TAMPEREEN TEKNILLINEN YLIOPISTO
TAMPERE UNIVERSITY OF TECHNOLOGY

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Implementation of Safety Management in Outsourced Services in the Manufacturing Industry

Julkaisu 1023 • Publication 1023

Tampere 2012

Tampereen teknillinen yliopisto. Julkaisu 1023
Tampere University of Technology. Publication 1023

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Thesis for the degree of Doctor of Science in Technology to be presented with due permission for public examination and criticism in Festia Building, Auditorium Pieni Sali 1, at Tampere University of Technology, on the 24th of February 2012, at 12 noon.

Tampereen teknillinen yliopisto - Tampere University of Technology
Tampere 2012

ISBN 978-952-15-2776-0 (printed)
ISBN 978-952-15-2806-4 (PDF)
ISSN 1459-2045

ABSTRACT

Procuring of operations from external service providers has become a common practice among manufacturing companies in recent years. This kind of outsourcing transfers some tasks to an external service provider organisation and typically also brings employees from these service provider organisations to the customer's worksite thereby creating multi-employer worksites. Ensuring sufficient safety levels in such shared worksites is more demanding and challenging than safety management in traditional single employer workplaces. For safety management the major challenges of outsourcing arise from differing working cultures, unclear responsibilities and insufficient communication. In multi-employer worksites, the operations performed by one party may also endanger the safety of other persons working at the site. Nonetheless, ensuring sufficient levels of safety at multi-employer worksites is the responsibility of both the customers and their service providers. However, many service providers find it far from easy to implement effective safety management when operating with various customers at diverse worksites.

This study discusses safety management at multi-employer manufacturing worksites. The main focus is on service provider operations though the customer viewpoint is also considered. The subject is approached by investigating the consideration of safety at multi-employer manufacturing worksites, charting the safety management problems encountered and reviewing the contributory factors of accidents. These issues were studied using the following methods: company interviews conducted in eight Finnish service provider and ten customer organisations; a questionnaire sent to parties operating in manufacturing industry (n=75) and an analysis of fatal accidents during 1999–2008 at manufacturing worksites (n=83). The results of these studies were used in the construction of an operational model of safety management for service providers operating in manufacturing worksites. The operational model development process was carried out in collaboration with the service provider organisations taking part in the research project. After 17 months of use, the feasibility of the model was evaluated by means of a questionnaire sent to the service providers.

The results of this study show that various safety issues, such as communication and hazard identification, have gained great recognition at the multi-employer manufacturing worksites while management of some other areas of safety has received only limited attention (e.g. safety performance assessment). In addition, implementation of safety cooperation between service providers and customers at multi-employer worksites vary greatly between different partners. This study shows that both service providers and customers encounter various challenges in managing safety at multi-employer worksites. Such difficulties include the proper implementation of communication, identification of hazards, preplanning of work tasks and organisation of induction training. It is significant that the accident report analysis showed that many of these problematic issues are also common factors contributing to accidents that had occurred at multi-employer manufacturing worksites. Removing these obstacles is necessary

before a better safety management level can be achieved at worksites shared by different operators.

The purpose of the operational model for safety management is to overcome the deficiencies and challenges encountered in safety management at manufacturing multi-employer worksites. The operational model supports the implementation of safety management in the service provider organisations by discussing the management of safety from a theoretical viewpoint and also by providing examples of effective practices and tools to promote safety in everyday operations. The operational model is targeted mainly at managing service providers' safety activities but it can also be used in other contexts, such as in planning cooperation at multi-employer worksites, and in promoting the implemented safety measures.

TIIVISTELMÄ

Teollisuusyritykset ovat viime vuosina siirtäneet yhä enenevässä määrin toimintojansa palveluntuottajien toteutettavaksi. Ulkoistamisen myötä työkohteessa työskentelee useimmiten asiakkaan työntekijöiden lisäksi myös palveluntuottajan henkilöstöä. Tällaisilla yhteisillä työpaikoilla riittävän turvallisuustason varmistaminen vaatii enemmän huomiota ja sisältää useampia haasteita kuin turvallisuuden hallinta perinteisissä yhden työnantajan työkohteissa. Ulkoistamisen aiheuttamat merkittävimmät haasteet turvallisuuden hallinnalle johtuvat muun muassa toimijoiden erilaisista toimintakulttuureista, epäselvistä vastuukysymyksistä ja riittämättömästä kommunikaatiosta. Yhteisillä työpaikoilla eri toimijoiden työsuoritukset vaikuttavat kaikkien työkohteessa olevien turvallisuuteen ja turvallisuuden varmistaminen kuuluukin sekä asiakkaan että kohteessa työskentelevien palveluntuottajien vastuulle. Tehokkaan turvallisuustoiminnan toteuttaminen koetaan kuitenkin usein haasteelliseksi varsinkin palveluntuottajien keskuudessa, jotka toimivat yleensä useiden asiakkaiden kanssa ja vaihtelevissa työkohteissa.

Tämä tutkimus käsittelee turvallisuusjohtamista teollisuuden yhteisillä työpaikoilla. Tutkimus keskittyy pääasiassa palveluntuottajien toimintaan, mutta myös asiakkaan näkökulma tuodaan esille. Tutkimusaihetta lähestytään turvallisuuden huomioimisen, koettujen turvallisuusjohtamisen ongelmien ja tapaturmiin johtaneiden tekijöiden kautta. Kyseisiä tekijöitä selvitettiin kahdeksassa palveluntuottajaorganisaatiossa ja kymmenessä asiakasyrityksessä toteutettujen yrityshaastattelujen, teollisuuden toimijoille suunnatun kyselyn (n=75) ja vuosina 1999–2008 teollisuuden työpaikoilla tapahtuneista kuolemaan johtaneista tapaturmista laadittujen TOT-raporttien analysoinnin avulla (n=83). Näillä menetelmillä saatuja tuloksia hyödynnettiin teollisuuden työpaikoilla toimiville palveluntuottajille suunnatussa turvallisuusjohtamisen toimintamallissa. Toimintamallin kehitysprosessi toteutettiin yhteistyössä tutkimushankkeeseen osallistuneiden palveluntuottajayritysten kanssa. Mallin käyttökelpoisuutta turvallisuuden hallinnan työvälineenä testattiin 17 kuukauden käyttöjakson jälkeen samaisille palveluntuottajayrityksille suunnatulla kyselyllä.

Tämän tutkimuksen perusteella lukuisat turvallisuusasiat, kuten kommunikaatio ja riskien hallinta, ovat saaneet laajasti huomiota teollisuuden yhteisillä työpaikoilla, mutta samalla turvallisuuden hallinta toisilla osa-alueilla on ollut hyvin rajallista (esim. turvallisuustoiminnan arviointi). Lisäksi, turvallisuusasioissa tehtävän yhteistyön taso vaihtelee merkittävästi eri toimijoiden ja yhteisten työkohteiden välillä. Tämän tutkimuksen perusteella sekä palveluntuottajat että asiakasyritykset kokevat turvallisuuden hallinnan yhteisillä työpaikoilla monin paikoin haasteelliseksi. Esimerkiksi riittävän tiedonkulun varmistaminen, vaarojen tunnistaminen, asianmukainen töiden suunnittelu sekä perehdytyksen järjestäminen aiheuttavat haasteita yhteisen työpaikan toimijoille. Huomionarvoista on, että tapaturmaraporttien analyysi osoitti monien palveluntuottajien ja asiakkaiden kokemista ongelmakohdista olevan myös teollisuuden yhteisillä työpaikoilla tapahtuneisiin tapaturmiin johtaneita tekijöitä. Näiden

ongelmallisten tekijöiden ratkaiseminen on välttämätöntä yhteisten työpaikkojen turvallisuuden hallinnan kehittämiseksi.

Turvallisuusjohtamisen toimintamalli laadittiin vastaamaan niihin yhteisten teollisten työpaikkojen turvallisuuden hallinnan epäkohtiin ja ongelmiin, jotka nousivat esille turvallisuusasioiden huomioimista, turvallisuushaasteita ja tapaturmatekijöitä selvitettäessä. Toimintamalli tukee teollisuuden työkohteissa toimivien palveluntuottajien turvallisuus-johtamista esittelemällä aiheeseen liittyvää lainsäädäntöä ja teoreettista tietoa sekä tarjoamalla näiden ohessa myös esimerkkejä hyvin toimivista käytännön ratkaisuista ja työkaluja turvallisuuden varmistamiseksi arkipäivän toiminnoissa. Toimintamalli on tarkoitettu pääasiassa tukemaan palveluntuottajayritysten toimintojen turvallisuuden varmistamista, mutta mallia voidaan hyödyntää myös esimerkiksi suunniteltaessa yhteistyötä yhteisillä työpaikoilla tai kerrottaessa toteutetuista turvallisuustoimenpiteistä asiakkaille.

PREFACE

I am indebted to many people for finally reaching this last phase of my doctoral thesis. This five-year thesis project has been a major learning process and sometimes its completion seemed merely a distant prospect. I was encouraged that so many people believed that it would eventually see publication.

The impetus for the thesis came from staff and colleagues in the Center for Safety Management and Engineering of Tampere University of Technology. I am grateful that I had the chance to grow several years as a researcher before starting on the thesis project. I would also like to thank those organisations and their representatives who took part in this research and provided practical insight into occupational safety at multi-employer worksites and service providing organisation. I am also grateful to all the participants of the safety cooperation questionnaire that was conducted as part of the project. My sincere thanks are due to my colleagues who collaborated with me. I am indebted to Juha Vasara, in particular.

The financial support I received was crucial for carrying out this research. First, I wish to acknowledge the Finnish Work Environment Fund and those organisations that funded the research project. I have also been fortunate to have carried out my doctoral research as a graduate school student and I am very grateful to the Graduate School of Concurrent Engineering and the Industrial Engineering and Management Doctoral Programme for their financial support. I would also like to thank the Foundation for Economic Education for the scholarship granted for writing the introductory part of my thesis.

I owe a debt of gratitude to Professor Jouni Kivistö-Rahnasto for supervising my thesis with a judicious balance of freedom and guidance. I am also very grateful to the examiners of my thesis, Dr. Markku Aaltonen (Finnish Institute of Occupational Health) and Dr. Arto Kuusisto (European Commission, Joint Research Centre), for their constructive comments.

Thanks are also due to Noora Nenonen and Marileena Koskela for our stimulating discussions and the new viewpoints and ideas they provided for drafting the scientific articles and the thesis. I am also grateful to all my colleagues, former and present, who have helped me over the years. I also wish to express my gratitude to Professor Ana Póvoa from Instituto Superior Técnico for the opportunity to join her research team and to finalise my thesis in the sunny climes of Portugal. I would like to thank Alan Thompson for reviewing the language of the thesis. In addition, I am indebted to all my dear friends for their support throughout the thesis project and especially for all the time spent in not discussing this topic.

My special thanks and hugs go to my parents and brother for their unstinting support and belief in me: you prompted me to seek out why things are as they are – an important quality in a researcher. And finally, I wish to express my love and gratitude to my husband and to the little

ones for their support, patience and caring on the sometimes rocky road of my doctoral studies. You made this possible!

Estoril, November 2011

Sanna Nenonen

LIST OF ORIGINAL PAPERS

I Nenonen, S., 2010. Safety Management Problems Encountered by Industrial Service Providers. In the proceedings of the IEEM International Conference on Industrial Engineering and Engineering Management, December 7.–10., 2010, Macao.

II Nenonen, S. & Vasara, J., Accepted for publication. Safety Management in Multi-Employer Worksites in the Manufacturing Industry – Opinions on Cooperation and Problems Encountered. The International Journal of Occupational Safety and Ergonomics.

III Nenonen, S., 2011. Fatal Workplace Accidents in Outsourced Operations in the Manufacturing Industry. Safety Science 49(10), 1394–1403.

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KEY DEFINITIONS

Accident	An incident giving rise to injury, ill health or fatality (BS 18004, 2008).
Customer	The organisation receiving a service (ISO 9000, 2005).
Fatal accident	An accident that leads to the death of a victim within one year of the accident (Eurostat, 2001).
Manufacturing	Manufacturing industry can be considered as the traditional basic manufacturing but it can also include mining and quarrying as well as electricity, gas and water supply (Statistics Finland, 2011c). In this study manufacturing industry is regarded as a combination of basic manufacturing operations and those relating to electricity, gas and water supply.
Multi-employer worksite	See 'Shared worksite'.
Occupational accident	An accident causing injury to the employee in the course of the employment or in circumstances arising from employment (Statistics Finland, 2011a).
Occupational safety	Conditions and factors that affect, or could affect, the safety of employees, temporary workers, contractor personnel, visitors and other persons in the workplace (BS 18004, 2008).
Operational model of safety management	A guideline constructed during this study that supports the implementation of safety management in service provider organisations.
Outsourcing	In this study outsourcing is regarded as procurement of services from external service providers (see e.g. Harland et al., 2005).
Outsourced service	A service realised by an external service provider organisation.
Safety	In this study the term 'safety' is used as a substitute for the term 'occupational safety and health'.

Safety management	Comprehensive, systematic and continuous management for controlling safety and health risks in order to ensure employees' safety and health, resulting in a productive, safe and healthy workplace (Hämäläinen & Lanne, 2001).
Safety management system	A part of the overall management system that facilitates the management of safety risks associated with the business of the organisation (OHSAS 18001, 2000).
Shared worksite	Worksite where a single employer acts as the main authority and where more employers or self-employed workers than one operate simultaneously or successively in such a way that the work may affect other employees' safety or health (Finnish Occupational Safety and Health Act, 2002).
Service	The result of an activity performed at the interface between the service provider and the customer (ISO 9000, 2005).
Service provider	An organisation that provides a service to a customer (ISO 9000, 2005).
Workplace accident	An accident that occurs at a workplace, in a workplace area or a worksite outside the actual workplace (Federation of Accident Insurance Institutions, 2005).

1 INTRODUCTION

1.1 Safety at multi-employer worksites

Procuring services from external service providers has become a common practice in recent years and nowadays it is an integral part of many companies' operations and strategies. This process of outsourcing has created worksites on which there are several employers. In such multi-employer worksites, at least one, and usually more, external companies or self-employed parties operate alongside the customer's personnel. From the safety perspective, this has important implications. In such multi-employer worksites the operations carried out by one company may have an impact not only on the safety of its own employees but also of other individuals present at the workplace (Finnish Occupational Safety and Health Act, 2002). It has been suggested that outsourcing can even increase the risk of accidents and workplace injuries (e.g. Blank et al., 1995; Federation of Accident Insurance Institutions, 2009; Mayhew et al., 1997; Quinlan, 1999; Rousseau & Libuser, 1997; Salminen, 1995). However, precise figures on the extent of this effect have not been reported due to shortcomings in the accident statistics (see Blank et al., 1995; Gochfeld & Mohr, 2007; Hämäläinen, 2010). Nevertheless, it has been shown that accidents at multi-employer worksites typically involve employees of a service provider. However, accidents involving external employees are usually attributable not only to the performance of service providers but also to that of customers (Rantanen et al., 2007).

