

Safety training parks - Cooperative initiatives to improve future workforce safety skills and knowledge

Arto Reiman¹[0000-0002-1480-5462], Olli Airaksinen² and Klaus Fischer³

¹ University of Oulu, Oulu, Finland

² Sinenkaari Ltd, Oulu, Finland

³ FOM University of Applied Science, Mannheim, Germany

arto.reiman@oulu.fi

Abstract. Construction is one of the most unsafe industries worldwide. Safety training is one essential element to improve occupational safety skills and performance. A wide variety of different safety training methods has been introduced, and a need for more engaging training methods has been recognized. Finnish construction industry has introduced a new Safety Training Park (STP) concept to meet that challenge. Three STPs have been constructed in Finland. STPs are concrete learning environments, in which real life work situations are demonstrated at training points. This study focuses on STP in northern Finland (STPNF). STPNF is a macroergonomics construct designed, financed and constructed by a large consortium of 80 different stakeholder organizations. In addition to construction companies, stakeholders such as schools and universities, municipalities and service providers are included in the consortium. This descriptive study aims to provide an overview of the STPNF concept and describe the most typical STPNF utilization approaches. Further, stakeholder collaboration is discussed and a discussion is initiated on the potential and prerequisites for the transferability of the STP methodology to other contexts.

Keywords: Construction, Safety Training, Social sustainability

1 Introduction

Construction has been and still is recognized as one of the most unsafe industries worldwide. Various risks for accidents, injuries and other health hazards are associated to construction work. In addition to adversely affecting at individual level to human health and well-being, they usually have broader effects at the company, family and society levels [1-3].

Construction sites are shared workplaces where different personnel groups – often representing different employers – act together. Thus, intra- and interorganizational collaboration approaches and skills are required. The backgrounds of the multiorganizational personnel at construction sites might vary, but some common characteristics can be identified. Work is physical and various kinds of health hazards (accident risks, noise, vibration, dusts etc.) are met daily at work sites. Further, the employees tend to be less educated and male-dominated. In addition, employees at the work sites might have different cultural and language backgrounds [4]. These all pose challenges to occupational safety and health (OSH) management processes. Safety training is one essential element of OSH. A wide variety of different safety training methods have been introduced and a need for more engaging training methods tailored to the trainee group have been recognized [5,6].

1.1 Safety Training Park concept

A unique approach to safety training – a Safety Training Park (STP) concept – has been introduced in Finland [7,8]. STPNF is a physical learning environment in which OSH and ergonomics issues are trained (see Figure 1). The first one of this kind, named Rudus Safety Training Park (RSTP) was opened in southern Finland in 2009. In 2014, a STP was opened in northern Finland. The major difference between the two first STPs is that the first one has been designed, constructed and financed by one company; namely Rudus, whereas the latter one in northern Finland has been made possible by the efforts of a large collaboration

network of 80 different stake-holders. As we aim to discuss STPs as a micro- and macroergonomics construct we will focus on the STP (later STPNF) in northern Finland.



Fig. 1. An overview of parts of the STPNF area

Trainings in the STPs are based on trainer-led trainings where trainee groups are circulated at training points (see Fig. 2). Over 200 in-house trainers – representing stake-holder organizations – have received an official certificate to provide trainings in STPNF. The background of the trainers varies, however a majority of them are OSH professionals (OSH representatives, experts, managers) in their organizations. Currently there are 25 training points in use in the STPNF. The trainings are based on dialogic learning at the training points. Work environments and dummies representing good and bad practices are supplemented with OSH knowledge that is shared by different channels (visual, texts, videos, auditory) at the training points. In addition, some of the training points include possibilities in kinesthetic learning. The aim is to facilitate dialogue inside the trainee group. The assumption is that this dialogical approach supplemented with OSH knowledge leads to better understanding about the risks at construction sites and provokes changes at individual, group and organizational levels.



