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Risk evaluation in Fira Oy

Current practices and future measures

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<p>The aim of this Bachelor thesis was to investigate hinders workers from taking part in risk evaluation of their own jobsite, and where information about safety stops in the chain of command. To investigate this a large amount of interviews was conducted with different players in the construction field.</p> <p>The solution is found to be a combination of complex command lines, and attitudes formed by culture, and the companies' differences of interests. To combat the differences a more diligent management philosophy has to be implemented. This is required to reduce the number of accidents and to provide the main contractor with documentation in case an accident does occur.</p>	
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Contents

1	Introduction	1
2	Statistics	2
3	Job site safety legislation	4
3.1	Decree on the safety of construction work 205/2009	5
3.2	The different levels of construction according to the law	8
4	Sub-contractor	8
5	Management styles/leadership styles/philosophies	10
6	Lean management	12
7	Fira's organization	13
7.1	Chain of information and command	13
8	Results in practice in Fira	14
9	Fira's current job site safety measures	15
10	Information break	16
10.1	Construction site consequences	17
11	Comparison with other countries - Norway Vedal	18
12	Hinders to job site safety	19
12.1	Cost	19
12.2	Attitude	20
12.3	Inconsistent demands in the business	20
12.4	Knowledge	21
12.5	Work left unplanned	21
12.6	The language barrier	22
13	Measures	22

13.1	Procurement phase	23
13.2	Contract meeting	23
13.3	Start-up meeting	24
13.4	During the construction work	24
13.5	The role of job site introductions	25
13.6	Repercussions in case of safety breaches	26
14	Management of implementation	27
15	Challenges in implementation	27
16	Conclusion	29
	References	31

1 Introduction

Fira is a construction company that makes 30 - 60 contracts for every construction site. For the daughter company, Fira Palvelut, the number is a bit smaller, but it is still a considerable amount. Currently Fira and Fira Palvelut together have about 40 construction sites. The total number of contracts is between 1200 and 2400 contracts every year. On top of this come the contracts that the contractors make with sub-contractors. Every contract represents at least one task that is to be executed.

The risk evaluation in these jobs is currently mainly done by talking to the manager of the company that does the job. Fira's manager talks to the manager of the company and they agree on the safety procedures that need to be implemented. Alternatively, no written risk evaluation is done at all. Since there is no written documentation of the risk, evaluation management and leadership of the risks on the job sites is close to impossible.

This thesis aims to find a solution to at least part of this problem. How do we make sure that the risk evaluation and knowledge about job specific risks reach the workers actually doing the job? Also where does the knowledge about risk stop in the chain of contractors?

Fira as a company believes that the only logical starting point in construction is people. People should according to Fira's philosophy be the basis for construction as they are the end users of the building. It is also people that design and construct a building. That makes their input important and buildings are, in Fira's opinion, better because of it. Fira's core values are trust, transparency and caring. These come into view with a strong focus on digital construction and client participation. Fira have their own group of engineers dedicated specially to customer contact called a service engineer. In 2015, Fira had a turnover of about 130 million euros. (1.)

2 Statistics

The number of occupational accidents has been steadily decreasing in Finland since the beginning of the 1990's. In 1993 there were 3.5 deaths per 100 000 employees. In 2013 the number had been reduced to 0.8 deaths per 100 000 employees. This is a significant reduction in deaths and a very desirable development. (2.)



Figure 1: The graph shows deaths per 100 000 employees in Finland from 1993 to 2013. (2.)

The amount of accidents is still large however. The number of accidents requiring sick leave in 2013 was 64, 916. The number requiring 4 days or more was 47, 432. The share of the construction field was 28 per cent, making it the second most accident prone area of employment after courier services and postal distribution. (3)

In construction, most accidents happen to men. 16 % of the accidents in Finnish working life happened to men in construction, and a mere 0.8 % were sustained by women in the same field. The number of accidents were 4332 accidents sustained by men and 102 by women. This also reflects the number of male and female employees in the field, as far more men than women are working in construction. (3.)

Most accidents in Finnish working life are the result of slipping, falling or jumping. The second biggest category is sudden physical workload, and the third is handling of sharp objects. All of these activities are present on construction sites, and to a large degree. (3.) Great Britain has the best statistics when it comes to deaths in working life in Europe. They have a record of 1 death per million working hours in construction as compared with 1.3 in Finland (4). With Great Britain having a much larger population than Finland, comparing actual numbers of accidents is not a very good method.

Reported accidents that caused sick leave in Norway 2014

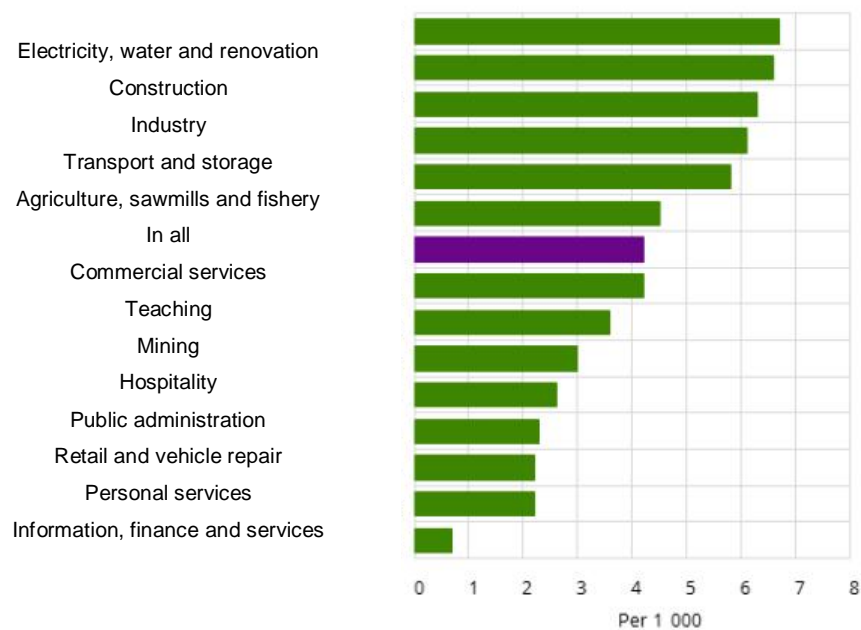


Figure 1 *Accidents that caused sick leave in Norway in 2014*

Norway, however, has a similar population and a similar sized construction area as Finland. Like Finland, the construction field is second in accident frequency, but in Norway, the field electricity water and renovation tops the statistics, not postal distribution and courier distribution. The reporting method is slightly different, as Norway uses accidents per thousand working hours as their measurement. In 2014, they registered 6.5 accidents per 1000 hours. Converted to millions, this equates to 6,500 accidents per million working hours. From these statistics Finland seem to be the better of the two.(5.)

