interviewees were allowed to read through the respective transcripts and comment any misunderstandings. Because of the nature of the topic researched, the interviewees have been anonymised in this article.

3 THEORETICAL FRAMEWORK

3.1 Counterfeit, fraudulent and sub-standard materials (CFS)

The following sub-chapter investigates some laws and regulations relevant to construction materials. It is essential to investigate this because of the definition of CFS materials previously given. Koskela (1992) investigates the 11 important principles for flow process

design and improvement. One of these principles is reducing variability, something that is highly related to material quality.

Actors within the Norwegian construction industry are bound to follow the “Regulation on the documentation of construction products” (In Norwegian: Forskrift om dokumentasjon av byggevarer, hereafter called DOK) (Norwegian Building Authority undated³) DOK includes regulations and rules about the documentation of products for use in the construction industry. DOK states that “CE-marking applies to those construction products where there exists a harmonised standard, or where the producer has chosen to have made a European technical assessment of the product.” (Directorate for Building Quality, undated¹). For manufactured steel constructions, the standard NS-EN 1090 is the harmonised standard that applies (Norwegian Steel Association, undated³) NS-EN 1090 consists of three parts, with two of them being relevant for steel products. Part one outlines the requirements for the conformity assessment, and part two provides the technical requirements for steel products.

A declaration of performance is obligatory for products covered by a harmonised standard (Directorate for Building Quality, 2016b). A declaration of performance describes the characteristics and use of the product (Directorate for Building Quality, 2016b). Further, there are ten different requirements that should be stated. Six of them are obligatory: tolerances on dimensions and shape, weldability, fracture toughness, the characteristics of the material when exposed to fire, hazardous elements and durability. In addition, the load bearing capacity, fatigue strength, resistance to fire and deformation should be declared (Directorate for Building Quality, undated²) (Norwegian Steel Association, 2016).

The municipality administration is responsible for issuing a certificate of completion before the building or construction can be used. In “Byggesaksforskriften (SAK10)”, The Directorate for Building Quality states that before the construction or building can be used, a certificate must be given. The municipality must issue the certificate within three weeks (Directorate for Building Quality, 2016a). If a building is proven to be using non CE-marked products, the municipality authorities could refuse to issue the certificate of completion until the material or component has been replaced (Norwegian Steel Association, undated¹)

3.2 Characteristics of the construction industry

Ballard and Howell (1998) draw similarities between the construction industry and other manufacturing industries. They especially talk about three characteristics of the construction industry; temporality, uniqueness and on-site production. These characteristics are also investigated by Vrijhoef and Koskela (2005). They look at three fundamental characteristics, which they call site-production, temporary production organisation and one-of-a-kind product. The characteristics in table 1 are a summary of the characteristics found in the literature review. They also include characteristics mentioned by Thomassen (2004) and Dubois and Gadde (2012).

Table 1: Characteristics of the construction industry

Source	Characteristics
Dubois and Gadde (2012)	Focus on single project, local adjustment, utilization of standardised parts, competitive tendering, marked-based exchange, multiple roles
Thomassen (2004)	Fragmentation due to many small (and often subcontracting firms), separation of design and coordination from production, highly interdependent activities, poor communication and coordination, sector troubled by low quality, late delivery and overspending
Ballard and Howell (1998)	Temporality, uniqueness, on-site production
Vrijhoef and Koskela	Site-production, temporary production organisation, one-of-a-kind product

Although all of these characteristics seem applicable to the industry, three fundamental characteristics are standing out: temporality, uniqueness and on-site production. These will be emphasised on in this article.

To complement these characteristics, it is also useful to note one peculiarity of the Norwegian society itself. It tends to, in general, have a higher trust than other countries. The World Values Survey (2005-2008) has published data from different countries, including Norway, Germany, Spain and Turkey. Table 2 shows results from the question; “Generally speaking, would you say that most people can be trusted or that you need to be very careful in dealing with people?”. (World Values Survey, 2005-2009) As can be observed, Norway stands out as a very high-trusting society.

Table 2: Data from The World Values Survey wave 5: 2005-2009 Question V23

	Norway (N=1,025)	Germany (N=2,064)	Spain (N=1,200)	Turkey (N=1,346)
Most people can be trusted	73.7 %	33.8 %	19.8 %	4.8 %
Need to be very careful	25.7 %	57.9 %	78.9 %	94.6 %

Lichtig (2006) discusses the “five big ideas” of lean project delivery. One of these is to increase relatedness among all project participants, which involves that participants must develop relationship between each other based on trust. The risk of CSF materials must be seen as a threat to a trusting relationship between actors.