Fig. 2. An example of a training point focusing on construction work for house technology. The right side of the picture demonstrates problems related to bad planning (various different work phases performed simultaneously vs. scheduled work phases (left side))

STPNF was jointly created in 2012-2014 by various stakeholder organizations from construction companies to service providers and employee and employer associations. Currently 80 stakeholder organizations belong to the STPNF consortium. Collaboration is based on a shared vision and funding by the consortium members. Each organization has provided something for the common purpose of constructing and developing the STPNF. Mutually, the consortium members get the rights to use the STPNF premises for their own training purposes. A decision made by the consortium – supporting social impacts and long-lasting learning – is related to the common agreement that all schools and universities in northern Finland are allowed – without any fee – to use STPNF for their educational purposes. Student groups from pre-school to university level have been trained in the STP.

1.2 Objectives

In this article, we present the STPNF concept. The concept has risen interest outside Finland. Different consortiums in Nordic countries have been formed to seek possibilities to adopt the concept [see e.g. 9]. In addition, we conduct an analysis to categorize the typical stakeholders that have utilized STPNF. To enliven that analysis, we present examples of the most typical STPNF utilization approaches. We further discuss the potential and prerequisites for the transferability of the STP methodology to other contexts (target groups and regions) more generally. Therefore, the STPNF concept will be characterized due to different ergonomic perspectives: Microergonomics concerning the safety improvements at workplace level, macroergonomics concerning the change management training method and community ergonomics focusing on the stakeholder consortium model for funding and vision building.

2 Material and methods

This study is based on a STPNF design and construction process document analysis (drawings, training point descriptions, administrative documents and the booking calendar) and personnel interviews. Personnel interviews were arranged to six experts familiar to STPNF. Four of the interviewees represented construction companies' top management, one was a teacher utilizing the STPNF and one was an expert familiar with the STPNF administration processes. In the interviews, typical STPNF utilization approaches were identified. These approaches focus both on micro- and macrolevels. A concrete aim of the approaches is to improve personal OSH skills and knowledge which is ultimately assumed to lead to OSH performance improvements at work-place and organizational levels. In addition, the interviews focused on yielding in-depth information on the STPNF stakeholder collaboration. Thus, STPNF consortium is discussed as a macroergonomics construct having broader effects.

3 Results

3.1 Stakeholders utilizing the STPNF

The stakeholders utilizing the STPNF were categorized into four groups: construction industry, educational organizations, other industries and other stakeholders (see Figure 3). The first two of those represent the largest groups by the attendance. The category of "Construction industry" includes all kinds of construction companies and their service and technology providers. Educational organizations from a preschool phase to universities and adult education have utilized STPNF for educational purposes. In addition, various other stakeholders from different branches have utilized the STPNF.

In order to deepen our analysis on the stakeholders utilizing the STPNF a description of different types of STPNF utilization approaches is provided for the two most common groups; construction industry and educational organizations.

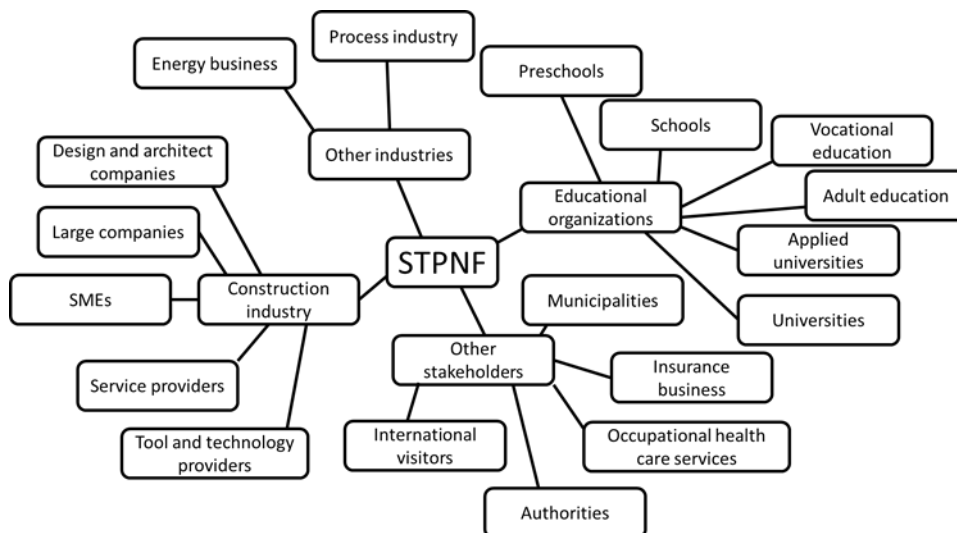


Fig. 3. Stakeholder groups utilizing the STPNF

3.2 Construction industry

As the companies belonging to the STPNF consortium have trained their own in-house-trainers, the execution of the trainings varies between the companies. Below we present the most typical training approaches.