If we compare the Eurostat numbers for both countries the picture changes dramatically. Here Norway's numbers are smaller than Finland's with 11,000 and 35,000, respectively.

This is diametrically different to the numbers from the national databases. Finland's numbers are slightly smaller and Norway's are reduced by two thirds. (6.)

Table 1 Non-Fatal accidents in construction

Non-fatal accidents at work by economic activity and sex
 Last update: 02-03-2016
 Table Customization [show](#)

TIME: [] + GEO: [] +
 Classification of economic activities - NACE Rev.2: [] + Sex: [] +
 Agriculture, industry and construction (except mining), services of the business econo: [] +

GEO	2008	2009	2010	2011	2012	2013
Bulgaria	2,437	1,961	1,800	1,748	1,768	1,662
Czech Republic	89,549	58,100	56,875	37,036	36,028	38,015
Denmark	47,876	37,725	37,393	34,333	34,245	32,868
Germany (until 1990 former	781,673	698,070	761,280	747,560	709,940	721,866
Estonia	6,567	4,255	4,756	5,145	4,993	5,363
Ireland	12,967	7,751	11,422	11,101	9,794	13,444
Greece	23,134	18,725	14,594	12,617	10,065	8,708
Spain	590,989	441,616	401,386	363,510	281,045	273,983
France	523,230	474,825	473,299	483,476	461,376	440,424
Croatia	:	:	9,356	10,875	8,844	8,925
Italy	399,689	383,274	362,385	321,084	274,040	269,629
Cyprus	2,127	1,960	1,913	1,747	1,511	1,301
Latvia	1,352	872	902	1,050	1,213	1,376
Lithuania	2,650	1,640	1,828	2,155	2,303	2,497
Luxembourg	7,056	5,895	6,133	6,320	6,299	6,117
Hungary	19,291	15,326	16,326	14,277	16,717	15,401
Malta	2,791	2,413	2,375	2,121	2,190	2,225
Netherlands	127,200	106,439	125,772	119,941	116,029	108,097
Austria	66,528	57,715	60,668	58,253	56,299	54,445
Poland	78,816	62,721	67,359	69,352	67,472	59,877
Portugal	145,666	133,100	124,738	121,730	109,511	107,086
Romania	4,040	3,020	3,201	2,810	2,889	3,091
Slovenia	17,314	14,361	13,637	12,449	11,505	10,136
Slovakia	10,598	8,112	8,102	7,734	7,469	7,471
Finland	44,737	34,316	35,741	40,302	34,821	35,532
Sweden	24,732	21,464	23,543	24,089	24,864	24,313
United Kingdom	183,598	169,043	159,404	156,416	143,171	159,893
Iceland	:	:	:	:	1,063	:
Norway	31,728	29,723	21,840	14,855	24,395	11,715
Switzerland	63,530	64,741	67,502	71,770	72,106	72,995

3 Job site safety legislation

Job site safety in Finland is governed by the Occupational health and safety act (738/2002) (7). This act is applicable for work executed in a service relationship, meaning a relationship defined according to private law (§2) (7). The laws purpose is found in the first section:

“The objectives of this Act are to improve the working environment and working conditions in order to ensure and maintain the working capacity of employees as well as to prevent occupational accidents and diseases and eliminate other hazards from work and the working environment to the physical and mental health, hereinafter referred to as health, of employees. (7.)

Section 3 in the act establishes that the act is applicable if one uses hired worker just as much as if one uses one's own workers. Just as with one's own workers the employer has

the responsibility to check that the worker has the necessary competence to execute the work before the laborer starts working. (8).

The job occupational health and safety act works as an umbrella legislation and covers all branches of work in Finland. To govern specific branches and even areas of branches the government decides on a government decree for each branch. The aim of the decree is to clarify the responsibilities of each party in every specific branch. This is not restricted to safety in any way, nor is it restricted to working relationships. The government uses decrees to clarify the law in a specific field. There are decrees for most branches and areas. There is for example a decree for how much force the police can use (245/2015). (9.)

3.1 Decree on the safety of construction work 205/2009

The decree regulating jobsite safety is the government decree on safety of construction work (205/2009). The first paragraph outlines the decrees area of validity.

This Decree is applied to construction, renovation and maintenance of buildings or other structures on or underground or in water, as well as to installation, demolition, earthwork, hydraulic engineering and construction design in connection with such construction, renovation or maintenance. The Decree is also applied to the preparation and planning of a construction project concerning such work. (205/2009 §1). (10.)

The second paragraph defines the term common workplace and the different parties involved.

Shared construction site means a workplace where work referred to in section 1 is carried out and where more than one employer, or more than one self-employed worker, working in return for compensation, operate simultaneously or successively

Client means a person or organization initiating a construction project, or other actor that directs and supervises a construction project, or, where none of the above exist, the purchaser. (10).

Project supervisor means the main contractor appointed by the client, or an employer using the main authority, or where there is no such employer, the client. (10.)

This clarifies to a large degree the different participants in a construction project. The law then goes on to define the responsibilities of each party with regards to safety. Paragraph three gives a very clear picture of the responsibilities:

(1) In a construction project, the client, the designer, the employer and the self-employed worker must together and each for their part ensure that no danger arises from the work to those working at the construction site or other persons in the zone affected by the work. (2) The project supervisor must, through training and guidance, ensure that all those working at the shared construction site are sufficiently familiar with safe working practices and that they are familiar with the hazards and risks of the construction site in question and the measures required for eliminating them. (205/2009. §3). (9.)

The paragraph makes the responsibilities of all parties very clear. Everybody involved in a construction project has a responsibility both on their own and together to make sure safety on site is maintained. Every contractor is responsible to make sure the workers know the risks and danger on site, this is not the sole responsibility of the main contractor.