4 RESULTS

4.1 Do counterfeit, fraudulent and sub-standard (CFS) steel products exist in the Norwegian construction industry?

Not much research on the occurrence of CFS materials in the Norwegian construction industry has been identified. The 2016 survey did, however, revealed such occurrence or perceived occurrence. As can be seen in figure 1, 53,0 % of the respondents (9 out of the

17 that responded to the question) believed that fake materials are a threat to the construction industry to a high or very high degree.

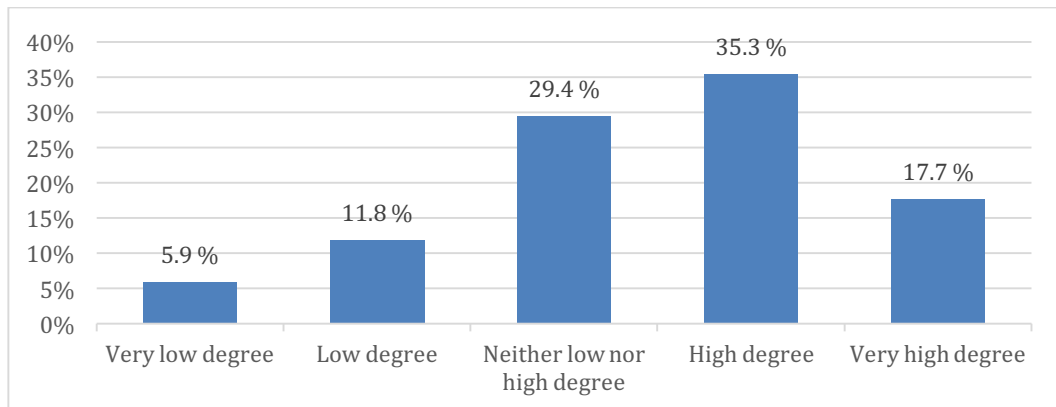


Figure 1 Q4: To what degree do you believe that fake materials are a threat to the construction industry?

Question nine was about the occurrence of such materials in the industry. Out of 17 responding, four people or 23,5 % answered yes to the question, as seen in figure 2.

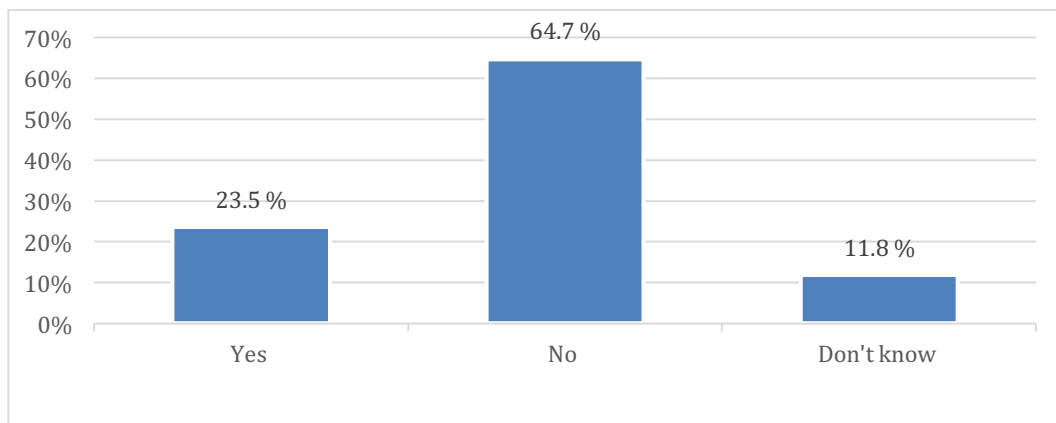


Figure 2 Q9: Have you heard (from what you consider to be credible sources) that someone was exposed to fake materials on a project you did not work on?

To uncover what kind of control functions the respondents of the survey used, they were asked about their quality control of materials. The responds indicated that although some had control procedures at reception, others had “as good as none”. The answers did not state the extensiveness of the control procedures, or whether it included inspections or just document control.