Occasional visits. A majority of the company-specific trainings in STPNF are based on occasional visits in the STPNF. During the training, the trainee groups are circulated around the STPNF. For such purpose, the STPNF Association has developed a four-hour long basic course, which covers all training points. All trainers have been trained to lead these basic courses. However, the trainers are also encouraged to tailor their trainings based on the trainee group expectations. Thus, there are variations in the occasional visits. For instance, the trainings might have been designed to be a part of a company's outing activities. Companies might also use STPNF premises for focused meetings, in which OSH is discussed. These discussions are enlivened by visits to selected training points. In addition, for instance Finnish Safety Training Card trainings have been arranged in the STPNF.

Continuous visits. Some companies have decided to have STPNF trainings repetitiously. As an example, an international service company has decided to have annual trainings all its employees in northern Finland. Their trainings are tailored to include only selected training points. Another large employer belonging to the STPNF consortium has trained all its' employees in the STPNF and now utilizes STPNF environment for instance for annual OSH trainings for summer job workers.

3.3 Educational organizations

All schools and universities in the area of northern Finland have been relieved from the membership fees. Roughly, half of the annual trainees in STPNF represent students from different educational levels. Below we present three different types of student training processes.

Vocational education. Repetitive STPNF visits are included in the curriculum of construction worker students. Designated courses include STPNF training sessions where the course contents are enlivened by STPNF trainings. For instance, a course related to roof work may include a section in STPNF in which OSH when working at heights is discussed and trained in practice in STPNF.

Universities. Various utilization approaches have been exploited. For instance, students (n=70) from a course focusing to ergonomics and safety in product design visit-ed STPNF to familiarize themselves to

different risks related to construction work. Students were divided into smaller groups; each of which was given an assignment to develop solution proposals to identified risks. In addition, the groups were given contact information to local construction companies in order to enable further in-depth discussion. Solutions were introduced to a panel of experts from the STPNF consortium.

Preschool children. A trial was arranged to a group of preschool children, (n=22, 5-6 years old). Preschool teacher students designed a three-hour training by selecting five training points which they considered being the most interesting for this particular trainee group. The training focused on the visibility and shadow areas of a heavy machinery (to concretize the risks related to playing near heavy machinery), safety at high places (risks related to climbing at high places), Excavation work (risks related to playing near excavations), railroad safety (risks related to playing at rails) and chemical safety (risks related to playing with unknown substances). Figure 4 illustrates this by presenting children getting familiar with heavy machinery shadow areas.



Fig. 4. An example of the preschool student training. In the figure, children are getting familiar to shadow areas of a heavy machinery

3.4 Stakeholder collaboration

A key factor enabling STPNF success is related to broad collaboration in the design, construction and financing phases. That is highlighted by an expert interview: “It was very important to understand that we [the project group] are not the ones having the wisdom, but the stakeholder organizations. They should actively participate in the design and construction phases...”. The stakeholders – even when representing rival companies – shared a vision that OSH is a common development topic for the construction industry: “Yes, this [OSH] is a topic that is valuable enough to be developed together”. The trainings in the STPs aim to provoke individual thinking concerning safety. That expectation to provoke individual level changes, is expressed by a top management interviewee: “... to perceive that such an accident has occurred somewhere. It stays in your mind after that and starts affecting your own behavior in similar work situations. That is having a positive influence on safety. That is the ultimate goal”.