The adverse effect of outsourcing on the worksite safety has been widely recognised (see Quinlan et al., 2001; Walters & James, 2009) and the importance of effective safety management measures in multi-employer worksites has been highlighted (e.g. Luttkus, 2002; Mynttinen, 2006; Shafer, 2008; Sauni et al., 2005). The necessity for safety management in worksites shared by multiple employers has also been recognised in the legislation by setting requirements for safety activities for both customers and their service providers (Council Directive 89/391/EEC, 1989; Finnish Occupational Safety and Health Act, 2002). Hence, safety management at the multi-employer worksites is not only a legal requirement but it is often also in the interests of all the parties sharing the worksite. It has been reported that customers are showing increasing interest in the safety performance of their service providers. This trend can be attributed to various concerns such as the possible negative economic and ethical as well as image effects resulting from the service providers' poor safety performance (European Agency for Safety and Health at Work, 2000; Zimmerman, 2005). From the service providers' viewpoint, effective safety management can result not only in better safety records, but also lead to improvements in other areas such as in quality services (Cooper & Phillips, 1995), cost savings and even add to competitive advantage in the intensive markets (Fernández-Muñiz et al., 2009; Rechenthin, 2004).

1.2 Outsourcing and safety in the manufacturing industry

Companies operating in the manufacturing industry are among the major procurers of external services (Alajääskö, 2006; Ali-Yrkkö, 2007; Eurostat, 2009b). It has been reported that at the beginning of 2000s about two thirds of Finnish manufacturing companies employing at least ten employees had transferred some of their operations to service providers. Typically such manufacturing companies outsourced not only basic services (e.g. accounting, security and maintenance) but also to some extent production and research and development operations. (Ali-Yrkkö, 2007)

In addition to high outsourcing figures, manufacturing industry is also one of the most dangerous sectors in terms of accident frequency. In 2008, there were about 13,500 workplace accidents causing at least 4 day absence for wage and salary earners working in Finnish manufacturing organisations. Compared with the total amount of workplace accidents in Finland with similar absences, about every fourth accident occurred in manufacturing operations. (Statistic Finland, 2011b) In terms of accident frequency, manufacturing industry, with a frequency of 20.6, is the fourth most dangerous sector after construction, transportation and storage, and administrative and support service activities (Statistics Finland, 2010a).

The trend in the number of accidents causing at least 4 days absence in the Finnish manufacturing industry has decreased slightly in recent years (see Statistic Finland, 2010b). Even though the implemented safety work has had an effect on the improved statistics, part of the change can be explained by the increased use of service providers. This is because accidents of external employees are recorded according to their employer's field of business (e.g. transportation or construction) (see Eurostat, 2001). The accident figures for the manufacturing industry are not, therefore, fully in compliance with the actual accident frequencies at manufacturing worksites.

1.3 Safety management in service provider organisations

While the importance of the safety management at multi-employer worksites has been generally recognised, its implementation, on the other hand, poses a number of challenges. It has been reported that service provider organisations encounter problems in managing safety due to the specific features of service delivery such as operating at various and sometimes unfamiliar worksites with several customers, each with their own organisational and safety culture as well as working practices and habits (Lind et al., 2006). In order to ensure safe service production, service providers should be able to manage the safety of their own operations as well as adapt their performance to the customers' procedures and requirements. However, many service provider organisations, particularly the smaller ones, do not have sufficient resources or competence to implement the level of safety management needed to ensure proper safety performance (e.g. Lin & Mills, 2001). Further, the available guidelines for safety management do not really have a service provider approach and they have also been criticised as too difficult and onerous to apply (Matthews & Rowlinson, 1999).

This thesis contributes to the field by studying safety management in outsourced services in the manufacturing industry. The topic is approached by charting consideration of safety in multi-

employer worksites in the manufacturing industry, by reviewing the factors perceived as problematic in safety management implementation as well as studying the contributory factors of workplace accidents at manufacturing worksites. On the basis of this information an operational model is presented to support the management of safety directed particularly at service providers operating in the manufacturing industry.

2 OUTSOURCING, SERVICES AND SAFETY IN MULTI-EMPLOYER WORKSITES

2.1 Introduction to outsourcing

2.1.1 What is outsourcing?

Different references define the term 'outsourcing' in different ways. However, most of the sources see outsourcing as shifting work previously undertaken in-house to an external company (e.g. Belcourt, 2006; Mayhew & Quinlan, 1999; McCarthy & Anagnostou, 2004; Singer & Donoso, 2011). Gilley & Rasheed (2000) refer to this kind of outsourcing activity as a 'substitution-based outsourcing'. Here employees of the original organisation are commonly transferred to a service provider's employment (Belcourt, 2006). Other references, however, make no distinction between whether or not an operation was originally implemented in-house. Therefore, as an extension to the previous definition, these references regard outsourcing as also including all operations purchased from external service providers that could have been realised in-house, even though they have never been (e.g. Ahearne & Kothandaraman, 2009; Gilley & Rasheed, 2000; Harland et al., 2005). In this kind of thinking, a distinction between the basic procurement of activities that cannot be produced in-house and those strategically decided to source from service providers is made, so that only the latter activity is specified as outsourcing. This type of outsourcing is referred as an 'abstention-based outsourcing'. (Gilley & Rasheed, 2000) Besides these two common interpretations of outsourcing, several others definitions have been presented (see Gilley & Rasheed, 2000; Harland et al., 2005). For example, according to Gilley & Rasheed (2000), the term 'outsourcing' has been used so loosely that the definitions formulated include 'virtually any goods or service that an organisation procures from outside firms'.

In addition to the term 'outsourcing', several parallel terms are also utilised to describe similar kinds of situations. For example, the terms of contracting out (e.g. Dijkgraaf et al., 2003; Vining & Globerman, 1999), subcontracting (e.g. Mayhew et al., 1997; van Mieghem, 1999), externalisation (e.g. Bounfour, 1999), vertical disintegration (e.g. Desyllas, 2008; Kazmi, 2008; Rossini, 2005) and make-or-buy (e.g. Arnold, 2000; Ford & Farmer, 1986; Klein, 2005; Moschuris, 2008) are commonly employed to refer to the practice of procuring operations from an external service provider instead of realising them in-house. In addition, the term 'offshoring' is also often used to differentiate between domestic outsourcing and those operations outsourced to other countries (e.g. Kirkegaard, 2006; McIvor, 2005; Olssen, 2006).

Whichever definition is adopted, broad or narrow, outsourcing can be considered as a contractual agreement between the customer and the service provider(s) on realisation of services or processes (Seuring, 2003). It has also been noted in the literature that outsourcing involves not only the purchase of services but also the transfer of responsibility for business functions and knowledge to the external organisation (McCarthy & Anagnostou, 2004). This transfer depends on the extent of the outsourcing. For example, Allen & Chandrashekar (2000) divide outsourcing

into the following three major categories: labour contracting, mixed outsourcing and complete outsourcing. In the first, only labour is procured from a service provider and in the third the customer provides only a liaison. The second category, mixed outsourcing, lies somewhere in between. (Allen & Chandrashekar, 2000)

2.1.2 Motivations for outsourcing

Outsourcing has become an important business approach in many organisations (Gilley & Rasheed, 2000; McCarthy & Anagnostou, 2004; McIvor, 2005) and thus the number of service providers is increasing (Parrod et al., 2007). The literature contains a number of reasons to explain why companies' increasingly prefer to procure certain operations from external service providers. One commonly cited is a company's desire to focus on its core activities (e.g. Abdel-Malek et al., 2005; Ali-Yrkkö, 2007; Arnold, 2000; Beale, 2003; Downey, 1995; Ekström, 2007; Hendry, 1995; Kakabadse & Kakabadse, 2002; Kiiskinen et al., 2002; McIvor, 2005; Parrod et al., 2007; Seuring, 2003). The reasons for purchasing supporting and enabling operations from an external service providers is the need of a company to focus on and be a specialist in its core business in a highly competitive environment (Parrod et al., 2007). Globalisation (Abdel-Malek et al., 2005) and technological advances (Doz and Hamel, 1998) have also been given as reasons for companies turning their focus to core operations.

Several authors have reported that outsourcing is both efficient and economical in terms of a company's available resources (Ardeti & Chotibhongs, 2005). For example, outsourcing can be utilised to redress imbalances and shortages of resources (e.g. Beale, 2003; Kiiskinen et al., 2002) and to acquire special skills and staff not found among the company's own personnel (Abraham & Taylor, 1996; Beale, 2003; Kakabadse & Kakabadse, 2002; Kiiskinen et al., 2002; Rikama, 2008; Solakivi et al., 2010). Outsourcing offers flexibility in the recruitment of labour by enabling companies to exploit only the labour they need at any particular certain time and paying only for the resources utilised (ILO, 2001). For example, Ardeti & Chotibhongs (2005) report that in the construction industry, general contractors are often unable to hire skilled craftsmen full-time for each special task and that owning and maintaining specialised equipment used only for a limited time during a project may not be feasible. Procurement of such resources from external organisations, therefore, is usually considered more reasonable option. It is also reported that qualified service providers typically perform their work more quickly and at lower cost (Ardeti & Chotibhongs, 2005). Hence, the decision to outsource is often seen as being based on the desire to achieve cost savings (Downey, 1995; Hendry, 1995; Kakabadse & Kakabadse, 2002; Kremic et al., 2006; PricewaterhouseCoopers, 2009; Solakivi et al., 2010) and to meet demand and efficiency requirements (Beale, 2003; Kiiskinen et al., 2002; Parrod et al., 2007, Sauni et al., 2005).

Outsourcing can also be a method for managing risks, for example, when organisation is modifying its activities or when it wants to assure a sufficient standard of service (Kiiskinen et al., 2002). Additionally, the decision to outsource may be prompted by the need to increase quality (Aminoff et al., 2009; Kakabadse and Kakabadse, 2002; Kremic et al., 2006), improve customer service (Solakivi et al., 2010), screen potential new employees (Downey, 1995) and access innovations (McIvor, 2005). However, the motives for outsourcing often vary from company to company. For example, Solakivi et al. (2010) report that larger companies are often

motivated by different concerns to smaller companies when outsourcing logistic services. Different reasons for outsourcing are also reported to exist between European companies and those in the USA (Kakabadse & Kakabadse, 2002).

2.1.3 Extent and objects of outsourcing

It is generally recognised that contract work has always existed in certain industries such as construction (Kalleberg, 2000) but the use of service providers started to grow in the 1990s also in other lines of business (Purcell & Purcell, 1998). Today, companies operating in manufacturing industry are among the most eager procurers of external services (Alajääskö, 2006; Ali-Yrkkö, 2007; Eurostat, 2009b). It has also been reported that Finnish companies show greater readiness to employ outsourcing than European companies in general (Ekström, 2007; Eurostat, 2009a; Rikama, 2008). For example, according to an outsourcing study by Accenture, 80% of the large (more than 400 employees) Finnish organisations have outsourced at least some of their operations. The corresponding share among Swedish and Norwegian organisations was only about 50%. (Accenture, 2005) According to Ali-Yrkkö (2007), during the first decade of 2000 almost two thirds of Finnish manufacturing companies with more than ten employees outsourced some of their operations. In 2009, the costs of using these external services (such as subcontractors and maintenance services) in Finnish manufacturing industry amounted to about 6 billion euro. When this figure is compared to the labour costs of in-house personnel, the amount allocated for external services represents almost half of total labour costs. (Statistics Finland, 2011d)

The share of outsourced operations is predicted to increase even further in the future (Ekström 2007; PricewaterhouseCoopers, 2009). For example, a study by PricewaterhouseCoopers (2009) showed that, depending on the function, between one third and a half of the companies responding planned to increase their current outsourcing over the next five years. It is interesting to note that even though almost half of the respondents of the Accenture (2005) study believed that outsourcing will continue to focus on non-core operations in the future, many respondents also thought that outsourcing will play an increasingly strategic role. The PricewaterhouseCoopers (2009) study also shows that a substantial number of companies will also consider outsourcing their core operations alongside their other business functions.

Overall, organisations have been keener to outsource their non-core operations. Singer and Donoso (2011) report that the most commonly externalised operations are supporting services such as catering and cleaning, information technologies, human resources, telecommunications, e-commerce and logistics. The PricewaterhouseCoopers (2009) study shows that information technology services are the most widely outsourced. However, production or delivery of core products or services, logistics and distribution, HR services, sales and marketing, innovation, research and development, procurement, customer call centres, and finance and accounting were also commonly purchased from external companies. (PricewaterhouseCoopers, 2009) According to the Accenture (2005) study, Finnish companies typically outsource IT-infrastructure, logistics, training, IT-development and IT-maintenance. Business processes like payroll administration and financial management services are also being procured increasingly from external service providers. (Accenture, 2005) In the field of manufacturing, the most commonly outsourced operations have been those supporting the main activities such as maintenance, property services

and cleaning (Ali-Yrkkö, 2007; Beale, 2003; Mayhew & Quinlan, 1999). About half of Finnish manufacturing companies employing more than 10 employees have purchased such services from a service provider (Ali-Yrkkö, 2007). Outsourcing of logistics functions is also common in Finnish industrial organisations (Solakivi et al., 2010).

2.2 Services

2.2.1 Definition of service

Services are activities carried out by a service provider interactively with a customer (ISO 9000, 2005) to meet the customer needs (Tekes, 2010). Grönroos (1991) has presented a more comprehensive definition stating that a service is 'an activity or series of activities of more or less intangible nature that normally, but not necessarily, take place in interactions between customers and service employees and/or physical resources or goods and/or systems of service provider, which are provided as solutions to customers problems' (Grönroos, 2001b). Other definitions have been presented such as that of Vargo & Lusch (2004) who define services as 'the application of specialised competences (knowledge and skills) through deeds, processes, and performances for the benefit of another entity or the entity itself (self-service)'. However, all these theoretical definitions share a similar abstract approach in order to cover the diverse phenomenon of services (Edvardsson et al., 2005).