Chapter 2 of the decree establishes how to regard occupational safety and health on a construction site. It focuses on the management of the construction work and the competences that the different participants of the construction project need to possess. Section 5 states that every construction project shall have a safety coordinator appointed by the builder. The safety coordinator needs to have sufficient competences according to the project demands, and is, together with the main contractor responsible for making sure the demands in section 5-9 in the decree are adhered to.

Section 8 and section 9 deal with documentation and this it's required updating. In section 8 the decree establishes that there needs to be a document that explains and identifies the risks in the construction work. The builder then has to make written instructions for the construction work and for how the risks are to be minimized and avoided. Scheduling is one of the factors that need to be taken into account here. Section 9 states that the documents mentioned in paragraph 8 have to be kept up to date. If the builder does not have sufficient competence to make the required plans he is to give the task to an external party that possesses this competence (9).

Paragraph 10 and 11 are aimed at the main contractor. Section 10 states that the main contractor is to provide the builder with safety plans. Before work commences he is to make written plans for how to identify and minimize risk and dangers at the construction site. Risks are to be eliminated, and if they cannot be eliminated, their effect on the working environment are to be evaluated. The documents that are created are to be updated

continuously as the project progresses. Special consideration is to be given to the following areas:

Office, personnel and storage space locations

Position/placement of cranes, machines and other large tools

Placement/storage of filling masses

Location of loading docks for construction materials

In the event of element construction, the carrying capacity and stability of the ground on the lifting areas, the cranes lifting radiuses and capacities, and the view of the crane driver

Traffic on the construction site and the connection to civilian traffic

Connection and transport roads and their maintenance

Order on site and reduction of dust

Gathering, storage, expropriation and destruction of goods that are dangerous to human health

Fire safety

Location and fencing of areas for storage, especially when dangerous goods are stored. (9.)

The safety plans are to be written and updated continuously as the project evolves. Section 3 looks at the construction phase and the responsibilities of the main contractor in this phase. The main contractor is to appoint a main responsible manager for the execution of the project. He is to be responsible for the project for as long as it lasts, and is responsible for the demands put upon the main contractor. Paragraph 13 states that the plans mentioned in paragraph 10 and 11 are to be updated continuously, and adhered to. The main contractor is to inform the builder about any changes, to follow the safety standards and to make sure that at no point are the workers submitted to unknown risks. (9.)

The remaining part of the decree looks at specific parts of construction work, such as crane locations, dust control and ergonomics. They are a necessary consequence of adhering to the main factors and plans in this chapter (9).

3.2 The different levels of construction according to the law

The law clearly divides the safety into three different spheres. The first and outermost sphere is the company and management level. The second sphere is the project specific level. The third sphere is the construction site specific level. The company and management level is discussed in the second chapter of the decree on job site safety in construction work. According to the law the builder needs to have personnel with sufficient skill to ensure the safety in a construction project. The company needs to have sufficient plans for job site safety in place before the project starts, as well as making sure safety is ensured during the project.

The two innermost levels are directly related to the main contractor. On a company level the main contractor is responsible for making plans regarding safety on the site. These are to be maintained, and reported to the builder. The organization from the main contractor on site is to have sufficient knowledge and have one responsible person in charge at all times

On a construction site the main contractor is to have plans in place to ensure the safety of the workers and the plans are to be updated whenever this for any reason would be required. These plans have to cover every aspect that might cause harm or injury or other events that might be unfavorable for the workers on site.

The workers have the responsibility to report safety issues to the leadership on site without delay. They are also responsible in case safety remedies have to be removed to perform a job, that they are replaced as soon as the job is completed. Failure to do so can cause later legal action against them, even if such occurrences in recent times are very rare. (9.)

4 Sub-contractor

A sub-contractor is hired to do work for the main contractor. In the case of Fira, sub-contractors are performing all the physical construction work on a project. The project

management sends out a request for tender and companies answer this tender. The tender includes the quality demands and schedule as well as the amount of work and materials that are required.

When the sub-contractor has been chosen he is invited to a contract negotiation meeting. Here the job is gone through again together with the site management. Here the contract is gone through in detail and signed.

At the day agreed in the contract meeting, the sub-contractor comes for a start-up meeting. In the start-up meeting the job is gone through in even more detail. The schedule is locked for specific weeks. The materials are gone through and the quality demands are established together with the solutions required to meet these. The command lines are clarified and the safety demands together with the rest of Fira's specific requirements are shown and have to be accepted before the job starts. The next step is the start of the job, where the sub-contractor's workers arrive to start on-site work (interview 1).

The sub-contractor can have his own sub-contractors execute part of or in some cases the whole job on his behalf. These sub-contractors have no affiliation with Fira contract wise, but Fira is responsible for their safety on site. With this follows that they have to be given the general job site introduction, as well as the specific demands the job entails with regards to safety and quality.

From Fira's point of view there are several challenges with the use of this type of contractors. One is the lack of authority from Fira in regard to the contractor. The sub sub-contractor answers to his contractor, and not to Fira. This makes the command chain longer and less clear. Even though Fira has the final say in how a job should be executed on site, commands and demands have to be given through the contractor that has a contract with Fira. The exception from this are the demands that are universal for the whole site, such as safety demands and requirements (Interviews 1 and 2.)

Another issue with the use of sub sub-contractors is the unclear working environment that it creates. In an average sized Fira construction site there are, as mentioned above, about 40-60 contracts made, and if each of them has two sub sub-contractors the total amount of contractors reaches a staggering total of up to 180. This also means that the number of

managers and organizations to be dealt with grows similarly. This makes management of the site comparably more difficult.