The interviewees identified also larger societal influencing possibilities through STPNF. All the interviewees representing top management identified STPNF as a forum for influencing the future workforce in a longer perspective. It was seen that OSH was not a topic that was or had been taught very profoundly in different educational organizations in Finland and new approaches were needed. This was expressed by an interviewee representing top management: “It was understood in the [consortium] companies that a construction student is easily made familiar with OSH issues in practice in STPs. That eases companies’ duties in the future when that student is hired into working life. That was definitely seen as committing construction companies to participate [in STPNF]”. In that sense, the companies consider STPNF as a friendly gesture to society at large, as expressed by another top management interviewee: “OSH should

definitely be taught and discussed to the future workforce before they enter working life. STPNF provides a channel to such influencing at broader level”.

4 Discussion: Success factors and transferability of the STP concept

As the STP concept is highly regarded in Finland and further Scandinavian countries, the question rises if and under which conditions STP methodology can be transferred to further regions, thereunder also industrially developing countries as well as to further application fields beyond construction industry. For discussing these aspects, it is first of all necessary to look on the core enabling factors of the STP methodology and to identify their specific impact on success (Section 4.1). Subsequently, their transferability to other contexts will be discussed (Section 4.2).

4.1 Enabling factors and their impact on success

Starting from the presentation of the STP methodology in the previous sections, two core enabling factors can be identified: Stakeholder cooperation and a specific mix of ergonomic methods, combining micro- and macroergonomic interventions. In the next paragraphs, these factors and their specific contribution to the success of the STP methodology are discussed.

Stakeholder cooperation: Improving resource availability and scope of the STP. In Oulu, Northern Finland (STPNF), stakeholder cooperation allows a pooling of re-sources and competencies for setting up training infrastructure, developing training concepts and for running the STP. Different stakeholder groups (cp. Section 3) are involved as consortium members, contributing to the funding as well as to the ongoing operation of trainings.

Stakeholder cooperation’s impacts on success are twofold: Looking at resource availability, stakeholder cooperation allows to realize a high-quality training format while significantly lowering the costs of implementation; even free trainings are made available. This is a crucial point as STP methodology is – compared with traditional training methods as classroom-trainings – quite complex and costly to realize.

Concerning the scope of the STP, cooperation increases the involvement of different stakeholders and improves the accessibility to and the worthiness of the trainings for specific target groups. Besides consortium membership of different stakeholders, trainings are led by a wide range of trainers representing different stakeholder organizations. They need to obtain a training certificate ensuring high quality trainings without conflicting with the openness of the STP concept: As over 200 trainers completed the certificate, the trainings can be widely held and receive different groups. Thus, the STP infrastructure can be efficiently used for different training formats and specific stakeholder settings.

Ergonomic mix of methods: Realizing profound and long-lasting training results. As shown in the previous sections, the STP methodology combines specific micro- and macroergonomic methods for achieving profound training effects.

The microergonomic components mainly manifest the contents of the trainings and the design of the particular work systems and situations that are visualized at the training points. Core characteristic of the microergonomic design of the STP method-ology are:

- Physical learning environment in “real work systems”
- Incident-based training, concretely addressing various safety issues (e.g. handling of asbestos, risks of roof work etc.)
- Multi-channel and interactive training, using in-situ visualization, texts, videos, auditory media and exercises.

Complementary to the microergonomic training design, some overarching macroergonomic change management principles are implemented. They are framing how the OSH knowledge shall be transferred and how behavioral changes can be achieved. Core macroergonomic characteristics are:

- “Story-telling-approach”; participants are consistently encouraged to think about severe long-term effects of a possible occupational accident on their own life (introduction by a rousing short movie, dummy installations representing alternative “life stories” etc.)
- Illustrative good and bad practices; simulated work environments with dummies improve the identification with the shown working situations
- Dialogical approach; different to the one-way communication of many training formats STP methodology provokes mutual exchange supporting experience sharing and a deeper reflection of the OSH contents

Besides these aspects, the STP methodology itself contributes to a certain community change management towards OSH awareness raising through common vision building and stakeholder involvement.

4.2 Transferability of enabling factors

Looking at the above identified enabling factors and their impacts on the success of the STP methodology, the question rises whether these factors are a “unique” result of the interplay in Finland (resp. in Oulu, where the STPNF is set-up) or if they can be transferred.