Services can also be defined by their characteristics. In contrast to physical products, services are in many cases intangible, heterogenic, inseparable and perishable (e.g. Fitzsimmons & Fitzsimmons, 2008; Kotler, 2003; Zeithaml et al., 1985), collectively referred as IHIP. Intangibility refers to the fact that services are more activities than tangible products and therefore they cannot be seen, touched, or tasted (Edvardsson et al., 2005; Zeithaml et al., 1985). Heterogeneity refers to the high variability of services (Zeithaml et al., 1985), thus service performances are rarely the same between different customers (Grönroos, 1991). Inseparability refers to the simultaneous production and consumptions of services (Zeithaml et al., 1985). Perishability means that services cannot be saved or stored (Zeithaml et al., 1985) to be provided at some time in the future (Fitzsimmons & Fitzsimmons, 2008; Kotler, 2003). However, it has been noted that these IHIP characteristics are not applicable to all services in all situations (Edvardsson et al., 2005; Lovelock & Gummesson, 2004) or that they do not even differentiate between services and goods (Vargo & Lusch, 2004). Hence, other characteristics (see Haynes, 1990) and competing descriptions (see Spring & Araujo, 2009) have also been presented.

Despite these divergent views of service characteristics, services are commonly considered as dynamic and interactive processes during which a customer outcome is created (Edvardsson & Olsson, 1996; Grönroos, 2001a). Service processes consist of a chain of activities from which all must function properly in order to enable the production of a service. The service processes differ from manufacturing processes because, in the former, customers take part in the production process. (Edvardsson & Olsson, 1996; Fitzsimmons & Fitzsimmons, 2008) The customer may play an active role in the service production or participate in the process more passively (see Larsson & Bowen, 1989) but either way, they have an influence on the service outcomes.

2.2.2 Service classifications

Services can be classified according to their components to core, supporting and facilitating services (Grönroos, 2009). Core services are the reason an organisation is in business (Grönroos, 2009) and as such they respond to the customers' primary needs (Edvardsson & Olsson, 1996). Supporting services consist of operations supporting the utilisation of core services (e.g. customer service) but they are not necessary for the production of a service (Grönroos, 2009). Supporting services deal more with customers' secondary needs by providing additional value to customers (e.g. training) (Edvardsson & Olsson, 1996). Facilitating services, on the other hand, are operations necessary to make the production of core services possible (e.g. logistics) (Grönroos, 2009).

In addition to the foregoing components, a variety of other service classifications has been presented in the literature. Silvestro et al. (1992) reviewed these service classifications and presented the following six ways to divide services. The classification of Thomas (1978) classifies services according to whether equipment plays a key role in service delivery (e.g. vending machines) and according to whether these are people based where service personnel form a core element in service delivery (e.g. repair and accounting services). Chase (1981) has presented a customer contact-based classification in which services can be divided into high-contact and low-contact services according to the amount of time the customer is in direct contact with the service system (Chase, 1981). Maister & Lovelock (1982) created a two-dimensional service classification based on the degree of customisation and client contact. Haynes (1990) suggests that services can be divided according to the intensity of interaction with the customer being either mechanistic or organic and according to the complexity of technology (simple/complex) (Haynes, 1990). Maister's (1983) classification divides services into back-office oriented services and front-office oriented services according to the numbers of customer contact personnel as a proportion of total employees. Additionally, Johnston & Morris (1985) have presented a classification based on product/process orientation where product-orientation relates to services with an emphasis on end product and process-orientation for those geared more to the service delivery process (Johnston & Morris, 1985). Silvestro et al. (1992) combine these classifications and present a grouping consisting of the following three classes: professional services, mass services and service shops. In this classification, the professional services are considered as highly customised, process-oriented, front-office services with a relatively long contact time and considerable modification to meet customer needs. Mass services are the converse of professional services and service shops fall between these two types (Silvestro et al., 1992). However, categorisation of a company's services is often not so straightforward because many companies implement more than one type of service business (Thomas, 1978; Chase, 1981).

2.2.3 Service projects and processes

Projects are temporary endeavours undertaken to create unique products or services (Project Management Institute, 2008). Projects have also been defined as a set of planned, goal oriented, complex and interrelated tasks that are executed in a fixed period of time within a certain cost and extent (Artto et al., 2006). Even though every project has an exact start and finish, the deliverables and activities of the projects can vary widely between different projects. Further,

different projects vary in size and complexity. Processes, on the other hand, are defined as a set of interrelated or interacting work activities which transform inputs into specific outputs (ISO 9001, 2005) for a particular customer or market (Davenport, 1993). The difference between projects and processes can be considered as the continuity and repeatability of a process while projects are one-off in nature (Kvist et al., 1995).

Projects can be described in terms of their lifecycle structure from the start of the project and continuing through to the organisational and preparation stages of the project work and ending with the completion of the project (Project Management Institute, 2008). However, the terms used in the literature for the different project stages differ and these four stages can also be divided into several sub-stages. Further, each stage of the project includes various factors that need to be considered (e.g. timing, economics, financing and environment) (Ward & Chapman, 1995). The common project life cycle classification introduced by Adams & Barndt (1978) consists of four stages; conceptualisation, planning, execution and termination. In this model, the initial phase of the project is called the conceptualisation stage. This stage involves recognising a strategic need for the product or service to be produced. After this the preliminary objectives and means of implementation of the intended project are determined. In addition, the capacity and skills to accomplish the activities are explored. (Pinto & Prescott, 1990) The final step in the conceptualisation stage is to assess whether to proceed to the next stage or discard the plans made (Ward & Chapman, 1995). During the second stage, referred to as planning, the means for achieving the objectives set in the previous stage are planned in a more structured and formalised way. The plans made at this stage need to take into account scheduling, budgeting, and the allocation of specific tasks and resources (Adams & Barndt, 1978). Ward & Chapman (1995) consider this second stage as consisting of the design, planning and allocation phases. These phases involve much the same themes as those in the approach of Adams & Barndt (1978) but they also include a decision on whether or not to proceed after each phase (Ward & Chapman, 1995). During the third stage, execution, the plans made in the previous phases are realised when the actual product or service is produced (Adams & Barndt, 1978; Pinto & Prescott, 1990). In the service context, this stage is more complex because customers often actively participate in the execution of services and thereby also influence the results (Bitner et al., 1997; Grönroos, 2001a). The final stage of a project life cycle, termination, occurs once the project has been completed. During this stage the resources assigned to the project are released and personnel reassigned to other duties. It is also the stage when the output of the project is handed over to the customer (Adams & Barndt, 1978; Pinto & Prescott, 1990). In the service context, the service has already been consumed simultaneously with its realisation (see Bitner et al., 1997; Grönroos, 2001a). Ward & Chapman (1995) consider the termination stage to consist of three distinct steps: delivery, review and support. In this classification, delivery means the handover of the products to the user, review involves auditing of the project and support relates to the liability and maintenance of the deliverables (Ward & Chapman, 1995). The basic process classification follows the stages of projects. It consists of the initiating, planning, executing, monitoring and controlling, and closing phases (Project Management Institute, 2008).

2.3 Safety management in multi-employer worksites

2.3.1 Introduction to safety management

Safety management can be described as measures implemented in order to improve safety. Despite this concise definition, safety management has also been defined in numerous other ways even if the different versions are somewhat similar. For example, Heinrich et al. (1980) consider safety management as being the 'control of worker performance, machine performance and physical environment' in which 'control' includes both the prevention and rectification of unsafe conditions and circumstances. Lanne (2007) widens this description by stating that safety management is 'systematic and organised management aiming to prevent situations harmful for people, environment, property, knowledge or reputation'. Kirwan (1998) sees safety management as actual practices, roles and functions associated with remaining safe. Laitinen et al. (2009) see safety management as managerial operations aiming to continuously improve the safety level and competitiveness of the workplace. For their part, Frick & Wren (2000) regard safety management as a strategy utilising systematic management in order to preventively decrease ill health by observing and eliminating workplace hazards. In addition, several other definitions have been presented (see Hämäläinen & Lanne, 2001; Hämäläinen & Anttila, 2008) However, Hämäläinen & Lanne (2001) have formulated descriptions that neatly condense the ideas presented in the definitions above. They consider safety management as comprehensive, systematic and continuous management for controlling safety and health risks in order to ensure employees' safety and health and to result in a productive, safe and healthy workplace (Hämäläinen & Lanne, 2001).

Several important practices for efficient safety management have been reported in the literature. Among others, these involve positive safety attitudes and safety culture (Booth & Lee, 1995; Kirwan, 1998), willingness to comply with the safety measures (Booth & Lee, 1995), management commitment to safety (Hämäläinen & Lanne, 2001; Mearns et al., 2003), construction of safety policy (Booth & Lee, 1995; Hämäläinen & Lanne, 2001; Kirwan, 1998), planning of safety procedures (Booth & Lee, 1995), defining operational liabilities and authorisations (Booth & Lee, 1995; Hämäläinen & Lanne, 2001; Kirwan, 1998), involvement of employees (Frick et al., 2000; Mearns et al., 2003) interaction between different personnel groups (Hämäläinen & Lanne, 2001), risk assessment (Booth & Lee, 1995; Frick & Wren, 2000; Hämäläinen & Lanne, 2001), sufficient competence (Hämäläinen & Lanne, 2001), effective communication systems (Booth & Lee, 1995; Hämäläinen & Lanne, 2001; Mearns et al., 2003) and sufficient resources (Kirwan, 1998). The importance of integrating safety into day-to-day decisions and everyday operations (Booth & Lee, 1995; Hämäläinen & Lanne, 2001) and monitoring performance with an appropriate measurement system (Booth & Lee, 1995; Hämäläinen & Lanne, 2001) have also been identified as important practices. Even though the elements of effective safety management can be considered quite similar for every organisation, their implementation can differ markedly between organisations (Hämäläinen & Anttila, 2008).

Safety management is implemented through various practices that constitute a safety management system. Thus a safety management system can be considered as a combination of different practices through which management implements safety management in the organisation (Levä, 2003). The objective of a safety management system is to eliminate safety

related risks at the worksite through well-planned and proactive procedures consisting of a continuous cycle of planning, implementation, evaluation, and correction (Robson et al., 2005). Several formal safety management system models have been developed to support the implementation of safety management in organisation. The best-known safety management system models are BS 8800, Occupational health and safety management systems; OHSAS 18001, Occupational health and safety management systems; and ILO-OSH 2001, Guidelines to health and safety management systems. Most of the safety management system models share many similar features (Fernández-Muñiz et al., 2009). For example, the three previous models approach management of safety, among others, through hazard identification, responsibilities, training, communication and emergency preparedness (see BS 8800, 2004; OHSAS 18001, 2000; ILO-OSH 2001, 2001). These safety management system models are general in nature, but there are also business-specific models. For example, Safety Checklist Contractors (SCC) is a safety management system model that has been specially developed for industrial manufacturers and service providers. The SCC discusses safety management through 12 elements that are similar to the above mentioned general models (SCC - SHE Checklist Contractors, 2008). The safety management system models provide a flexible approach to the implementation of safety management. However, these system models are best suited to large organisations rather than small organisations, which may find them too burdensome or complex to implement (Makin & Winder, 2008; Eakin et al., 2000).

2.3.2 Effect of outsourcing on safety and safety management

Outsourcing leads to significant changes in the organisation (Johnstone et al., 2001). Employees of one or more service providers and even their subcontractors will need to operate in a workplace where earlier worked only employees of the main company (Väyrynen, 2003). In such multi-employer worksites, where employees from more than one employer or self-employed workers operate simultaneously or successively, the performance of tasks may affect the safety and health of other performers (Finnish Occupational Safety and Health Act, 2002). Thus, outsourcing work affects not only the safety of the main company employees but also those working for service provider organisations (Lingard & Rowlinson, 2005; Mayhew and Quinlan, 1999).

There are numerous reports to the effect that outsourcing has a negative impact on safety performance at worksites (see e.g. Hale, 2003; Lingard & Rowlinson, 2005; Mayhew & Quinlan, 1999; Walters & James, 2009). Lingard & Rowlinson (2005) give an example of poorly realised outsourced maintenance of machinery that may pose hazards to the employees working for the main company. Conversely, poor safety management in a customer company may endanger external employees despite the latter observing safety procedures (Mynttinen, 2006). The safety risks experienced by service providers may also originate from the activities of other service providers (Lingard & Rowlinson, 2005).

According to Quinlan et al. (2001), all the literature on the topic published between middle 90's and the end of the previous century and where there was a correlation between outsourcing to safety performance, found that outsourcing adversely affects safety performance. It is claimed that this negative effect of outsourcing on the worksite safety stems from the changes in work communities and working relations due to the influx of new operators at the workplace (Mayhew

and Quinlan, 1999). The utilisation of external employees results in a complex network of organisational boundaries (Hale, 2003) and fractures tasks into separate working units, creating complex command chains (Johnstone et al., 2001). In multi-employer worksites the coordination of different activities and implementation of safety measures are also reported to be more difficult (Papadopoulos et al., 2010). Other adverse factors for safety caused by outsourcing are the temporary nature of the work and the rapidly changing work environment (Kartam et al., 2000). Outsourcing has also been shown to cause cuts in staffing levels and a reduction of qualified personnel (Johnstone et al., 2001). In addition, service providers often have a limited overview of the customer company's operations, performed work tasks, special features, and safety regulations, factors which can compromise the management of safety (Loosemore et al., 2003; Luttkus, 2002). In addition, service providers usually operate with several customers so that the divergent working habits, cultures and practices at customer sites may detract from the management of safety in service provider companies (Heikkilä et al., 2005; Lind et al., 2006).

In multi-employer worksites, service providers play an important role in worksite operations and hence they also have a direct effect on worksite safety (Molenaar el al., 2009). Some sources even regard service providers and their employees as front-line operators on a site and thus as the ones with major responsibility for site safety (Toole, 2002; Langford et al., 2000; Love, 1997). The paradox here is that such employees are often regarded as lacking in safety management skills and knowledge (see Wilson & Koehen, 2000; Matthews & Rowlinson, 1999). For example, Mynttinen (2006) shows that the safety of outsourced operations is often of a lower calibre than in those tasks performed in-house. Hinze & Gambatese (2003), however, report that service provider safety is also influenced by the quality of the scheduling and coordination realised by the main company. In certain cases, service providers' safety can even be influenced more by the customers than by the service providers themselves. (Hinze & Gambatese, 2003)

Nevertheless, along with the outsourcing and changes in work relations, the means to manage safety and health need to be reconsidered; traditional safety management procedures are rarely well-suited to multi-employer worksites (Ylijoutsijärvi et al., 2001). For instance, Heikkilä et al. (2005) state that safety management requires greater effort in multi-employer sites than in traditional ones. In addition, the organisation and timing of work tasks also requires better preplanning (Mayhew & Quinlan, 1999). The need to reinforce safety management becomes even more important when service providers subcontract their operations further (Ylijoutsijärvi et al., 2001).