One of the questions addressed whether the respondents perceived that the problem with “fake materials” was increasing or decreasing. Out of the eight, three believed that the problem was increasing, three believed that it was neither increasing nor decreasing and the final two did not know. None of the respondents believed that the problem was decreasing. In the semi-structured interviews, the interviewees were asked about the occurrence of fake materials. One of the respondents had experience with sub-standard steel products delivered to them: *“I have one case where we (...) received a steel product that (...) we later received information (about) from the Directorate for Building Quality that the certificates that were attached to the item most likely were fake or were not correct.”*

A foreign producer had delivered steel to their wholesaler, and it turned out afterwards that the producer delivering the goods was not approved for issuing the certificates. The steel was already in place in a building, and was a part of a load bearing system. The problem got to be known by the producer because they were contacted by authorities. *“We got to localise where (the steel) was, what kind of loads it was exposed to and et cetera, and then nothing more became of the matter after we sent over the documentation and what we had (...)”*

The other interviewees did not suspect any CFS steel products on projects they had worked on. All of the interviewees had, however, heard of other projects with CFS steel materials. While one had heard about a problematic delivery, the two others had heard about specific cases with sub-standard steel. These specific cases involved sub-standard items:

“I know of a project in (name of place in Norway) somewhere where there was delivered steel from a foreign steel supplier (...), one steel quality was described, and it was delivered with a different steel quality.(...) There was described a higher steel quality than what was delivered.”

“I haven’t been in touch with materials where fake steel products were in a project (...), what I have heard from others is that materials that have been imported from China among other things have not had the carbon equivalent that is declared in the material, meaning that it was incorrectly alloyed. (...) And that is very serious.”

All the interviewees believed there was some risk of fake steel products existing in the Norwegian construction industry: *“Yes, I think it does (exist), but I don’t think it is... I think it’s the exception more than the rule (...) So luckily, and we should be happy about, I don’t think it’s a big problem, but (it is true) that it exists and that there are serious consequences if something happens”.*

4.2 Which key characteristics of the construction industry make it especially vulnerable to these materials?

The interviewees were asked directly which characteristics they thought made the industry vulnerable to these materials. One of the issues discussed was the accessibility of the industry:

“(...) very little is required to start a company in the construction industry. You can just buy yourself a pickup truck and a hammer and you’re started, right. So it’s an industry that has been familiar with a lot of ”cowboy-business”.

The trust in the industry was also emphasised. One of the respondents pointed at the combination of trust and a certain lack of control:

“Maybe we’re not naïve, but we (...) trust the papers that arrive. And when we never do a third party assessment or a third party control, it is, what can you say, you can’t say a bad characteristic, but an absent requirement in the construction industry. So we could wish that there be more control.”

The certain lack of control was also discussed by another respondent:

“I think the possibility for being caught (by the municipality or the authorities) is disappearingly low. And it is like with everything else: If you’re not controlled, it’s easy to cut a corner or drive too fast. So I think it’s important that the authorities do a lot more controls.”

“If no one asks those questions, we will never uncover anything. Then everyone think that everything is in order. You have the papers. You have the product. It is welded up and assembled. And everyone is happy.”

5 DISCUSSION

The findings provide evidence for the existence of CFS steel materials in Norwegian construction projects. When asked about whether they thought that fake steel products exist in Norwegian construction sites, the respondents answered that they did think so, but they were not sure about how wide-spread it is. Although these responses could imply that the problem is not widespread, the interviewees underlined the graveness of the potential problem, and the importance of it being mitigated. The survey supports the idea that the problem is increasing.

The data presents two main characteristics that allow for the entrance of CFS materials. The first is the industry being easily accessible to temporary and dishonest actors. It is easy to establish a company and join the industry, which is quite unique compared to other industries such as offshore or aviation. This characteristic can be linked to two of the fundamental characteristics of the construction industry; the uniqueness of the product and the temporality of the projects. The temporary and dishonest actors can move between projects, close down business and start up again, and move over large distances and projects.

The second characteristic is the high degree of trust combined with a certain lack of coordinated control measures within the industry. The findings indicate that both the industry and the government have a high degree of trust in the certificates issued. It is not common to do material-testing on deliveries, instead a document control is preferred. The high degree of trust and lack of control can be linked to one of the central characteristics of the construction industry; on-site production.