Transfer of the stakeholder cooperation approach: In general, approaches of stakeholder cooperation can be set-up in very different arrangements, involving different stakeholder groups. The question is, if those stakeholders can be involved who are providing necessary resources and capabilities (e.g. manpower, money, expertise) to realize a STP concept. This should be the case in other well-institutionalized industries where OSH management is a matter of (economic) concern and perceived as an important issue (e.g. in the manufacturing or industry). But also in less institutionalized industries (e.g. in agriculture and forestry in industrially developing countries), stakeholder cooperation can be an effective method for pooling resources and involving those groups which are necessary to mitigate OSH risks at work. Of course, the design of a STP concept needs to be adapted to available resources and local needs for achieving low-threshold and convincing training offers.

Transfer of the ergonomic mix of methods: Combining micro- and macroergonomic methods for achieving profound and long-lasting effects is a general principle of ergonomic design. With regard to the design of OSH training methods, this is e.g. successfully implemented by so-called PAOT-trainings in very different application contexts in industrially developing countries [10]. They are working with a change management and facilitating approach to activate local expertise and available resources for achieving long-term OSH improvements. Locally “customized” STPs could provide a sustainable infrastructure for those initiatives.

Acknowledgements

This study was funded by the Finnish Work Environment Fund [Project: 114368].

References

1. van der Molen, H.F., Basner, P., Hoonakker, P.L.T, Lehtola, M.M., Lappalainen, J., Frings-Dresen, M.H.W., Haslam, R. Verbeek, J.H.: Interventions to prevent injuries in construction workers. Cochrane Database of Systematic Reviews, Issue 2. Art. No.: CD006251. DOI: 10.1002/14651858.CD006251.pub4 (2018).

2. Sousa, V., Almeida, N.M., Dias, L.A.: Risk-based management of occupational safety and health in the construction industry – Part 1: Background knowledge. *Safety Science* 66(July), 75–86 (2014).
3. Ringen, K., van Duivenbooden, J.C., Melius, J.: Construction safety and health – Foreword. *American Journal of Industrial Medicine* 53(6), 551 (2010).
4. Demirkesen, S., Arditi, D.: Construction safety personnel's perceptions of safety training practices. *International Journal of Project Management* 33(5), 1160–1169 (2015).
5. Burke, M.J., Salvador, R., Smith-Crowe, K., Chan-Serafin, S., Smith, A.N., Sonesh, C.H.: The Dread Factor: How Hazards and Safety Training Influence. *Journal of Applied Psychology* 96(1), 46–70 (2011).
6. Ricci F, Chiesi A, Bisio C, Panari C, Pelosi A.: Effectiveness of occupational health and safety training: A systematic review with meta-analysis. *Journal of workplace learning* 28(6), 355–377 (2016).
7. Reiman, A. Möller Pedersen, L., Väyrynen, S., Sormunen, E., Airaksinen, O., Haapasalo, H., Räsänen, T.: Safety Training Parks – Cooperative Contribution to Safety and Health Trainings. *International Journal of Construction Education and Research*. DOI: 10.1080/15578771.2017.1325793 (2017).
8. Reiman, A., Airaksinen, O., Väyrynen, S., Aaltonen, M. Chapter 10: HSEQ Training Park in Northern Finland — A Novel Innovation and Forum for Cooperation in the Construction Industry. In: Väyrynen, S., Häkkinen, K., Niskanen, T. (eds.) *Integrated Occupational Safety and Health Management - Solutions and Industrial Cases*, pp 145-153. Springer International Publishing, Switzerland: Cham (2015).
9. Sikkerhedspark [Safety Training Park Denmark web page], <http://www.sikkerhedspark.dk/>, last accessed 2018/04/18.
10. Kogi, K.: Participation as Precondition for Sustainable Success: Effective Workplace Improvement Procedures in Small-scale Sectors in Developing Countries. In: Zink K.J. (ed.) *Corporate Sustainability as a Challenge for Comprehensive Management*, pp 183-198. Physica: Heidelberg (2008).