2.3.3 Implementation of safety management in multi-employer worksites

Legal requirements

According to the European directive (Council Directive 89/391/EEC, 1989) and Finnish legislation (Finnish Occupational Safety and Health Act, 2002) both the customer company and the service provider organisation have the primary responsibility for the safety of their own employees. For example, Finnish Occupational Safety and Health Act (2002) requires employers to ensure that their operations pose no danger to the safety and health of their employees. The Act obligates the employer to carry out inspections which cover, for example, the working practices, work conditions and work environment. Furthermore, the legislation requires

employers, among others, to identify work-related hazards, to plan measures for the improvement of safety, supervise safety of the work environment and working practices, communicate identified hazards to the employees, ensure that employees have adequate knowledge and experience and also provide appropriate personal protective equipment (Finnish Occupational Safety and Health Act, 2002).

In addition to the above obligations, the Finnish Occupational Safety and Health Act (2002) cites supplementary responsibilities regarding safety activities multi-employer worksites. These obligations concern all the parties operating at worksites where one employer is considered to have the overall control and where employees from other companies or self-employed persons are working, either simultaneously or successively, and where the tasks performed can affect the safety and health of the other employees. In such multi-employer worksites levels of communication and cooperation between the different operators need be high enough to ensure safety at the worksite. The employer having the overall control must ensure that external employees are informed of any worksite hazards and that they are aware of relevant operating instructions and safety procedures. For their part, external parties need to inform other employers of any safety risks their own work could pose for other employees at the site. Moreover, the employer in overall control is responsible for coordinating the different workers' tasks, traffic schemes, general housekeeping and tidiness, worksite planning, and safety of the work environment and work conditions. (Finnish Occupational Safety and Health Act, 2002) For self-employed workers working at multi-employer worksites Finnish Occupational Safety and Health Act (2002) also provides regulations governing safety issues such as hazard identification, competence and machine safety.

Good practices

The requirements mentioned in the legislation for safety activities at multi-employer worksites are presented in fairly general terms. However, certain specific practices for effective management of safety in sites with several operating parties have been presented in the literature. Inclusion of safety in the service provider selection criteria, is a factor commonly mentioned as important in ensuring a sufficient safety level in multi-employer worksites (see e.g. Holmes et al., 1999; Lappalainen et al., 2003; Mynttinen, 2006; Sauni et al., 2005; Shafer, 2008). Several researchers stress the importance of this factor and recommend that potential service providers are informed on safety principles and requirements already at the tendering phase. This would help them to take into account the safety issues already in their initial plans (Lappalainen et al., 2003; Sauni et al., 2005; Shafer, 2008). It has also been recommended that before a contract is awarded, the outsourcer organisation should ensure that the service provider company fully meets the agreed requirements, complies with site safety rules, implements the necessary safety measures and supervises the safety of their work (Luttkus, 2002). The importance of including the customer's safety requirements in written contracts has also been noted (Lappalainen et al., 2003; Mynttinen 2006; Sauni et al., 2005). The safety responsibilities of the service provider organisation and the persons responsible should also be specified at this stage (Mynttinen, 2006; Sauni et al., 2005).

The literature also contains references which highlight the importance of proper hazard identification at multi-employer sites (see e.g. Mynttinen, 2006; Shafer, 2008). For safety

reasons, customer companies should require service providers to provide hazard identifications in their work tasks. These identifications can be carried out in cooperation between the customer and the service provider or by the service provider organisations themselves with feedback of the results to the customer. (Mynttinen, 2006) Trethewy et al. (2003) recommends that hazard identifications are realised with input from the employees since they have the best knowledge of the safety risks and that such identification should include analysis of relevant statistics. Further, Shafer (2008) proposes that daily hazard analysis is carried out prior to realisation of work tasks. This would be beneficial since it allows changing work conditions to be reviewed regularly and also serves as a regular reminder to employees of safety issues. It is also recommended that accidents involving service provider employees are reported to the customer and that these are investigated together with the customer company's representatives (Downey, 1995; Mynttinen, 2006).

Several studies highlight the importance of safety training for employees at multi-employer worksites (e.g. Downey, 1995; Lappalainen et al., 2003; Mynttinen, 2006; Sauni et al., 2005; Trethewy et al., 2003). Downey (1995) proposes that external employees should have the same orientation and safety training as the customer organisations' own employees and participation in these should be mandatory. It is essential that all service provider employees at the worksite are kept abreast of the prevailing hazards, preventive procedures and safe working practices. Orientation for new or unfamiliar tasks, substances, machinery or tools should also be given (Lappalainen et al., 2003). Shafer (2008) considers that good orientation helps employees to adjust more readily to the worksite conditions. Mynttinen (2006) recommends that customer organisations provide emergency training for service providers before they start work at the site. Trethewy et al. (2003) mention the importance of interactive training instead of written work instructions if the employee is a non-native speaker.

Communication has been mentioned by many authors as an important factor in multi-employer worksite safety management. For example, Väyrynen (2003) regards effective communication channels as essential when operating with other parties. Hinze & Raboud (1988) show that regular meetings help to identify safety problems and their solutions. Lin and Mills (2001) recommend the setting up of a safety committee comprising of representatives from the different parties operating at the site in order to promote interaction between the parties and to ensure communication. Mynttinen (2006) recommends that service provider employees participate in worksite safety meetings, inform the customer organisation of their working practices as well as their own employees of the customer's requirements. Shafer (2008) also advocates holding pre-operation meetings before service providers enter the site and daily review meetings before the work is started to communicate safety performance expectations.

It has been cited as a good practice when also the customer monitors service providers' safety performance in multi-employer worksites (Mynttinen, 2006; Sauni et al., 2005). Mynttinen (2006) also recommends that the customer organisation should intervene in the event of risk taking or unsafe practice. Such intervention is particularly important when no on-site service provider supervision is available (Mynttinen, 2006). Good liaison between customer and service provider companies is crucial for the successful implementation of safety measures and the mitigation of risks at multi-employer worksites (Luttkus, 2002).

A number of additional factors have been identified as important in promoting successful multi-employer worksite safety management. According to Sauni et al. (2005) key factors are good coordination among the various operations and effective rules between customer and service provider. They stress the importance of good scheduling and coordination so that disruptions in work phases and operations can be minimised (Sauni et al., 2005). Shafer (2008) also observes that good scheduling is especially important in safety related-activities, such as installation of fall protection systems and construction of protective enclosures. Certain potentially hazardous activities (e.g. painting and noisy operations) should be performed in isolation from other activities (Shafer, 2008). Vassie & Fuller (2003) have shown that the tendency to partnership and long-term contracts can help in promoting the effective management of safety. In the partnering approach, for example, the customer company and their service providers can obtain a well-trained and stable workforce, minimise conflict, and reduce accident rates (Vassie & Fuller 2003). Clear, relevant instructions and a good safety culture (Sauni et al., 2005) as well as thorough site planning (Shafer, 2008) are also key factors for safety at such sites.

2.4 Safety challenges of outsourcing

From the previous section it can be concluded that outsourcing is generally considered to have an adverse impact on the occupational health and safety of both the parent company employees and the external workers. According to Mayhew and Quinlan (1997), the main risk factors associated with outsourcing concern economic and reward factors (e.g. competition of tenders, long hours and inadequate resources), disorganisation (e.g. ambiguity in rules, work practices, and procedures, insufficiencies in communication and complexities in management and supervision) and the increased likelihood of regulatory failure (e.g. due to inappropriate support material and compliance strategies and weaknesses in occupational safety and health laws). Additional risk factors, such as a safety neglecting service provider selection criteria, weak commitment of service providers, dangerous work tasks and working practices, differences in working cultures and inadequate hazard identification, have been presented in the literature (e.g. Holmes et al., 1999; Mayhew et al., 1997; Mynttinen, 2006; Schubert & Aijkstra, 2009; Trethewy, 2003). These risk factors are discussed in greater detail in the subsequent sections.

2.4.1 Economic factors

Service provider selection

The service provider selection process should involve an acceptability assessment of the service provider's safety records (Lingard & Rowlinson, 1995). Even though some companies evaluate service providers' safety programs and experiences (Kochan et al., 1994), very few employ systematic and extensive safety criteria to assess service provider's safety levels (Mynttinen, 2006). One explanation cited for this is that service providers are commonly selected on the basis of price and availability criteria (Lingard & Rowlinson, 1995). However, such criteria often neglect safety considerations (Kochan et al., 1994, Mynttinen, 2006, Ruohomäki & Karlund, 2001; Shafer, 2008). If customers are concerned only with a low price it gives service providers an image that safety is an item from which customers are not willing to pay. This puts pressure on service providers to cut safety costs in the tender in order to make a competitive bid. (Hinze

& Raboud, 1988) According to Kartam et al. (2000) most service providers do not include safety costs in their tenders unless specifically required to do so. Some safety-orientated service providers have criticised the current tendering system for underestimating the importance of occupational safety and health (Langford et al., 2000).

As a result of an emphasis on the lowest price, safety performance at the worksite often suffers and extra costs can easily be incurred because of this (Hinze & Raboud, 1988; Ruohomäki & Karlund, 2001) and incidents (Shafer, 2008). According to Gunningham (2008), competitive pressures may even result in an increased risk of work-related injury and disease. This idea is supported by Hinze and Raboud (1988) who found that injury rates tend to be higher if the operations were competitively bid. In contrast, Lin & Mills (2001) found no significant differences in safety performance between contracts obtained via competitive tendering and negotiations. A possible reason for poorer safety performance is that price-based employment encourages service providers to focus on speedy execution of their work (Beale 2003; Mayhew et al., 1997) and to do extra hours (Gunningham, 2008; Mayhew et al., 1999) in order to maintain profitability. Tight schedules can impair the preplanning of work tasks and thereby endanger employees' safety (Ruohomäki & Karlund, 2001). In addition, scheduling pressure from the customer and deadline constraints can encourage the taking of short cuts that could jeopardise worksite safety (Heikkilä et al., 2005).

Resources

Insufficient resources, including time, money and personnel, for safety management and the improvement of safety performance is a problem encountered by many service provider companies, particularly the small ones (Holmes et al., 1999; Lin & Mills, 2001; Mayhew et al., 1997). Because most of the service provider companies are smaller than the customer companies, outsourcing is likely to reduce the overall resources available for safety work (Lin & Mills, 2001; Mayhew et al., 1997; Mayhew et al., 1999). When the supply chain lengthens, the work may be performed by smaller companies, which have even fewer resources for supervising and managing safety activities adequately (Ylijoutsijärvi et al., 2001). Beale (2003) reports that safety problems may also occur if the customer company lacks the resources to adequately supervise and manage operations.

2.4.2 Disorganisation

Responsibilities

Segmentation of work among several operators complicates the division of responsibilities (Clarke, 2003; de Beeck & van Heuverswyn, 2002; Johnstone et al., 2001; Sauni et al., 2005). Loosemore et al. (2003) state that service providers are often not fully aware of their occupational safety and health related responsibilities. According to Ardeti & Chotibhongs (2005), operators at multi-employer worksites are sometimes confused about which parties are responsible for worksite safety. Their survey found that about half the service providers and a slightly larger share of customers believed that worksite safety was the responsibility of service providers although a large proportion of respondents also felt that customers should employ an adequate number of safety personnel (Ardeti & Chotibhongs, 2005). This uncertainty over responsibilities can impair safety standards at multi-employer worksites (Clarke 2003).

Problems in safety may also be due to a lack of clarity as to managerial relations and supervisory duties (Heikkilä et al., 2005). Customer companies may shift the responsibilities for occupational safety and health to their service providers and even fail to ensure that the service provider is working safely and following safety procedures (Wilson & Koehen, 2000). On the other hand, according to Kochan et al. (1994) almost half of the service providers in their study had no safety professional at the worksite. In many cases there are no written detailed descriptions of safety duties, which can also lead to confusion in the allocation of responsibilities (Toole, 2002). In addition, safety issues are often discussed only cursorily during contractual agreements (Heikkilä et al., 2005). The relegation of safety issues in agreements often leads to confusion over responsibilities and may give rise to deliberate and/or unintended neglect of safety procedures (Beale, 2003). In addition, small organisations in particular may find it too onerous to keep abreast of safety rules and regulations (Holmes & Gifford, 1997).

Communication

Good communication is essential for effective safety management but in multi-employer worksites it can be challenging to manage the flow of information effectively (Väyrynen, 2003). Communication between the different parties operating at a multi-employer worksite is often problematic or insufficient (Lingard & Rowlinson, 1995; Mynttinen, 2006; Tulonen, 2010; Väyrynen, 2003). For example, Lingard & Rowlinson (1995) have reported that in construction projects communication between the various parties is rarely open and honest without conflict and confrontation making it difficult to achieve safety cooperation at the worksite. Shafer (2008) states that information concerning safety and customer requirements are not always sufficiently communicated to the persons realising the tasks. Communication problems can take the form of poor briefing on the various parties' work assignments or their status, a lack of information needed to perform tasks safely and improper communication channels (Tulonen, 2010). If the relevant information does not reach all performers, the general view and the importance of an individual employee's safe performance may remain unclear (Väyrynen, 2003). Hence, deficiencies in the flow of information may, at the worst, cause dangerous situations (Mynttinen, 2006) that could endanger the safety of both the service provider's and customer's employees. Johnstone et al. (2001), for example, mention that service provider employees may be unaware of some of the customer company employees' informal knowledge that would be essential in avoiding worksite hazards and endangering the other employees at the worksite.

The reasons for communication problems between customer and service providers have Been studied widely. Breakdowns in communication are considered to occur for several reasons such as unclear relationships between the different parties at the worksite (Kochan et al., 1994), work tasks executed under schedule pressures (Beale, 2003) or infrequent opportunities to share information with others at the worksite (Väyrynen, 2003). Furthermore, Heikkilä et al. (2005) report that customer company employees sometimes forget to share information with external employees. Many service providers, for example, feel that customers take their views and comments less seriously than those of their own personnel. Providing critical feedback to the customer about the personnel's inadequate safety behaviour may prove difficult. However, even if the communication channels between the service provider and the customer are open, there may be problems in the discourse between service providers themselves. (Huttunen, 2001)

Schubert & Aijkstra (2009) note that communication problems can be particularly acute with foreign service providers and employees.