5 Management styles/leadership styles/philosophies

With a few exceptions all of Fira's jobsite personnel are managers. Even though they do

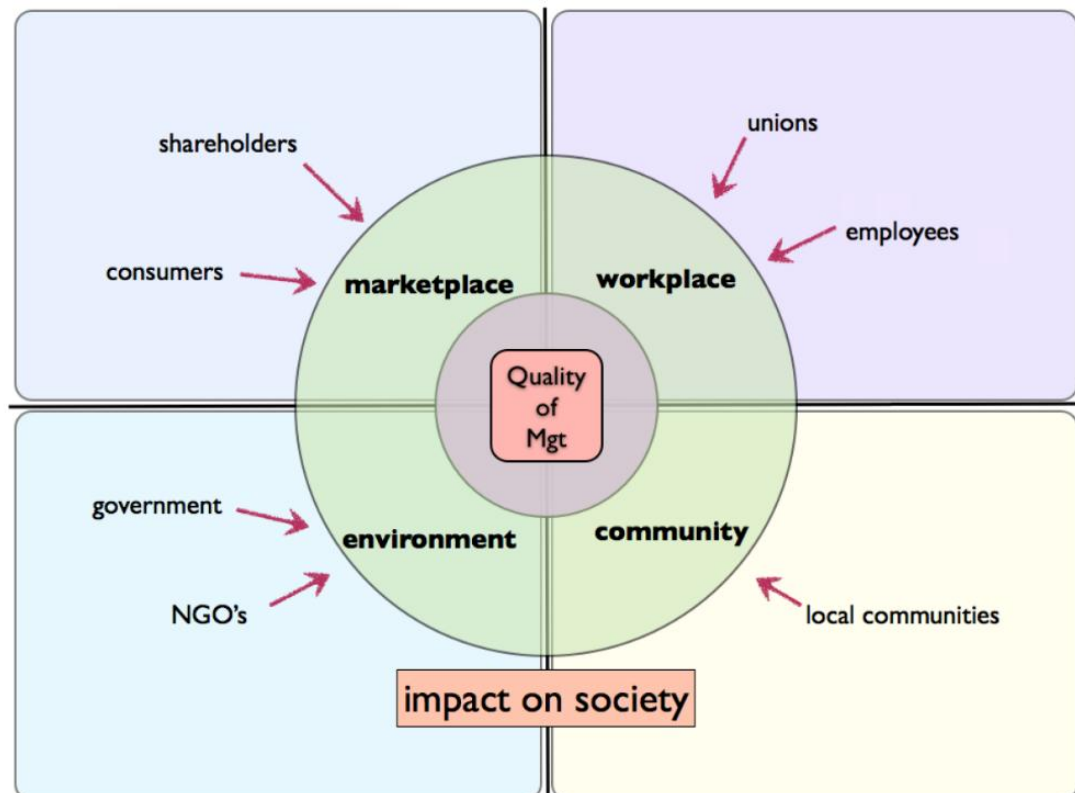


Figure 3 *Who is affected by management styles, according to Sarah Simpson (10)*

not have responsibility for their own workers, they are the ones that make decisions that directly affect the workers on the site. Implementing a safety culture is difficult because the ones that in the end have to make the actual decisions on site are not part of Fira's organization, but are still under Fira's management as long and whenever they are at Fira's jobsite. Fira's management's commands as such does not only have to trickle through to their own managers, but further past the sub-contractors leaders and down to the workers on site executing a job. (10.)

Even though the safety process affects all levels of the organization from procurement to worker, the major workload will still be on the job site managers and possibly to a certain degree on the site engineers. It is therefore beneficial to look at what management styles are currently being employed and which management styles could be employed on an organizational level and on an individual level to make the safety message go through to the last employee and with as little friction as possible (interview 3).

Looking at Fira's public profile, it is a company that gives the message that the client is important. Their working methods also imply that the client and end user are in focus on their projects. These methods include amongst others what is known as Bigroom meetings. In a Bigroom meeting all the designers, representatives of the jobsite personnel and representatives from the client are present. The company can as such be said to have an ethical management philosophy, where Corporate Social Responsibility is a part of it. This implies that the company has its own ethical standards that it complies with. Visibility, care and trust certainly are values that could be classed as ethical standards. (10.)

Part of an ethical leadership is a stakeholder analysis that would look at all the stakeholders in the organization and analyzes the stakeholders and their impact on the business. Focus is on the safety aspect of the organization, and in particular the risk evaluation that is done on jobsites and accident prevention. The focus is then on employees, regulatory authorities and the own organization. (11.)

6 Lean management

Fira is committed to LEAN type management. This is a way of thinking about leadership that is different from earlier ways of thinking leadership in the construction industry. It influences the onsite and offsite leadership philosophies of companies. The term LEAN management first used in the 1980's, to describe Toyota motor company's management philosophy. The philosophy is suited to Fira's core values of trust and responsibility. (13.)



Figure 4 Who is affected by management and is are stakeholder in the management philosophy, according to Sarah Simpson. (10.)

It's more a way of thinking than an actual management style. The effects of lean managements might therefore be different in different companies and over different branches.

The core idea is to maximize production while minimizing waste. To achieve this every task in the production chain is evaluated and optimized. The employee is to be given sufficient time and resources to make production as efficient as possible. Maximum production and minimum waste is beneficial both to the environment and to the company's bottom line (12).

7 Fira's organization

Fira's organization is divided into three parts. The management group based in the office at Vantaa is the topmost level of the organization. The management group consists of the Chief Executive Officer, Head of Production, Head of Development, Head of Security and Safety and Chief Financial Officer.

Below the leader management group, there are the support functions. These are designed to support production on a construction site although they are not actually located on a construction site. They are located at the office in Vantaa, but visit construction sites whenever they are required there. The support functions also handle company level issues, such as company level finances. (Interview 4).

On the construction site there is the personnel responsible for the production of the actual construction product. Additionally there is the responsible foreman. His staff includes job site engineers and job site supervisors. The job site supervisors are responsible for following up the work that is ongoing on the construction site. Their tasks include checking the quality of the work and that it is performed according to specifications. It is also their responsibility to ensure that the work is performed according to the schedule, and that delays do not occur. The jobsite engineer is responsible for job site specific procurements, communication with external parties such as the city administration or public authorities. It is important to note that even though these responsibilities are delegated by Fira to the persons and roles in question, the responsibility according to law is still located with the responsible foreman (interview 4).

7.1 Chain of information and command

Information that is needed by workers on the worksite comes to Fira first, either from an external planner or entity, or as a directive from Fira itself. Somebody in Fira's organization, for example a site engineer or site supervisor on the construction site then either contacts the workers directly or their on-site manager. In case the manager is contacted, the manager will distribute the information to the workers (Interview 1). Figure 5 gives a basic schematic overview of how information normally flows on a construction site.