6 CONCLUSION

From the interviews and the survey, there seems to be evidence for the existence of CFS steel products in the Norwegian construction industry. The survey also revealed that the respondents believe that the problems with “fake materials” are increasing. From the literature, three fundamental characteristics of the industry were mentioned. These were uniqueness, temporality and on-site production. According to the findings, it can be deduced that there are two important characteristics of the industry that render it vulnerable, the industry being accessible to temporary and dishonest actors, and a high degree of trust combined with a certain lack of control. These can in turn be linked to the three fundamental characteristics of the industry. Further work including more interviews with stakeholders in the industry can result in recommendations for countermeasures against the use of these materials. It would also be interesting to see if the same problems exist with other steel products and materials.

7 REFERENCES

- Ballard, G. & Howell, G., (1998) *What kind of Production is Construction?* Proceedings IGLC '98
- Bertelsen, S. & Koskela, L., (2002) *Managing the three aspects of production in construction* 10th annual conference in the International Group for Lean Construction, Gramado, Brazil, 2002
- Dubois & Gadde, (2012) *The construction industry as a loosely coupled system: implications for productivity and innovation* Construction Management And Economics Vol. 20 , Iss. 7,2002

- Engebø, A. , Lohne, J. , Rønn, P.E. & Lædre, O. (2016), *Counterfeit Materials in the Norwegian AEC-Industry* 24th Annual Conference of the International Group for Lean Construction. Boston, USA, 20-22 Jul 2016
- Howell, G. (1999) *What is lean construction* Proceedings 7th Annual Conference of the International Group for Lean Construction, Berkeley, CA, July 26-28, pp. 1-10
- Koskela, Lauri (1992) *Application of the New Production Philosophy to Construction* Stanford University
- Lohne, J., Svalestuen, F., Knotten V., Drevland, F.O., Lædre, O. (2017) *Ethical behaviour in the designphase of AEC projects* International Journal of Managing Projects in Business, Vol. 10 Iss 2
- Lichtig, William, A. (2006) *The Integrated Agreement for Lean Project Delivery* Construction Lawyer vol 26, American Bar Association
- Minchin, E., Walters, R. and Pan, J., (2014) *Product Integrity Concerns in Low-cost Sourcing Countries: Counterfeiting within the Construction Industry* Construction Industry Institute .
- Directorate for Building Quality, 2016a. *Byggesaksforskriften (SAK10) Kapittel 8 Ferdigstillelse*. [Online] Available at: <https://dibk.no/byggeregler/sak/2/8/innledning/>
- Directorate for Building Quality, 2016b. *Spørsmål og svar om byggevarer*. [Online] Available at: <https://dibk.no/produkter-til-byggverk/sporsmal-og-svar-om-byggevarer/>
- Directorate for Building Quality, (undated1) *Forskrift om dokumentasjon av byggevarer (DOK)*. [Online] Available at: <https://dibk.no/byggeregler/dok/>
- Directorate for Building Quality, (undated2) *Informasjon om prefabrikkerte stålkonstruksjoner EN1090-1*. [Online] Available at: https://dibk.no/globalassets/byggvareinfo1/prefabrikkerte_stalkonstruksjoner-en1090-1.pdf?amp;epslanguage=no
- Directorate for Building Quality, (undated3) *Veiledning om omsetning og dokumentasjon av produkter til byggverk*. [Online] Available at: <https://dibk.no/byggeregler/dok/>
- Norwegian Steel Association (2016) *Innføring i NS-EN 1090 del 1 og del 2*. Material from a course on controls at the construction site held by the Norwegian Steel Association
- Norwegian Steel Association, (undated1) *6. Byggherrens, hovedentreprenørens og underentreprenørens ansvar* [Online] Available at: http://www.en1090.no/byggherrens_og_hovedentreprenorens_ansvar.htm
- Norwegian Steel Association (undated2) *3. CE-merking av stålkonstruksjoner*. [Online] Available at: http://www.en1090.no/CE_merking_av_stalkonstruksjoner.htm
- Thomassen, M. A., (2004) *The economic organisation of building processes - On specialisation and coordination in interfirm relations* Report BYG DTU - Technical University of Denmark
- Vrijhoef, R. & Koskela, L., (2005) *Revisiting the three peculiarities of production in construction*. 13th International Group for Lean Construction Conference., 19-21 July 2005, Sydney, Australia
- Yin, Robert K. (2013) *Case study research: Design and methods*, Sage publications
- World Values Survey Wave 5 2005-2008 Official Aggregate v.20140429. World Values Survey Association (www.worldvaluessurvey.org). Aggregate File Producer: Asep/JDS, Madrid SPAIN.