Hazard identification

The study of Mynttinen (2006) shows that customer companies commonly identify hazards relating to the tasks of their own employees but that these observations are usually not shared with the service provider. However, only a few of the service providers in the study had executed systematic hazard identifications (Mynttinen, 2006). Glazner et al. (1999) have also reported similar results, in which only about half of the service provider respondents had conducted job hazard analysis and had rectified the hazards identified promptly. Even if proper hazard identification is performed, there can still be low employee participation or poor communication of the results (see Mynttinen, 2006). Systematic and complete hazard identification by service providers can be hindered by inadequate resources or a lack of willingness and skill (Trethewy et al., 2003). Frequent changes in the composition of workforce, working hours and working conditions, as well as tight schedules, may leave little time to conduct comprehensive risk assessments (Papadopoulos et al., 2010). Shafer (2008) remarks that service providers may find it too onerous to implement hazard identifications on their work activities, particularly at the beginning of the contract when they are not fully conversant with the working processes. Papadopoulos et al. (2010) suggest that currently used risk assessment tools are inadequate for dealing with the complex situation emerging from outsourcing. Another drawback in hazard identification is that reliable and comprehensive data on worksite accidents and injuries are not available because customer companies rarely compile statistics for accidents involving their service provider personnel (Kochan et al., 1994).

Attitudes and culture

It is reported that outsourcing significantly affects the safety culture in the customer company (Molenaar et al., 2009). For example, Fang & Wong (2006) who studied construction sites in Hong Kong found that service provider employees often have a less positive attitude to safety than employees of the customer company. Molenaar et al. (2009) concluded that the use of service providers adversely affects the safety culture of the main organisation because developing a consistent culture requires years of work with the same employees. Service providers are also considered to be less committed, particularly the small companies, to manage safety issues in multi-employer worksite because of their smaller involvement and limited scope to affect such issues (Holmes et al., 1999; Holmes & Gifford, 1997; Lin & Mills, 2001; Wilson & Koehn, 2000). However, it has been shown that safety performance of external employees is affected by the actions of the customer company (Hinze & Gambatese, 2003; Lingard et al., 2010). For example, Choudhry and Fang (2008) have reported that if co-workers and supervisors at the multi-employer site are perceived to be unsupportive of good safety practice, service provider employees will be more inclined to adopt unsafe work practices. Even though several sources have discussed the impact of outsourcing on safety culture, Lingard et al. (2010) argue that the impact of utilisation of an external workforce for safety climate is still not well understood.

The literature in the field contains a variety of reasons to explain the importance of service providers' safety attitudes and their effect on worksite safety. One of these is that service

providers must work with several customer companies, all of whom have their own, often distinctive, organisational and safety culture and different working habits and practices (Lind et al., 2006). Such differences may often hamper the adoption of good safety practices (Heikkilä et al., 2005; Lind et al., 2006). According to Melia et al. (2008) service provider employees' loose connection with the customer company and relative isolation from their own company may have an impact on the formulation of their safety attitudes. Differences in cultural background complicate safety performance. Employees may have different levels of risk acceptance or regulation awareness (Schubert & Aijkstra, 2009). Problems can also arise if outsourcing leads to conflict between different operators and adversely affects working climate (Heikkilä et al., 2005). The attitudes of external employees' may be defective, for example, relation to safety regulations and instructions. Attitudinal problems are a common concern, especially in short-term projects. (Ruohomäki & Karlund, 2001)

Supply chains

Long supply chains involving complex relations, created by contracting outsourced tasks further, can also complicate safety management in multi-employer worksites (Beale, 2003; Loosemoore et al., 2003; Luttkus, 2002). As a result of a lengthened supply chain, safety risks encountered by employees may increase (Luttkus, 2002) and the constructed extensive network with its changing relationships can make it difficult for collaborating companies to meet their safety responsibilities and performance (Loosemoore et al., 2003; MacEachen et al., 2010). It is also possible that committed and well-trained employees initially selected by the customer organisation will, after the further contracting, be replaced by poorly trained employees with less commitment to good safety practice (Beale, 2003).

2.4.3 Work performance

Competence and training

Outsourcing is also seen as posing a risk to worksite safety because employees of an external company may often lack the requisite skills for the work tasks or familiarity with the worksite (Luttkus, 2002). Sometimes service providers may have only limited understanding of the site and the safety requirements in force (Luttkus, 2002) as well as the customer company's practices and procedures (Clarke, 2003; Lingard & Rowlinson, 2005). Service providers may also have insufficient expertise and resources to interpret and implement safety procedures effectively (Loosemoore et al., 2003). Due to shortcomings in competence, service providers also increase the accident risk (Clarke, 2003). According to Heikkilä et al. (2005), customer companies frequently fail to check the service providers' educational background or the competence to perform particular tasks. In the case of foreign service providers, it may be hard to validate employee qualifications and educational levels (Schubert & Aijkstra, 2009).

Service providers' employees usually have had less safety training than the customer's own employees (Rousseau & Libuser, 1997). In Wilson & Koehn's (2000) study almost half of the service provider employees had received no pre-work training. A lack of safety training is particularly marked in the case of smaller organisations (Lin & Mills, 2001). The reasons given for this by service providers is that work task and site specific training are generally not feasible in terms of time or cost because of the short duration of the relationship (Wilson & Koehn, 2000).

Safety training of the external company's employees often takes the form of an on-the-job learning exercise. Service providers may neither offer as effective safety training for their employees as the customer companies for economic reasons. (Rebitzer, 1995) Indeed, customers may not provide safety training for their service providers even when they have trained their own employees. This is often attributed to a lack of time and coordination and also to a belief that safety training is a service provider's responsibility (Goldenhar et al., 2001). However, poorly trained employees may fail to recognise the hazards associated with a particular work task (Toole, 2002).

Dangerous work tasks and working practices

It has been reported that a higher proportion of outsourced work tasks involve greater risks than those performed by customer company employees (Blank et al., 1995; European Agency for Safety and Health at Work, 2007; Kochan et al., 1994). Such outsourced tasks are often associated with maintenance, construction and installation (Beale, 2003; Blank et al., 1995). Service provider employees may also have different work conditions to the customer company's employees (Blank et al., 1995; European Agency for Safety and Health at Work, 2007). In combination, work hazards and deadline pressures can jeopardise worksite safety (European Agency for Safety and Health at Work, 2007).

Mayhew et al. (1999) report that, compared to the customer's employees, service provider employees are more likely to be exposed to dangerous and even illegal working practices, such as insecure scaffolding, improper use of safety harnesses, breaches of safety practices and excessive overtime. Unfamiliar work tasks and worksites along with a lack of awareness of hazards they involve may increase the temptation to circumvent safety regulations and employ dangerous working practices (Beale, 2003). It has been reported that overriding or even blocking machine safety systems is sometimes prompted by a desire to be more efficient and meet production targets (European Agency for Safety and Health at Work, 2007).

Accident prevalence

Several studies have shown that service provider employees tend to have higher accident rates than employees of a customer organisation (Azari-Rad et al., 2003; Blank et al., 1995; Fotta & Rehti, 1996; Cunningham, 2008; Kirchenbaum et al., 2000; Kochan et al., 1994; Quinlan, 1999; Rousseau & Libuser, 1997; Salminen et al., 1993; Salminen, 1995). Blank et al. (1995) have estimated that in the case of Swedish mining industry the accident rate of service provider employees in 1989 was almost double that for customer company employees. Fotta & Rehti (1996) observed a similar tendency in their study of U.S. mining between 1992 and 1994 in which 26% of the accident fatalities occurred to service provider employees even though their work accounted for only 6% of the total working hours. In addition, it has been shown that external employees suffer subsequent work injuries. According to Kirchenbaum et al. (2000) about 75% of the victims of work related injuries requiring medical care and who had previously suffered such injuries were service provider employees. Blank et al. (1995) has reported that accidents involving external employees are more severe than those of employees of a customer organisation. Their study showed that fatality rate among service provider workers was almost two times greater than customer company employees and that service provider employees were also more likely to suffer minor injuries. Sick-leave absences of service providers performing

certain activities (e.g. maintenance and repairs) were markedly longer than those of customer company employees performing the same tasks. (Blank et al., 1995) However, even though several studies consider that service provider employees have a higher prevalence of accidents than in-house employees, more research is needed to determine the extent of the problem (Gochfeld & Mohr, 2007; Manu et al., 2010), particularly in view of the shortcomings of accident data (Gochfeld & Mohr, 2007; Hämäläinen, 2010). These shortcomings stem from the under-reporting of accidents in service provider organisations; difficulties in extracting the accident data for service provider employees from the overall figures; and insufficient data to reliably apportion the accident figures to a particular group of service provider employees (Blank et al., 1995; Gochfeld & Mohr, 2007).

Several reasons for the higher prevalence of accidents among service provider employees' have been presented. The higher accident risk has been explained in terms of the following causes: service providers' unfamiliarity with the worksite and its practices and procedures (Clarke, 2003); service provider employees' short duration of visits to the site (Salminen, 1995) and high employee turnover rates (Hinze & Gambatese, 2003; Gunningham, 2008; ILO, 2001); a tendency for service providers to perform more hazardous activities (e.g. construction and maintenance) (Blank et al., 1995; Clarke, 2003; Gunningham, 2008; Kochan et al., 1994); service providers' inferior safety training (ILO, 2001; Kochan et al., 1994) and experience (Kochan et al., 1994); insufficiencies in the service providers' hazard identification (Salminen 1995); and inappropriate safety awareness (Hon et al., 2010). Blurred demarcation of responsibilities (Clarke, 2003), economic pressures such as tight budgets (Holmes et al., 1999; Quinlan & Mayhew, 2000), tight schedules (Holmes et al., 1999), poor coordination of work tasks among the various performers (Heikkilä et al., 2005; Quinlan & Mayhew, 2000; Ruohomäki & Karlund, 2001), shortcomings in safety management systems and organisational failures (Beale, 2003) have also been cited as contributing to the higher accident rates among service provider workers. However, even though such accident victims are more likely to be service provider employees, the activities of the customer also contribute to the accidents in which they are involved (Rantanen et al., 2007).

3 STUDY DESIGN

3.1 Research gap

The management of safety is shown to be more challenging in multi-employer worksites than in the traditional single employer sites. Service providers in particular are seen to be more likely to encounter problems in managing the safety of their operations (Matthews & Rowlinson, 1999; Wilson & Koehen, 2000). Complexity of safety management among the service providers arises from the special nature of service production involving the need to operate with several customers on various sites, often with unique working practices (see Lind et al., 2006; Välimaa et al., 2001). Despite the complexity of safety management in the service provider companies, such companies are, in any case, still legally required to ensure acceptable safety levels in their operations (see Council Directive 89/391/EEC, 1989; Finnish Occupational Safety and Health Act, 2002). Increasing interest is being shown in service providers' safety by the customer organisations (see European Agency for Safety and Health at Work, 2000; Zimmerman, 2005). However, some customers also continue to show a tendency to regard the service providers as having full responsibility for safety in their operations (Arditi & Chotibhongs, 2005).

Although the problems relating to safety management in service provider organisations have been noted, research and solutions in the field have been rather limited (Figure 1). The reasons for this are as follows: research has focussed on customers' problems and their interests in improving multi-employer worksite safety with the result that the service provider's viewpoint has received only minor attention (see e.g. Beale, 2003; Downey, 1995; Ernst et al., 2007; Luttkus, 2002); studies have covered only certain industrial sectors, mainly construction industry and some single fields of manufacturing industry such as the nuclear power or chemical industry (see e.g. Beale, 2003; Blank et al., 1995; Holmes et al., 1999; Kochan et al., 1994; Lin & Mills, 2001; Trethewy et al., 2003); some of the research has concentrated on specific fields of safety management such as safety training and accident investigation (see e.g. Lanne et al., 2007; Ylitalo, 2005); and much of the research in this field has adopted a theoretical approach with limited scope for practical solutions (see e.g. Johnstone et al., 2001; Loosemoore & Andonakis, 2007; Mayhew & Quinlan, 1999). In addition, most studies have been published over a decade ago and most have focussed on safety management at non-Finnish multi-employer worksites. Because only a limited amount of research has been carried in recent past years, the larger picture of the extent and nature of the current problems within the topic, particularly in Finnish organisations, is still far from clear.

Some of these constraints such as the customer viewpoint and generic approach also relate to the safety management solutions available for service providers. Few guidelines exist that are applicable regardless of the organisation size and that also offer practical tools or solutions for service provider organisations. Most of the guidelines are theoretical in nature and do not offer practical solutions or deal specifically with the service production sector (e.g. BS 18004; OHSAS 18001; ILO-OSH 2001). In addition, many safety management guidelines have been

found to be difficult or burdensome to adopt (Matthews & Rowlinson, 1999), particularly in small companies (Hämäläinen & Lanne, 2001) with limited resources available for safety management. There is a gap between the guidelines that are available and those sought for. There is a lack of practical solutions for the implementation of safety management in service provider organisations based on empirical research targeted directly at the needs of service providers.

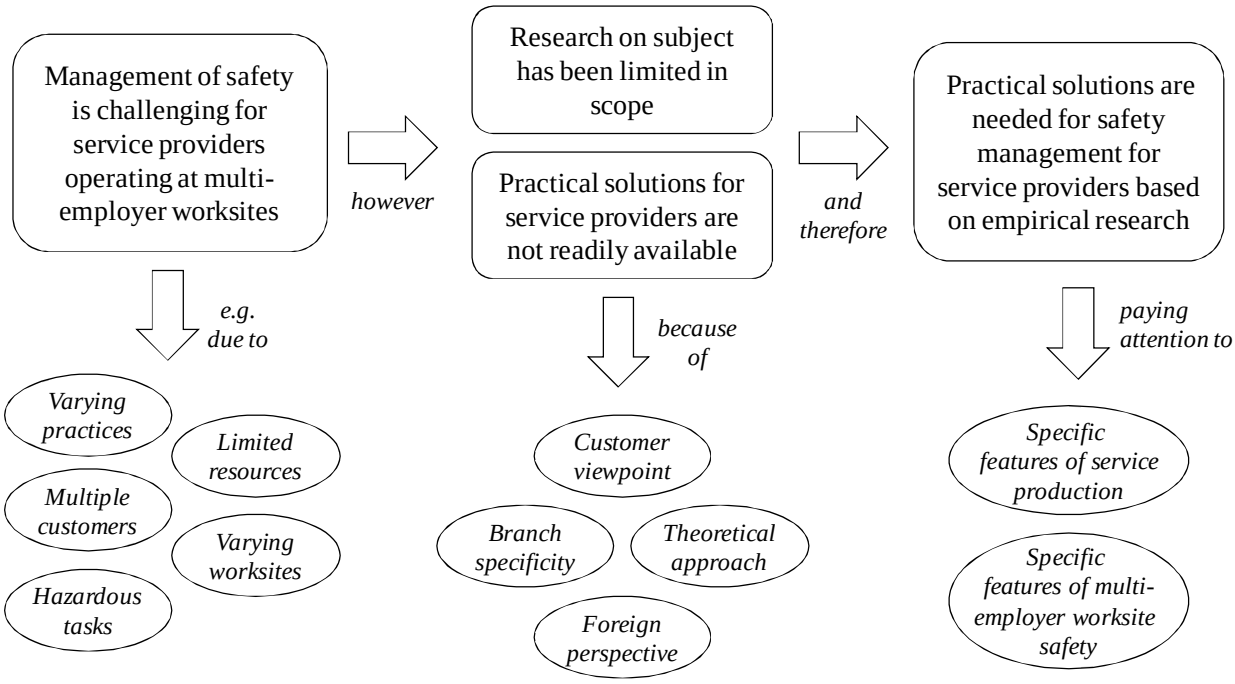

Figure 1 The research gap

3.2 Objectives and scope of the research

This study discusses management of safety in outsourced operations in the manufacturing industry. The focus is on service providers' activities but comparisons with customers' performance are also presented. There are two main objectives:

1) Review safety management implementation at multi-employer worksites in manufacturing industry.
2) Construct an operational model of safety management for service providers operating in manufacturing industry.