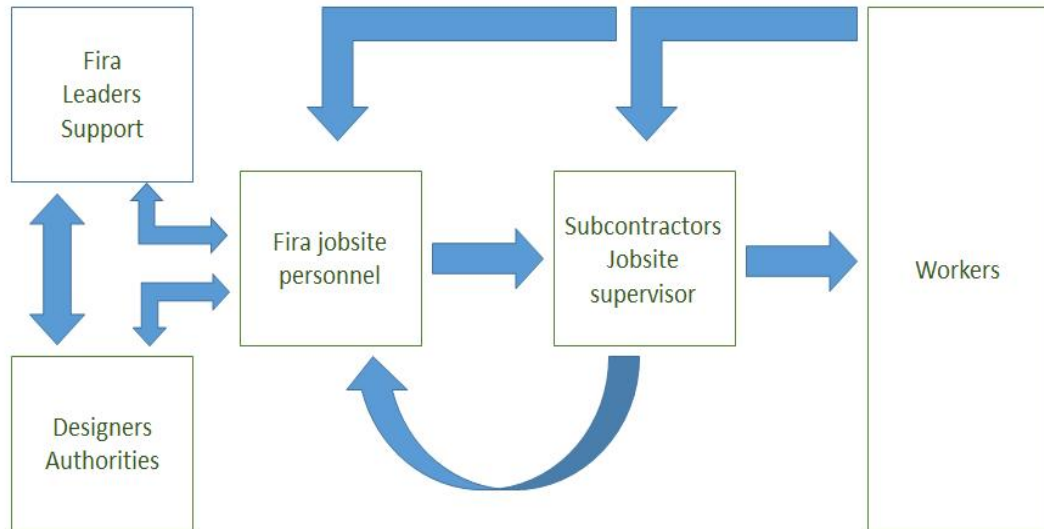


Figure 2 Command lines in a traditional job site organization.

Smaller pieces of information like details of an ongoing task are normally dealt with by talking to the workers directly. Larger pieces of information like scheduling issues or quality demands are given to the sub-contractor site supervisor for him pass it on to the workers. There are no guidelines for how the information flow should be dealt with, the solution is made on a case by case basis (interview 1, interview 3, interview 4).

When the workers have questions about their job, they will normally ask their direct supervisor for the information they require. If the information is not obtained there, they will ask Fira's on-site management. The exact distribution of how often they ask whom is not known, but it is clear that the workers will turn to the supervisor more often than Fira's management (interview 4).

8 Results in practice in Fira

In Fira, LEAN has resulted in specific ways of thinking and in routines that are set in place to increase efficiency and improve the working environment. On the construction sites they have introduced what is called the last planner meeting. This is a meeting where all the sub-contractor site supervisors and Fira's supervisors are present and they go through the schedule together. This allows for different sub-contractors to talk not only to Fira's supervisors but also to each other. Goals for the following week are set and the

previous week's goals are evaluated. The minutes are then written and presented in written form to all supervisors. This has received good feedback from all involved parties (interview 3).

The integration of LEAN to Fira's organization is not yet complete, and according to the basic idea of the philosophy it never will be. It is impossible to reach the end point as long as continued improvement is one of the core values of the philosophy. Continued improvement is important to make processes more efficient in the future. (interview 8.)

9 Fira's current job site safety measures

Fira has implemented many measures to improve the job site safety procedures and safety culture on site. Lean philosophy is the basis for some of these and the demands of the law are the basis for some. The main idea in both cases is to reduce the number of accidents and injuries on construction sites (Interview 1).

From the law it follows that all employees that work on a common construction site shall be introduced to the site's specific and general dangers. In addition, the main contractor is responsible to inform the workers of the general specifications of the site, such as where the showers are, where they can park and so on. In Fira, job site introductions are taken seriously and all workers are given a job site introduction. In some cases, it could probably be better and more thorough or even updated more regularly, but everybody is given a job site introduction with quality.

The law specifies that the main contractor is responsible to inspect the job site for safety concerns weekly. The area wide standard for this inspection is called a TR measurement. A TR measurement consists of six categories that are evaluated for the site. They are evaluated as approved or failed. At the end of the measurement a percentage value is obtained that shows how many mistakes there are on the sites. Everything over 95 % is seen as very good. TR measurements are performed on site every week, for all sites. The TR reports are then gathered in a database for further reference. The quality of these measurements is important and in Fira the measurements are taken seriously. When the

report is completed, the results are distributed to all sub-contractors and all of Fira's job site personnel.

Personal protection equipment is the responsibility of the employer, but according to the law the main contractor is responsible for making sure everybody on site wears the protective equipment whenever they are on the site. Fira's demands in this regard are stricter than the law demands, in that they require e.g. protection glasses at any given time on the construction site (interview 1).

Fira has implemented an electronic feedback system for reporting safety issues on site. This is a reporting system where everybody that has an email address can report safety issues on a construction site. The instructions on how to make a report are given at the general job site introduction. Any reports are then gathered in a common database, and evaluated by the chief safety and security officer. He then reports the concerns to the responsible site manager can then can fix the problem himself or delegate the responsibility to one of his site supervisors or a sub-contractors. The reports are logged and each site is measured according to how many reports that are received every week. In 2015 the requirement was at least one every week, amounting to over 2000 reports company wide. The requirement this year is minimum 2 per week that will take the number to over 4000 in the company.

All accidents on Fira's sites are to be reported to management and a report to be created. The report is to say what happened, why the accident occurred and what is to be done to avoid similar accidents in the future. The information is then published on Fira's internal web so that all members of the Fira community can see it, and take action on their own sites if required (interview 3).

10 Information break

Fira's demands and safety culture is, as established based on the law and the company's own philosophy. Still the information and the Fira's requirements does not in all cases reach the workers on site performing the work. This is true even when the information has been supplied to the sub-contractors site supervisors. The break in communication seems to occur between Fira's and the sub-contractors' organization.

The reason for this information break is hard to establish. In any case the break between two organizations causes a collision between two cultures. In a construction project these two cultures have a common goal, to get the job done according to specifications. But the organizational goal is fundamentally different. The sub-contractor answers to his own organization both financially and schedule wise. His association with Fira is momentary and not permanent. As long as this is the case, a common culture is impossible or at least very difficult to establish.

The risks of Fira and its subcontractors is fundamentally different. Fira's risk is related to the project and its completion. If the sub-contractor is late the project stands a risk of being delayed. The sub-contractor carries a similar risk of running late according to schedule, but his schedule is related to other than Fira's jobs. The risk is therefore different on a basic level (Interviews 1-6).

If accidents happen there is a personal risk to the responsible site manager and Fira's site manager. In addition, the sub-contractors site supervisor also carries a risk if something happens. The sub-contractor has the financial burden of somebody being hurt on the job as well, a risk that Fira does not carry. The cost of somebody being sidelined on a sick leave is considerable for a company. This should be a motivational factor to think about safety on the job site but does seem to reach only so far.

10.1 Construction site consequences

The fact that all the sub-contractors have their own management is as already established as concern above. In practice it means that management is not always available. Several sub-contractors have many construction sites ongoing at the same time, and the manager might be resolving an issue at another site when he would be needed at one of Fira's sites. This is a concern considering management and safety. An absent site manager will have problems assessing safety concerns as well as managing his workers, even in this age of cell phones and other digital communication means. The communication chain is momentarily broken and this leads to problems with Fira's management reporting to the workers and the other way around (interview 2).

11 Comparison with other countries - Norway Vedal

The following information is obtained by interviewing a Norwegian site Engineer at Vedal AS. Vedal is a medium sized construction company based in Oslo with a turnover of 2 000 000 000 kroners. This equates to about 220 million euros and makes the company roughly 1.7 times larger than Fira, measured in turnover. In Norway a lot of the inspiration with regards to job site safety has come from the oil industry. In the oil industry there is an absolute zero tolerance for accidents. Vedal's management is committed to safety on the jobsite and like in Finland the law is strict. In addition, the importance of a committed building owner is stressed. (Interview 9.)

The work with safety starts already in the project development phase where the constructor will be active in suggesting solutions that eliminate or reduce potentially dangerous lifts or processes. (Interview 9.)

Before a subcontractor starts work on a site, he has to deliver an analysis of the project he is to execute to the main contractor. This is called a Sikkerhet, Helse og arbeidsmiljøplan (SHA plan). This plan contains information about what is to be done, a map of the organization, a general risk analysis, safety measures, ergonomic measures, schedule and a reference area. This plan is project specific. It is required in the contract that this analysis is evaluated and presented for all the workers, and they have to sign the plan after it has been presented to them. This plan is to be presented to the site management and approved before the work starts. In addition, the riskier jobs that is to be done require a Sikker jobb analyse (SJA analyse), or a safe job analysis. The SJA is a risk analysis for the specific job that is to be executed. This could be for instance be difficult lifts, concrete element installation. The SJA is be added to the SHA plan. That has to list the risks that can occur during the work, and how it is to be avoided, and how likely they are to occur. The plan has to be presented to all the workers, and they have to sign that they have received the information. In addition, the site management has the right to be present when the plan is presented, to make sure it is done with quality. (Interview 9.)

Three TR measurements are done every week. They focus on the same areas the Finnish ones do. The major difference is that every other week the TR measurement is completed

together with the sub-contractors. This is done to ensure that the information from the TR measurement reaches the correct manager, and that they can fix the problem immediately. In addition, the goal is to make the sub-contractors feel more ownership towards the TR measurement. Sanctions towards workers that do not comply with the safety procedures are in place. At first they get a written warning. The next step is removal from site. There is no monetary sanction.

12 Hinders to job site safety

Some of the factors hindering construction site safety have been established through interviews. The factors mentioned here are not exclusive and there may be more. However, the ones mentioned are mentioned by both Rakennusteulisuus and site managers.

12.1 Cost

Cost is one reason given to not adhere to job site safety standards. Adhering to standards is evaluated as being expensive in many ways. One is time. By adhering to standards some managers feel that the work is not executed in an efficient manner. In this case the cost is estimated in time, and how much work can be done in a specific time. One of the factors influencing this is money, as more time means more money and in the end affects the total production of the company (Interview 4).

Another factor influencing the cost argument is tight schedules. Schedules are tight and can be demanding. In order to keep up with the schedules that the main contractors set to the sub-contractors have to be efficient and smart. Sometimes the sub-contractors feel they have to make shortcuts with regards to safety.

The cost of equipment may in some cases be one of the factors prohibiting safety on the construction site. Although the personal safety equipment is not expensive and in most cases available already, in some cases there is other equipment that need to be in place before work can be executed. This can be a telescopic lift for the attachment of harnesses during difficult builds for example. These machines are expensive to hire, and it might be

possible, but dangerous, to execute the job without it. The cost might then be to take and the work is done without the necessary equipment in place. (Interview 1).

12.2 Attitude

Finland has had a tradition for seeing the construction field as an area where accidents happen and that it is part of the job. The idiom “tekevälle sattuu”, roughly translates to doers get hurt, is used to describe this. Safety measures are seen as a hindrance to effective work. Often the “we have always done it like this and nothing has happened” argument is used when explaining why safety measures are not implemented. In some cases, this might also deter employees from adhering to safety measures out of fear of being seen as weak (interview 1).

12.3 Inconsistent demands in the business

As long as all the companies in the construction business have different requirements with regards to safety it is difficult for sub-contractors to adhere to the requirements. Smaller sites, such as single family house construction sites where the contractors performing the work are smaller have had a more lenient approach to safety. This is possible to observe by looking at the differences in safety behaviour between Fira Oy and Fira Palvelut Oy. Fira Palvelut is specialized in pipeline and bathroom renovations. The TR measurement results show that respect for the TR criteria is lower on construction sites operated by Fira Palvelut, especially in the personal safety equipment category. The total difference is not large, only about 1%. However the requirements are the same for Fira Oy and Fira Palvelut. (Interview 6)

This shows that the real life requirements on different sites are different. A sub-contractor coming from one site to another operated by another main-contractor that he has not worked for before might therefore be surprised by the demands, routines and requirements that he is met with. (Interview 3.)