The first objective set is approached with the following research questions:

- How is safety taken into account during the different stages of the service project/process? What kind of opinions do service providers and customers have? (Papers II and IV)
- What kind of problems do service providers encounter in managing safety during a service project/process realised for manufacturing customers? Do these problems differ from those of customers? (Papers I and II)
- What are the typical factors contributing to fatal accidents when outsourced tasks are carried out at multi-employer worksites? What kind of corrective measures are recommended for their prevention? Do these factors differ between outsourced and in-house tasks? (Paper III)

The information gathered in answering these questions is used in construction of an operational model of safety management for service provider companies (Paper V).

The study investigates outsourced services in the manufacturing industry. The focus is on operations performed at the customer's worksite where there are employees both from the customer organisation and at least one service provider company. The term used here for such workplaces is 'multi-employer worksites'. This study does not differentiate between those services procured from service providers that could be produced in-house and those where the utilisation of external service providers is a necessity; all services purchased from service providers are considered as outsourced. In this research, the focus is on outsourced operations that are 1) carried out by an external service provider organisation 2) for a company representing the manufacturing line of business 3) at the customer's worksite. The service provider organisations studied here can, therefore, represent various sectors such as manufacturing, transport, real estate, and electricity supply and also produce a wide range of services such as maintenance and repair, installations, property maintenance, and cleaning. However, all these service providers operate with customer companies operating in manufacturing industry. The classification of a service project/process life cycle employed in this study is based on a general project life cycle classification. The first stage of the service project/process involves negotiating, including tendering, contract negotiation and contract preparation. The next following stage is delivery that includes realisation of services for the customer at the worksite. The final stage is called the ending stage, which involves an assessment of performance and feedback on completion of the tasks or expiry of the contract.

3.3 Summary of the research papers

The thesis contains five research papers of which four are scientific journal articles and one a peer-reviewed conference paper. Two of the papers are written with co-author(s). The author's contribution to the papers is presented in Table 1 and there are summaries of the papers below.

Paper I **Safety Management Problems Encountered by Industrial Service Providers**

Author: Nenonen, S.

Publisher: Proceedings of the IEEM International Conference on Industrial Engineering and Engineering Management, December 7.–10., 2010, Macao.

Summary: This paper discusses the results of a literature review charting the kinds of problems that are reported in the implementation of safety management at multi-employer worksites. The focus is on the problems of the service providers. The review was carried out by searching relevant publications in the electronic databases of scientific journals, library databases and by utilising Google search services. The results show that service providers encounter several problems in managing the safety of their operations due to the special features of service production. There are, however, only a few service provider specific tools to help service providers in solving such problems.

Paper II **Safety Management in Multi-Employer Worksites in the Manufacturing Industry – Opinions on Cooperation and Problems Encountered**

Authors: Nenonen, S. & Vasara, J.

Publisher: The International Journal of Occupational Safety and Ergonomics, Accepted for publication.

Summary: This paper studies implementation of safety cooperation and the safety problems encountered at multi-employer worksites in Finnish manufacturing industry. Material for the study was gathered from interviews with representatives of service providers and their customers and from the results of a questionnaire sent to personnel in the maintenance business. The paper reports on safety implementation practices in multi-employer manufacturing worksites, a topic treated only cursorily in the literature. It also describes several issues that adversely affect safety management that warrant closer investigation.

Paper III **Fatal Workplace Accidents in Outsourced Operations in the Manufacturing Industry**

Author: Nenonen, S.

Publisher: Safety Science 49(10)2011, 1394–1403.

Summary: This paper reviews fatal workplace accidents in Finnish manufacturing industry. The study investigates the various types of fatal accidents in outsourced operations at manufacturing worksites and the reasons for their occurrence. The paper also discusses preventive measures and presents a comparison of fatal accidents occurring in outsourced and in-house operations. The accident analysis employs accident report data compiled on fatal workplace accidents in Finland for the period 1999–2008. The results provide additional information on a topic that has previously received little attention.

Paper IV **Safety Considerations during Different Stages of a Project Life Cycle in the Manufacturing Industry**

Authors: Nenonen, S., Kivistö-Rahnasto, J. & Vasara, J.

Publisher: Human Factors and Ergonomics in Manufacturing & Service Industries, Under review.

Summary: This paper discusses the consideration of safety during the different stages of service project lifecycle. The focus is on services provided for Finnish manufacturing organisations. The review of the subject was carried out by means of interviews and a questionnaire distributed to representatives of Finnish manufacturing organisations and service providers operating in this field. The results show that safety issues are only partially and not systematically taken into account in the production of services. The topic presented here has not previously been investigated in the literature.

Paper V **An Operational Model of Safety Management for Service Providers in Manufacturing Industry**

Author: Nenonen, S.

Publisher: The Service Industries Journal, available online.

Summary: The paper presents an operational model of safety management for service providers. The model discusses the relevant legislation, safety management problems, contributory factors of accidents and the needs of organisations operating in the manufacturing business. The information used in the development process was gathered by means of a literature review, interviews, a questionnaire, analysis of fatal accidents, pilot testing and user reviews. The model introduced in the paper adopts a service provider approach and combines general and practical information. The approach adopted here differs from prior safety management guidelines.

Table 1 Author's contribution to the papers

Paper		Author's contribution to the paper
I	Safety Management Problems Encountered by Industrial Service Provider	- Carrying out the literature review - Writing the paper
II	Safety Management in Multi-Employer Worksites in the Manufacturing Industry – Opinions on Cooperation and Problems Encountered	- Design and implementation of the company interviews together with the co-author - Carrying out the questionnaire and analysing the data - Coordinating the writing of the paper - Main responsibility for writing the paper
III	Fatal Workplace Accidents in Outsourced Operations in the Manufacturing Industry	- Design and realisation of the data collection - Implementation of the data analysis - Writing the paper
IV	Safety Considerations during Different Stages of a Project Life Cycle in the Manufacturing Industry	- Design and implementation of the company interviews together with the other co-author - Carrying out the questionnaire and analysing the data - Coordinating the writing of the paper - Main responsibility for writing the paper
V	An Operational Model of Safety Management for Service Providers in Manufacturing Industry	- Coordination of the development process - Development of the model with the research group - Carrying out the user review and analysing the data - Writing the paper

4 MATERIAL AND METHODS

4.1 Material

Most of the material used in this study was collected during the course of the research project 'Safety Management of Industrial Services' which discusses safety management in outsourced operations in the manufacturing industry (see Nenonen et al., 2008). The research project was conducted at Tampere University of Technology between 2007 and 2008 in cooperation with service provider companies and their customers, who operate in the manufacturing industry (Table 2). Funding for the project was obtained from the Finnish Work Environment Fund and the participating organisations. The data gathered during this research project was later supplemented with materials required for finalising the thesis.

The service provider companies participating in the research supplied mainly maintenance and repair services, machinery manufacturing, installations and modifications, property maintenance, and cleaning services. Their customers in the study operated in various branches of the manufacturing industry such as the forest, packaging, food and energy industries. One of the service provider companies (H) also acted as a customer organisation and thus had two roles, as an organisation providing services and also as one purchasing them. Another service provider's (E) customer was the parent company so that, in this case, customer and service provider both represented the same company. In addition, one service provider (A) changed their appointed customer company during the course of the research but there was also another service provider (C) with two customers throughout this period. One customer company was appointed as a partner organisation by two of the service providers. In addition to the company participants, the Finnish Maintenance Society, Promaint, an association promoting Finnish maintenance, also took part in the study.

Table 2 Information on service providers and their customers participating in the research project

Service provider	Typical services provided	Number of employees	Field of the appointed customer company
A	Maintenance and repair	a few thousand	1) plastic industry 2) food industry
B	Cleaning and property maintenance	several thousand	machine manufacturing
C	Maintenance and installation	a few dozen	1) packaging 2) machine manufacturing
D	Industrial sanitation	a few hundred	paper industry
E	Maintenance and repair	a few hundred	energy industry
F	Information services	a few dozen	energy industry
G	Maintenance and upkeep	several dozen	food industry
H	Maintenance and installation	a few hundreds	sawmill industry

4.2 Methods

The material utilised in the study was collected in six phases (A–F), consisting of preliminary company interviews, a safety cooperation questionnaire, an accident analysis, supplementary company interviews, a pilot study and a user questionnaire (Figure 2). The aim of the preliminary company interviews (A) and the safety cooperation questionnaire (B) was to chart service providers' views on consideration of safety and safety related problems in multi-employer manufacturing worksites and compare these with customers' views. The interviews also sought to identify the service providers' requirements for the operational model that would be constructed during the study. The purpose of the accident analysis (C) was to provide information on the typical accidents that occurred during outsourced operations in manufacturing worksites and review their contributory factors. Another objective was to compare the accident contributors with the perceived problems charted in the previous phase. The supplementary company interviews (D) and a pilot study of the operational model utilisation (E) were carried out for model construction and further development. Finally, a user questionnaire (F) charting out utilisation and utility of the operational model was realised 17 months after launch of the final version of the model. The methods used are discussed in more detail in the following sections.

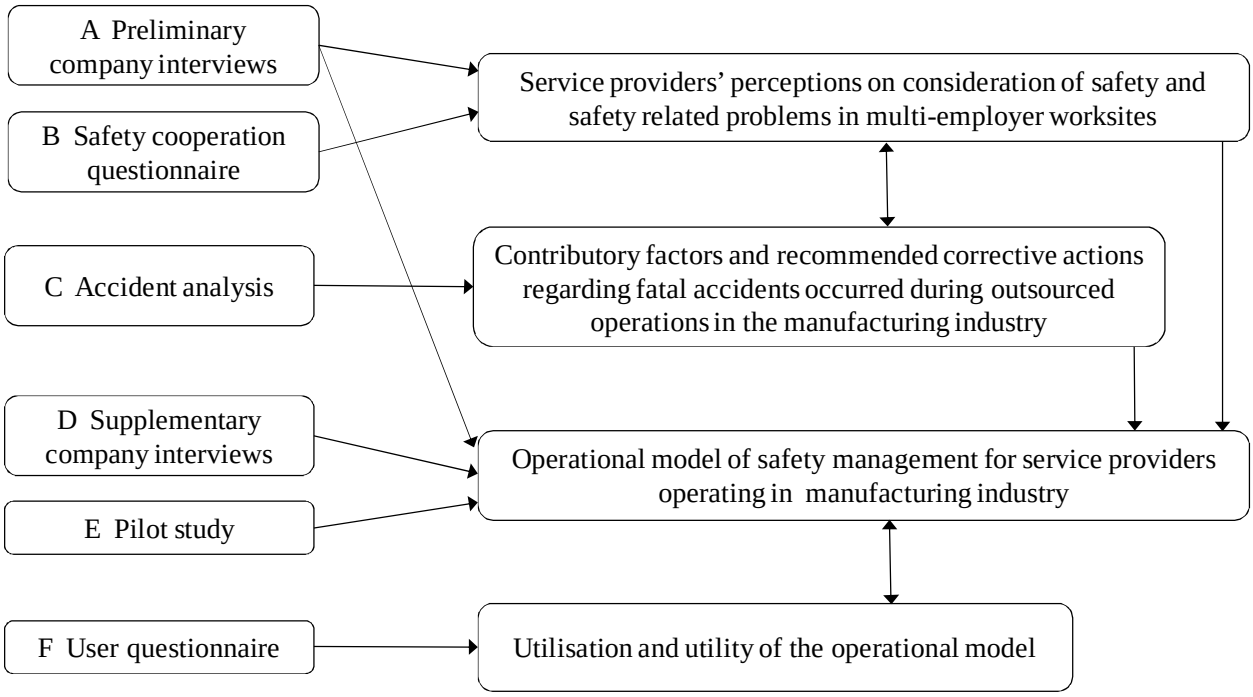

Figure 2 Research methods and outcomes

4.2.1 Survey on consideration of safety and safety problems

Preliminary company interviews

Manufacturing industry operators' opinions on safety management practices, implemented safety-related cooperation and problems encountered in safety management at multi-employer worksites were reviewed during the preliminary company interviews (Fig. 2, phase A). Representatives were interviewed from both the service providers participating in the study and

their appointed customer companies as well as the Finnish Maintenance Society, Promaint. The interviews were carried out as semi-structured theme interviews during which certain themes were discussed but the structure and order of the questions was flexible. The themes covered in every service provider interview involved the services they provided and the operations supporting and facilitating production of these services; safety aspects of these services; and accidents and incidents involving company employees. With the customer interviewees, the same themes were discussed but from a customer viewpoint (e.g. purchased services and safety issues relating to these services). An outline of the questions for the service provider interviews is presented in Appendix A.

The interviews were carried out during visits to the participating organisations by the researchers. The interviews were conducted in two stages. In the first stage, all the service provider and customer companies were visited and primary interviews executed. When it was deemed necessary, the results from these interviews were supplemented with a second round of interviews with service providers and some of their customers. The interviews were conducted in groups during which the service provider representatives were interviewed separately from customers but the customer interviews were conducted together with their service providers. There were 39 interviewees comprising of managers, superiors and employees. The responses received during the interviews were examined closely and summarised. However, the results can be seen only as indicative: the precise number of companies sharing similar opinions within certain topics cannot be calculated due to the free-form nature of the interviews.

Safety cooperation questionnaire

A safety cooperation questionnaire (Fig. 2, Phase B) charting consideration of safety and safety problems at multi-employer manufacturing worksites was compiled in order to supplement and widen the scope of the results obtained from the preliminary company interviews (Fig. 2, Phase A). In addition to the service providers' opinions, customers' views were also charted to enable comparison between these two respondent groups. Relevant literature and the results of the preliminary company interviews were utilised in devising the questionnaire. The main themes in the questionnaire were the implementation and success of safety cooperation, safety management problems encountered, consideration of safety and safety in contracts. Background factors such as the number of personnel, respondents' occupational status and produced/purchased services were also charted. The questionnaire is presented in Appendix B.