12.4 Knowledge

Knowledge about safety and danger is not necessarily always present with sub-contractor management and the workers. The conducted interviews show that the workers are aware of the dangers related to their own safety on their own working area and task. But the factors mentioned in the previous parts of this chapter make them still take the risks. These risk factors are known by the workers but not necessarily by the management, neither their own or Fira's. (Interview 2)

The workers do in some cases not know what they are required to do with regards to safety or what personal safety gear they are required to wear. The reasons for this might be many, but it is clear that workers from other countries than Finland have fewer opportunities to know about Finnish job site safety requirements than Finnish workers do (interview 2). This is due to differences in language and differences in culture from their home country.

12.5 Work left unplanned

The sum of all the factors mentioned above can cause work to be left unplanned. This is the worst case when thinking of jobsite safety as unplanned work means that safety is also left unplanned. This often happens when a sub-contractor arrives at site for a short routine job. For the sub-contractors the work feels so familiar that planning seems unnecessary.

This can be referred to as unplanned work within ongoing work. This is described as small tasks that occur during the ongoing work. The task might be included in the contract and must be completed for the completion of the job, but occurs at a point where the worker has to deviate from the ongoing main work to complete the task. It could be tightening a bolt that is outside the area where the scaffolding reaches, or a similar task that makes the safety procedures that are in place not satisfactory for the upcoming tasks.

Some workers will then take the risk and complete the job without the necessary safety equipment in place. The reasons for that are unknown, but it is likely to be associated with time and cost factors mentioned above. From the interviews the time factor seems to be the main culprit. (Interview 2)

12.6 The language barrier

The construction field is getting more and more international. Fira has registered over 40 different nationalities on its jobsites. The construction industry has even more nationalities working on sites all over Finland. The number of nationalities is not the main problem, but the different languages are. If there is a common language available, the problems are minimal. But in practice it has been experienced that this is not the case. Some workers have little or no English. English would be a language many Finnish managers would be able to handle besides Finnish. This not only contributes to the break in information described in chapter 8 but can in some cases completely break the information chain. (Interview 2, 6 and 8)

13 Measures

Bureaucratic leadership is not something Fira associates itself with. Some form of bureaucracy is still required to meet the demands of the Finnish legislation. It is also necessary to make sure there is a possibility to achieve accountability in the handling of safety issues, and when required to hand information to authorities.

The aim of the measures discussed below is to make safety planning traceable and make sure it reaches all the workers that are involved in a task. The tasks are also aiming to save time and make the process more fluent and transparent for the sub-contractors and Fira's personnel. By implementing the measures, knowledge about the safety demands in specific jobs and construction sites should be guaranteed to be distributed amongst all workers.

Some of the measures are already in place. Some of them are in need of a little change and some are completely new. The current status of the measures will not be clarified further as the process is the most interesting part and not the changes.

13.1 Procurement phase

To ensure that the knowledge reaches the sub-contractor at as early a stage as possible, the requirements of Fira should be sent to the sub-contractor as early as possible, making Fira's practices known in an early stage. The earliest stage at which Fira contacts its sub-contractors is in the procurement phase. Procurement in Fira is usually carried out either by support staff at the office, by a site engineer or by a site supervisor. (Interview 2 and 6.) When procurement is carried out the safety requirements should be included in the call for tender. This to make sure the information is delivered to the sub-contractor and also to give them the opportunity to implement the required measures both in the tender and in their plan for the job that is to be done.

Although no measures are required by law at this in the procurement phase it would be important to bridge the information gap mentioned in section 8 as early as possible. Also early information would lay the groundwork for further work in the safety area at future encounters and make the preparation time longer for the sub-contractors.

Strictly informative, the measure would require little or no work from the procurement personnel at Fira and as such would be an easy and effective way of informing sub-contractors. The aim is to both inform and to lay groundworks as early as possible.

13.2 Contract meeting

The next phase is the contract meeting when the sub-contractor arrives at the site to negotiate and sign the contract. Here safety requirements and measures are already part of the meeting agenda, but the diligence could be increased. It has been stated in the interviews both by Fira's personnel and sub-contractor personnel that this is an early stage to talk about safety on the construction site. The contract meeting would still be an appropriate arena to present and inform about the requirements that Fira imposes on its sub-contractors (Interviews 1, 3, 5.)

When the contract meeting is held, a solution for safety should be under development. According to the law this is the responsibility of a sub-contractor as an employer, and as

such in the contract meeting a solution should be demanded. The specific requirements that Fira might have for a job-site should be given to the sub-contractor for them to implement in their safety plan. Information should be given and requested to ensure the quality of the plan that is developed and presented. By quality in this instance is meant that it satisfies Fira's requirements.

13.3 Start-up meeting

In the start-up meeting the job is gone through in detail regarding practicalities. The schedule is presented in greater detail and the practical details of how the work is to be done are presented. Safety and risk evaluation should be an integral part of the material reviewed here.

The safety plan for the job should be presented here. As discussed in section 15.2 the sub-contractor should present this plan as he knows the risks associated with his tasks best. This plan should be signed by all parties present at the meeting to prove that it has been reviewed by all involved parties. All levels of safety should be evaluated. The personal safety equipment the workers are required to wear, and in what jobs they have to have special equipment is one example of what should be mentioned here. When the plan is approved and signed it should be added to the contract as an attachment. This way the plan is a part of the contract and validated not only with the safety plan itself but as a part of the contract.

13.4 During the construction work

During the construction work there are several instances where safety needs to be assessed and controlled. This is where the work is executed and all the plans come into action. The main parties involved here are Fira's site supervisor, the sub-contractor's site supervisor and the workers.

Fira's management need to evaluate all jobs and assert their risk level. Then they need to make sure the correct safety measures are in place according to the plans that are drawn

in the earlier stages of the project. At this stage it is for the first time possible to evaluate if the risk evaluation has been completed with sufficient diligence. For the more challenging jobs a job-specific plan should be completed. This plan exists today, and is known as a TTS plan (Työvaihen turvallisuussuunitelma). The implementation of TTs on jobsites has been varied, and this should be addressed.

When the TTS has been filled, it should be signed by all participants in the job, meaning all the workers executing the job, Fira's management and the sub-contractors management. When the TTS is completed it should be added to the project specific safety plan as an attachment. As such, it is part of the contract and therefore binding. By making sure the workers have to sign the plan, the information break issue described in chapter 8 is also avoided as Fira is not dependant on the sub-contractor management to deliver the information. It is also an empowerment measure as workers can find it easier to inform Fira's and their own management when issues at the job site are not according to plan.