The questionnaire was realised as a web survey and sent to 347 members of the Finnish Maintenance Society, Promaint. In total, 89 responses were received, yielding a response rate of 25.6%. However, 14 of these respondents did not fall into the target group since they did not represent organisations providing services for manufacturing companies or organisations purchasing these services. Therefore, 75 responses were included in the subsequent analysis. Of these respondents 57% represented companies operating mainly as service providers and 43% operating mainly as customers. The service providers typically supplied maintenance, repair and assembly services, but also design, cleaning and property maintenance, among others, were provided. The customer organisations operated mostly in the basic manufacturing industry but also, for example, in utilities such as electricity, gas and water supply. The organisations representing the customers procured a wide variety of services from common maintenance to, for

example, cleaning, transportation, construction and security. Detailed information on the respondents' backgrounds is presented in Table 3. The data was analysed with SPSS 16.0. The basic features of the data were summarised by descriptive statistics and dependencies were identified with Fisher's exact test, Mann-Whitney U-test, and Kruskal-Wallis test.

Table 3 Summary of the respondent background

Variable	**Values**	**Service providers** (n=43)	**Customers** (n=32)
Number of personnel	1–9 employees	9%	9%
	10–49 employees	23%	13%
	50 employees or more	67%	13%
Respondent's organisational status	top management	30%	19%
	middle management	61%	66%
	supervisor	7%	16%
	employee	2%	0%
Certification (achieved or certification in progress)	ISO 14001	58%	63%
	ISO 9001	70%	66%
	OHSAS 18001	37%	38%
	other (e.g. Responsible Care)	7%	6%
Safety responsibilities included in respondent's job description	yes	28%	61%

4.2.2 Review of fatal accidents

The accident analysis (Fig. 2, Phase C) was carried out by gathering information from accident reports on fatal workplace accidents involving employees or entrepreneurs covered under the Employment Accidents Insurance Act (TOT-reports). These accident reports are based on investigations conducted by a group of experts (e.g. representatives of the Federation of Accident Insurance Institutions, labour unions, and officials' and employers' organisations). The accident reports were selected as a data source since they include information on whether the accident had occurred during outsourced or in-house operations. The reports were obtained from the 'TOTTI' database maintained by Federation of Accident Insurance Institutions. All accident reports from 1999–2008 were examined by the researchers and those reports falling into the target group (a fatal accident at a manufacturing worksite) were selected. There were 83 cases that matched the target group and these were selected for more detailed examination.

Based on analysis of the reports, data was compiled on whether the operation performed at the time of the accident was in-house or outsourced, what kind of tasks were performed by the injured employee, what caused the injuries, what factors contributed to the accident, and what corrective measures were recommended to prevent the reoccurrence of similar accidents. A variety of background information was also gathered (e.g. service provider's branch, company size and also victim's age, profession and work experience). Information on the type of operation, factors contributing to the accidents, recommended corrective measures and victim's work experience were included in the description parts of the accident reports. The other

variables reviewed were encoded in the reports according to the ESAW-classification (European Statistics of Accidents at Work). Details of the variables gathered are presented in Appendix C. The data gathered was analysed with SPSS 15.0 by calculating descriptive statistics and carrying out several statistical tests (Fisher's exact test and Mann-Whitney U-test).

4.2.3 Construction of the operational model

The development process of the safety management operational model was kept highly flexible to enable the construction of a well-designed material aggregate. The process involves the following five, partially overlapping phases: a requirement specification, conceptual design, content provision, pilot testing and final deployment. (Figure 3)

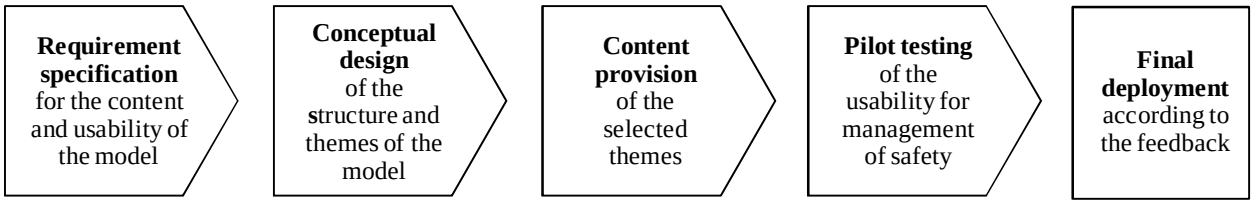

Figure 3 Phases of the operational model construction process

In the first phase, the preliminary requirements set in the project proposal were revised in collaboration with the companies that took part in the research project. These requirements were discussed during the preliminary company interviews (Fig. 2, Phase A). The basic aim of the operational model was to provide information for the implementation of safety management at organisations providing services for the manufacturing industry and also to promote safety-related cooperation with the customer companies. In addition, the service provider organisations presented several specific requests and requirements for the model (see Table 4). In the conceptual design phase, the first draft of the structure and content of the model was designed according to the output of the previous phase. The results of the safety problem surveys and accident analysis were also utilised. The design was reviewed and finalised together with the participating companies during the supplementary company interviews (Fig. 2, Phase D). Following this phase, the operational model was structured according to the principle of continuous improvement. Further, it was decided to include both general and worksite-specific sections in the model. The model also contains a discussion of safety management in outsourced operations in terms of the typical problems faced by the operators as well as the relevant legislation. The content provision phase involved the consecutive stages of content production and commentary. The source materials used in this phase came from the literature, legislation, interviews, accident analysis, guidebooks and standards. During the four-month pilot testing phase (Fig. 2, Phase E), the operational model was field-tested in the participating companies in order to evaluate the utility and functionality of the model as well as its compliance with the set requirements. After the testing period interviews were conducted to chart the experiences of the model users. This feedback showed that, to a large extent, the tested version of the model was suitable for its purpose. However, certain revisions were recommended such as clarification of the structure and outline of different fields and also rephrasing of certain paragraphs to improve their intelligibility. In the final deployment phase, the model was revised into its final form on

the basis of the feedback received from the piloting companies. After approval from the participating companies, the finalised version of the operational model was released.

Table 4 Summary of the service providers' requirements and recommendations for the operational model

Requirements and recommendations for the operational model
Considers work tasks performed by different operators
Enables development of uniform practices in different units of the organisation
Considers relevant legislation
Guides management of safety when operated with multiple operators in varying worksites
Practical and easy to use
Applicable at different worksites
Compatible with framework of common safety management systems
Suitable for different size companies
Offers wide-ranging information on safety management implementation
Includes compact listings of safety issues in everyday operations
Contains information related specifically to risk management, responsibilities, competence, communication, dangerous work tasks, licences, insurance, working abroad and foreign employees

4.2.4 Utilisation and utility of the operational model

A questionnaire reviewing utilisation and utility of the operational model (Fig. 2, Phase F) was carried out among the participating service provider companies and their customer partners 17 months after the launch of the final version of the operational model. The aim of the questionnaire was to review users' perceptions of the applicability and adequacy of the model. The questionnaire contained questions on the utilisation of different contents of the model; situations in which the model had been utilised; and the people who had utilised the model. The questionnaire also covered assessment of utility, coverage and correspondence with the requirements. More detailed information on the contents of the questionnaire is presented in Appendix D.

The questionnaire was realised as a web survey and sent to contact persons in the participating organisations operating in the manufacturing industry. The company providing information services was excluded from this analysis due to the differences in service production characteristics. In addition, contact persons in three of the companies could not be reached due to changes in employment and so these companies were omitted from the questionnaire target group. Invitations to participate in the questionnaire were sent to the representatives of 14 companies, of which seven responded to the survey, yielding a response rate of 50%. Five of these organisations represented service providers and two their customers. The data was analysed with SPSS 16.0 and summarised with descriptive statistics.

5 RESULTS

5.1 Consideration of safety at multi-employer worksites

5.1.1 Preliminary company interviews

The service provider interviewees raised several safety related issues that are implemented in cooperation with customers. The most common issues mentioned can be classified into the following five categories: communication, deviations, hazard identification, instructions and rules, as well as induction and training. Communication-related issues were often cited as factors to be considered at multi-employer worksites. Communication among the partners is implemented, for example, by organising regular joint meetings (e.g. shared weekly meetings and the opportunity for service providers to participate in customer's industrial safety committee meetings), joint planning of particularly dangerous work tasks (e.g. work in confined spaces, electrical work and hot work) and introducing a notification or work permit practice for the hazardous tasks. The interviewees had also noted that some of their partners wanted to invest in longer partnerships with their collaborators in order to strengthen communication and promote safety in the long-term. Furthermore, during the interviews it was pointed out that not only are accidents and incidents involving service provider employees commonly reported to the customer but also that the customers inform service providers about accidents involving their own employees (e.g. a database accessible for both parties). In some cases accidents involving the service provider company's employees are also investigated along with representatives of the customer organisation. Hazard identification was also mentioned as an activity normally undertaken jointly by the various parties or, at least, the results of the identifications obtained separately by each party are reported to the other parties. As for instructions and rules, the interviewees mentioned that instructions (e.g. for a certain work task) are drawn up in collaboration among with the relevant parties and that the instructions are available for everyone at the worksite. It was also noted that safety rules apply to all parties operating at the worksite and that each supervisor is responsible for ensuring compliance. Moreover, the service provider interviewees mentioned that their employees have the opportunity, or even the obligation, to participate in induction training organised by the customer before the commencement of work tasks. This practice is employed especially when there are major maintenance shutdowns. Safety training sessions and emergency drills are also conducted jointly among the parties. The various forms of cooperation mentioned in the interviews are summarised in Table 5.

In addition to the various forms of safety-related cooperation implemented together with their customers, the service provider interviewees cited the particular safety measures implemented in their own organisations. Such measures involved safety training and tests (e.g. occupational safety card, hygiene competence test, hot work permit), compilation of instructions for common work tasks, organising safety campaigns (e.g. proper use of personal protective equipment, near misses reporting campaign, purchase of safety vests for employees), uploading introductory material to the company's intranet, and training of local safety representatives.

Table 5 Summary of safety cooperation modes implemented at multi-employer worksites

Cooperation categories	Examples of the implemented measures
Communication	Appointing contact persons to share information between parties Cooperative task-planning and notification practices Reporting of defects and collaborative improvement planning Regular meetings between service providers and customers Tendency for partnerships and long-term cooperation
Deviations	Joint investigation of accidents involving service providers Reporting of accidents and incidents to the other parties
Hazard identification	Sharing results of individual hazard identifications with the other parties Involving representatives of occupational health care in identification process Performing identification jointly with service provider and customer Discussion of work task and site hazards already at the contract phase
Instructions and rules	Availability of instructions for all parties operating at site Instructions are drawn up in cooperation with relevant parties Rules apply to all parties and their compliance is supervised
Induction and training	Possibility/obligation for service providers to participate in customer's induction sessions Joint emergency drills at worksite Shared safety training sessions for customer and service provider employees

5.1.2 Safety cooperation questionnaire

Most of the service providers who responded to the questionnaire regarded safety cooperation with their customers as successful, with almost three quarters saying that cooperation was somewhat or very successful. However, most respondents also thought that safety was heavily dependent of the partner. Only 16% of the service providers considered the success of safety cooperation to be independent of the partner. According to the service providers, the main factors involved in successful safety cooperation were appropriate attitudes and safety culture, familiarity with the partner and procedures, commitment to safety, shared rules, and common safety standards. Attitudes and safety culture were mentioned by every third service provider and the other factors by every sixth. Background factors, such as organisation size, certificates, respondent's status, and safety responsibilities, were not statistically significant in the service providers' assessment of successful cooperation. However, there were differences between the views of service providers and customers as to the success of safety related cooperation, even though the differences were not statistically significant ($p=0.062$). Nevertheless, the customers gave less often poor marks for cooperation than the service providers. While none of the customers regarded cooperation as being weak, every ninth respondent among the service providers held the opposite view. The customers also often mentioned the importance of training and orientation, common safety goals, active communication and proper instructions as major factors in successful safety cooperation. However, the only statistically significant difference was found in the case of instructions. Of the customers, 17% cited this factor whereas none of the service providers considered this to have an impact on safety cooperation success ($p=0.039$).

According to over 90% of the service providers, safety issues are always or at least sometimes taken into account in contracts. The service providers reported that during the contract negotiations several safety issues are addressed. Typical of such issues were the required safety courses and licenses, work passes, and personal protective equipment. These issues were mentioned by 80% of the respondents representing the service provider organisations. Work supervision, reporting near misses and accidents, persons in charge, scaffold arrangements, and tools and equipment were also frequently mentioned; more than 60% of the service providers referred to these issues. Three quarters of the service providers reported that safety issues covered in contracts are also taken up in discussions between the parties. The size of the respondent's organisation and organisational status affected the responses significantly. The respondents representing smaller companies stated more often than those of larger ones that safety issues are considered already at the contract phase ($p=0.002$). Of the respondents from small companies, 75% considered that safety issues are, at least sometimes, covered in contracts but the share of those from middle-sized companies was only 10%, and in the case of large organisations the share was 57%. However, more respondents from larger companies than small and middle-sized said that near miss and accident reporting practices are discussed during contract negotiations ($p=0.022$). The share of the respondents raising this issue was 85% in the case of large companies but 50% and 40% for small and middle-sized organisations, respectively. Furthermore, the respondent's status in the organisation had a bearing on the mentioning of tools and equipment ($p=0.007$) and persons in charge ($p=0.002$). Middle management reported more often that these topics are mentioned in contracts (80% of middle management respondents) compared with less than 40% of the other management levels in the case of tools and equipment and about 50% in the case of persons in charge. On the other hand, the differences in opinions between the service providers and the customers were not statistically significant.

The service providers had fairly positive opinions about the implementation of safety in cooperation with the customer before executing work tasks. Nine of the ten service providers agreed that the customer always or sometimes provides pre-work induction training on the worksite and work task safety. The same amount of service providers also considered that dangerous work tasks are, at least sometimes, pre-planned together with the customers. However, two thirds of the service provider respondents said that task preplanning and only one third that induction training are managed appropriately in any occasion. (Table 6) The background of the service provider did not affect the responses, nor were any statistically significant differences found between service providers and customers.