The cases where workers neglect safety measures to get a job done quicker or with less cost are hard for site supervisors to monitor. When this kind of behaviour is observed, the reaction should be swift and immediate. Like attitude, this is very hard to manage by bureaucracy or consequence thinking. Getting this factor dealt with would require an intensive effort from the industry as a whole.

13.5 The role of job site introductions

Job site introductions are mandatory according to Finnish legislation, as described in decree 205/2009 § 3. During job site introductions the workers are given basic information about the site in question. This includes the site's specific dangers, traffic arrangements, locker room location, location of first aid kits and so on. The job site introduction is designed to make the workers aware of the sites critical functions before they start work on site.

A good job site introduction requires that risk evaluation is done for the site before job site introductions are initiated. Seen as a time thief by some managers and sub-contractors, job site introductions have an important role to play in the information chain. Job

site introduction is the first and often the only occasion that absolutely all workers have to go through before they enter the job site. The best job-site introductions make workers more effective at their site, whereas some are no more than a registration and a handshake.

A good job-site introduction should cover the general risks of the site but avoid the job specific risks that the workers will encounter during the work they are to execute. The job specific risks should as mentioned in chapter 14, be handled in the start-up meeting to avoid giving workers unnecessary information that might contribute to confusion. When used as an information opportunity, the job site introduction is a great place to inform workers about the risks that are present at the site.

13.6 Repercussions in case of safety breaches

Repercussions should be outlined in the contract so that all parties are aware of them before any work starts on the construction site. Repercussions on site are vary in their degree of seriousness. The simplest form is an oral warning given on site. The next level is a written warning where the consequences of repeated breaches are outlined. Fines of various sizes depending on the breach in question are the next step. The fines can be given to an individual or a company by Fira's management depending on the safety breach in question. Finally the worker can be expelled from the site. (interviews 1 and 5.)

In Norway there are no fines. Written warning is followed by discharge from site (interview 9.). Whether this shows a lower tolerance for safety breaches is not necessarily the case. But it has an advantage of getting the repeated offenders off site and in the process setting an example to the workers left on site. Not only to the workers from the same company but for workers from all the companies on site. Job site managers do not like giving fines as it is seen as something that is outside of their tasks. It is also understood as an inherent hostile act by the sub-contractors and there is an inherent reluctance by managers to give fines in fear of ruining an otherwise good relationship with a sub-contractor (interviews 1 and 5).

The effect of fines is therefore yet to be determined and would need further research. What is clear is that the reluctance to use them by job site managers is inhibiting their

effectiveness. It might be a good idea to remove them from the equation to make the consequences easier to understand while at the same time showing a smaller tolerance for safety breaches.

14 Management of implementation

The measures described in chapter 15 generate a lot of traceability in the risk evaluation work. Currently mostly in paper form and on the actual construction site it is difficult for the upper management to evaluate the work that is done on site. Fira has a lot of experience when it comes to electronic solutions for safety monitoring and reporting, and a similar solution would be beneficial with regards to traceability.

Contracts with an attached TTS should be electronically available so that the management can see how many of them are made per construction site, and what information they contain. This way the management can see if the measures are actually carried out on site and with what quality. The signed safety plans with the workers signatures should be available as well, again to see that the plans are actually made and signed.

The measures mentioned will also allow for statistics to be made and see if the measures are having the desired effect on the accident rate on site. As mentioned in chapter 10, Fira already has a database of the safety concerns that are sent from workers and managers. The company also have databases of the accidents and near accidents on site. Changes in the reports sent to this database are expected if the measures have an effect. An increase would be the expected outcome as knowledge and attitude towards safety changes on the construction site. Conversely, if the measures have an effect, a drop in the number of accidents is expected.

15 Challenges in implementation

Implementing the measures outlined here might pose challenges for Fira. Even though some of the measures are already in place the changes needed to implement these measures are still fairly large. It requires the full backing of the leadership in the company

and a plan for management of implementation need to be in place. The construction industry is known as an industry where change happens rather slowly. When this is combined with peoples inherent reluctance to change this will undoubtedly pose challenges. Some managers will also bring out the fact that what is currently being done is giving results and no change is needed.

16 Conclusion

The Finnish act and decree on occupational safety and health give a good framework to operate with when talking about safety on construction sites. However accidents occur where some of them unfortunately have a deadly outcome. In Fira the aim is to have no accidents whatsoever and that should be the goal for any company in the construction sector.

It is challenging to find a suitable method to monitor and manage safety because it is dependent on so many spheres of both the human being and business. It is therefore important that the methods and implementations are sharp and easy to understand as well as not too bureaucratic. Information sharing and command lines are a huge challenge and focusing on these two areas should be a priority. By sharing the same information in multiple steps of the construction project and with as many people with the sub-contractors as possible, the information gap can be reduced or at least made smaller.

By involving the workers in the process of risk evaluation it is possible to both make better plans and avoid a conflict of interest. Workers possess great knowledge about the processes they execute every day and the risks associated with them. By involving them in the risk evaluation process the quality of the evaluation will improve. Making them sign that they have done it can in some cases make sure that the process completed with greater quality.

The attitude towards safety in the industry has changed, but needs to change at a deeper level for all changes to be successful. This responsibility lies not only with the workers but with the managers as well. By premiering sub-contractors that take safety seriously there is a greater chance for basic change to occur. Having a database of contractors with good safety and quality records is therefore very important, as it would be a place where companies will strive to get to.

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Appendix 1

List of interviewees

- 1. Antti Anttilainen Työpäällikkö Fira Oy**
- 2. Miska Virtanen Työnjohtaja Fira Oy**
- 3. Henri Makkonen Työmaainsinööri Fira Oy**
- 4. Juha Suvanto Työturvallisuusasiantuntija Rakennusteollisuus**
- 5. Jyrki Siven Työpäällikkö Fira Oy**
- 6. Teemu Latva Turvallisuusasiantuntija Fira Oy**
- 7. Jari Pulkkinen Työturvallisuuspäällikkö Fira Oy**
- 8. Jari Nykänen päätarkistaja Aluehallintovirasto**
- 9. Lars Dybvik Job site engineer, Vedal AS**