The service providers gave rather positive evaluations of consideration of safety during the performance phase. The service providers were, for example, very satisfied with their partners' attitudes towards safety proposals. About 90% of the service providers agreed that their proposals are mostly well-received and acted upon. Further, about 80% of the service providers agreed that safety is taken into account in every situation and that the division of responsibilities is clear. Almost 60% thought that safety issues received a suitable amount of attention in joint meetings and a half considered work task instructions to be quite readily available. It was also generally agreed that accidents involving the service provider were usually investigated together with the partners. This was mentioned by about 40% as being standard practice and another 40% of the respondents felt this to be sometimes the case. However, cooperation was not as common

for hazard identification and only every sixth service provider always executed this task with their partners, while one in two said that they sometimes performed the identification process together with their partners. Fewer than half of the service providers fully or partially agreed that occupational health services provide enough cooperation. (Table 6) Service provider background had no statistical significance on the responses but differences in opinions between the service providers and the customers were found with respect to hazard identification (p=0.045). Customer attitudes were more positive in terms of execution of hazard identification together with the partner. Of the customers, about 75% reported that hazards are, at least to some extent, jointly identified whereas among the service providers the corresponding figure was about 60%.

According to half of the service provider respondents, safety performance is always or sometimes assessed on completion of the work task. The same proportion also said that safety performance is assessed on expiry of the contract. However, about 15% of the service providers said that safety performance is never assessed at this stage. (Table 6) The variation in the responses with respect to safety review at the end of contract was statistically significant and was related to company size (p=0.013). Of the respondents from small companies, 75% said that assessment is done sometimes or always at this stage. The corresponding proportion from larger organisations was about 30%. No other statistically significant differences were found between the various respondent groups or between service providers and customers.

Table 6 Service providers' perceptions on the joint consideration of safety with their partners

Cooperation regarding safety	**Share of respondents** (n=42)			
	Agree	*Somewhat agree*	*Somewhat disagree*	*Disagree*
Partner takes safety proposals into consideration	33%	60%	7%	0%
Safety is given consideration in every situation	17%	64%	19%	0%
Division of responsibilities is clear	22%	56%	22%	0%
Safety is given sufficient attention in joint meetings	12%	45%	38%	5%
Explicit instructions of work tasks are available	5%	41%	48%	7%
Occupational health services provide enough cooperation	12%	33%	33%	21%
	Always	*Sometimes*	*Rarely*	*Never*
Safety is taken into account already at the contract stage	48%	45%	7%	0%
Dangerous tasks are pre-planned with a partner	64%	26%	10%	0%
Customer familiarises service providers with worksite safety	31%	60%	10%	0%
Customer familiarises service providers with work task safety	29%	55%	14%	0%
Accidents are investigated together with a partner	41%	38%	21%	0%
Hazards are identified together with a partner	15%	46%	39%	0%
Safety performance is assessed at the end of work tasks	10%	38%	36%	17%
Safety performance is assessed on expiry of contract	7%	36%	43%	14%

5.2 Perceived safety problems

5.2.1 Preliminary company interviews

In the interviews the representatives of the service provider companies cited several problems regarding the management of safety in service production at multi-employer worksites. The problems mainly related to attitudes or safety culture, communication, coverage of instructions, planning of work tasks, responsibility issues, and variation in practices. (Table 7)

In terms of attitudes and safety culture, the service providers mentioned problems arising from poor attitudes to safety in customer organisations. The interviewees thought that the customer relationship could be endangered if service providers criticise their safety performance by mentioning poorly managed issues or requesting improvements. Some of the service providers were also concerned about the incautious attitudes of their own employees and the fact that safe work performance is highly dependent on the employee. Ingrained unsafe working practices were seen as a particular challenge when employees who had previously worked for the customer, were transferred to the service provider's employment as part of the outsourcing contract. The interviewees also said that friction could sometimes arise between external and in-house employees so that there was a general reluctance to interfere in the unsafe practices of the other party.

The interviews also showed that effective communication was often quite difficult to achieve. The service providers reported that interruptions in the flow of information arise, for example, during the handover of work shifts (e.g. poor communication about unfinished tasks and employees working on the worksite), in abnormal and changing situations (e.g. prolonged, unfamiliar and extra work tasks, use of new chemicals, or changes in processes), and when the employee and supervisor are not at the same location. In addition, mention was made of insufficiencies in the information flow between or regarding different service providers at a worksite. The interviewees also said that communication practices differ among the various performers, that the performers are not properly informed about new parties coming to the site or the hazards involved in their tasks, and that communication about further contracting of subcontracted tasks is often inadequate. In the case of instruction coverage, some of the interviewees doubted the relevance of the information being produced. For example, the instructions drawn up for certain work tasks were not seen as being applicable to different worksites since each had its own special characteristics. Other challenges reported at the interviews were devising instructions for acute work tasks and ensuring a sufficient flow of information to employees performing tasks at various sites.

The service providers saw the planning of work tasks as particularly challenging in the case of tasks that needed to be done at short notice and in great haste. Task planning problems were considered to be particularly acute when the tasks differ from those planned, they are prolonged, or additional work tasks emerge. Furthermore, lack of clarity over safety responsibilities was often considered to complicate safety management. Many of the interviewees mentioned that responsibilities between the parties operating at the site were not always clearly demarcated. This was most common in the organisation of induction training, realisation of accident investigation, and insurance. The allocation of responsibilities was seen as being especially

complex in overseas projects, where the typical problems involved divergent practices relating to licenses, insurance requirements and ensuring safety of tools and machinery. Further, the diversity of practices was widely blamed for problems in the management of safety. The differences in practices between the company's own units, those at the various customer sites and in different countries were mentioned as complicating factors. Such factors involved the division of responsibilities; ensuring sufficient communication; responding to requirements on competencies, licences, and safety training; organisation of induction training; and compilation of instructions.

Other obstacles to good safety management at multi-employer worksites received single mentions in the interviews with the service providers. These difficulties concerned issues such as the customer's demands to complete tasks as soon as possible, safety management resources often not readily available, productivity demands, short term contracts, language barriers when operating with foreign employees or abroad, and high turnover of employees.

Table 7 Service providers' opinions on the safety challenges of operating at multi-employer worksites

Challenge categories	**Examples of the challenging situations**
Attitudes / safety culture	Ingrained unsafe working practices Friction between external and in-house employees Reliance on the employee for safe work performance Poor attitudes to safety in customer companies Poor safety attitudes or safety culture in own company
Communication	Different locations of the employee and the supervisor Limited safety information received from customers Insufficient information flow in handover of work shifts Poor information flow between/regarding different service providers at worksite Situations diverging from those planned Lack of awareness of appointed contact persons
Coverage of instructions	Devising instructions for urgent work tasks Ensuring flow of information to employee performing work task Inadequacy of instructions obtained from customer / available on worksite Relevance of work task instructions in different worksites
Planning of work tasks	Urgent work tasks Coordination of different performers' work tasks Constant haste Tasks diverging from those planned Work tasks performed at several worksites
Responsibility issues	Division of responsibilities when operating abroad Insurance requirements for service providers in different situations Practices for investigating accidents and incidents Organisation of worksite-specific induction training
Variation in practices	Divergent operating practices among company's own units Varying working cultures and requirements in different countries Varying working practices between different customer worksites

5.2.2 Safety cooperation questionnaire

Of the respondents representing the service providers, about half considered the following to be the most common challenges for implementing safety at customers' sites: ensuring an adequate flow of information; hazard identification and risk assessment; and coordination of the different performers' operations. Other common challenges reported were coordination of simultaneous work tasks, varying working habits, task planning, implementation of induction training, determination of responsibilities and reporting dangerous practices on the part of the customer. These factors were mentioned by at least every fifth service provider. (Table 8) Statistically, the background factors did not significantly affect the responses. The challenges identified by the service providers were largely the same as those mentioned by respondents representing the customers. The only statistically significant difference between the opinions of the service providers and the customers was in relation to the organisation of supervision ($p=0.023$). Only about one in ten service providers considered this factor challenging compared to almost a third of the customers.

Table 8 The most common factors service providers viewed as challenges in managing safety at multi-employer workplaces

Perceived challenges	**Share of service provider respondents** (n=43)
Ensuring adequate flow of information	56%
Hazard identification and risk assessment	47%
Coordination of different performers' operations	47%
Coordination of simultaneous work tasks	40%
Differences in performers' working habits	37%
Task planning	37%
Induction training	26%
Demarcation of responsibilities	23%
Pointing out other performers' dangerous actions	23%
Unclear objectives	14%
Cooperation in investigation of near misses	14%
Turnover of worksites	14%

5.3 Fatal accidents in outsourced operations in the manufacturing industry

5.3.1 General information

Between 1999 and 2008, 34 fatal accidents occurred in outsourced work tasks at Finnish manufacturing worksites. This is about 41% of all fatal accidents at manufacturing sites during the period under review. The annual number of fatal accidents at operations performed by external employees ranged between 1 and 6 and represented 14–60% of all fatal accidents occurred at manufacturing worksites. One accident claimed three victims and others involved a single casualty. The majority (81%) of the employees injured during outsourced operations were salaried staff of the service provider. Most of the accidents were the result of the victim's own actions, while in only two cases was another person's activity a contributory factor.

In the case of outsourced operations, the average age of the injured employees was 43 and their ages ranged between 18 and 69; about a third were in the age group 45–54 years. Most of these were truck drivers (21% of the victims), machine operators (15%), electricians (12%), and machine repairers (9%). Most of the victims were experienced in the work tasks they were performing at the time of the accident; three quarters had at least 5 years' experience or were described as experienced. Half of the victims worked for a company employing at least 50 employees but also small employers (nine workers at most) were represented (40% of the cases).

The most common working processes at time of the accident involved installations and preparations. Most of the accidents occurred when moving on the worksite and the typical accident deviations were breakage, bursting, splitting, fall, or collapse of the material agent. The injuries were usually the result of trapping or crushing. A summary of the most common types of these accidents is presented in Table 9.

Table 9 The most common working processes, specific physical activities, deviations and modes of injury for fatal accidents in outsourced operations in Finnish manufacturing industry during 1999–2008

Variable	**Type** (% of the cases, n=34)
Working process	Installations and preparations (27%) Maintenance and repairs (18%) Cleaning tasks (15%)
Specific physical activity	Moving at site (41%) Working with hand-held tools (16%) Handling objects (16%)
Deviation	Breakage, bursting, splitting, fall, or collapse of the material agent (30%) Stumbling, falling, or falling of persons (24%) Shock, fright, violence, aggression, threat, or presence (18%)
Mode of injury	Trapping or crushing (44%) Horizontal or vertical impact with or against a stationary object (24%) Struck by or collision with object in motion (12%) Contact with electrical voltage, temperature, or hazardous substances (12%)

Statistically significant differences in the accident factors between outsourced and in-house operations were found in the case of victims' age group, company size and working processes. The share of victims in the age group of 24-year-old or younger was greater and a proportion of those falling into the group of 55–64 was smaller within outsourced tasks than in-house ones ($p=0.011$). Employees injured when performing outsourced tasks were more commonly employed by a smaller company than those involved in accidents occurring during in-house operations ($p=0.003$). The working processes performed at the time of the accident also differed between outsourced and in-house operations; production and monitoring were more common in the case of in-house tasks than in outsourced ones ($p=0.044$ and $p=0.019$, respectively).

5.3.2 Contributory factors and recommended corrective measures

According to the accident report analysis, the most common factors contributing to fatal workplace accidents in outsourced operations in the manufacturing industry related to dangerous

working practices (e.g. working in a danger zone) and insufficient hazard identification (e.g. underestimating the significance of identified hazards). These factors were seen as contributing to half of the reviewed accidents. Human error (e.g. miscalculation of the working of machinery) and deficiencies in instructions and guidance (e.g. inadequately implemented induction training to work tasks) were also typical contributory factors and were involved in almost every third accident. Other commonly reported factors were inadequacies in supervision, flow of information, safety devices, warning signs, and task planning as well as ignorance of rules and instructions, machine malfunction and maintenance of a running machine. Details of the most commonly reported contributory factors are presented in Table 10.

When the contributory factors mentioned in the fatal accident reports for outsourced operations were compared with those for in-house cases, a few statistically significant differences were found. Inappropriate warning signs ($p=0.003$), inadequate flow of information ($p=0.012$) and insufficient hazard identification ($p=0.035$) were factors mentioned more often in the outsourced cases than in the in-house ones. According to the reports, inappropriate warning signs were factors contributing to every fourth accident in outsourced tasks but this was only mentioned once as a factor contributing to accidents in in-house tasks. Inadequacies in the flow of information were mentioned as a contributory factor in 27% of the accident reports for outsourced operations compared to 6% for in-house operations. In the case of hazard identification, the percentages were 52% for outsourced tasks and 27% for in-house ones. In contrast, the accident reports mentioned machine malfunction as a contributory factor less often in outsourced operations than in in-house operations ($p=0.018$). This contributor was cited in almost 45% of the accident reports on in-house operations and less than 20% on outsourced cases. Differences in the contributor shares between accidents in outsourced and in-house operations were also found for deficiencies in instructions and guidance, safety devices and task planning. However, such differences were not statistically significant ($p=0.062–0.086$).

With regard to outsourced operations, the corrective measures most commonly recommended in the reports for the prevention of similar accidents were as follows: occupational instruction and guidance (mentioned in 82% of the accident reports), hazard identification (73%), safe work practices (64%), and supervision (64%). Task planning, machine design, and compliance with rules and instructions were also typically recommended corrective measures. Task planning was mentioned in every second and the other two factors in about 40% of the reports. Other recommended corrective measures included safety devices, appropriate warning signs, written work instructions, communication strengthening, determination of responsibilities, sufficient education or experience, machinery inspections and maintenance, appropriate working plane and passage, improvement of working environment, adequacy of personal protective equipment, and appropriate tools and machines. The most frequently recommended corrective measures for the common contributories are presented in Table 10.

Table 10 Most common contributory factors for fatal workplace accidents in outsourced operations in Finnish manufacturing 1999–2008 and typical corrective measures recommended in the accident reports for each particular factor

Contributory factors	**% of cases** (n=33)	**Other contributory factors mentioned in the accident report**	**Recommended corrective measures**
Dangerous working practice	55%	Insufficient hazard identification; deficiencies in instructions and guidance; inadequate supervision	Occupational instruction and guidance; safe work practices; hazard identification; supervision
Insufficient hazard identification	52%	Dangerous working practice; deficiencies in instructions and guidance; inadequate supervision; human error	Hazard identification; occupational instruction and guidance; supervision
Human error	30%	Ignorance of rules and instructions; insufficient hazard identification; deficiencies in instructions and guidance; inadequate flow of information	Supervision; occupational instruction and guidance; hazard identification; safety devices
Deficiencies in instructions and guidance	30%	Dangerous working practice; inadequate supervision; insufficient hazard identification	Occupational instruction and guidance; hazard identification; supervision
Inadequate supervision	27%	Dangerous working practice; deficiencies in instructions and guidance; insufficient hazard identification	Hazard identification; supervision; task planning
Inadequate flow of information	27%	Insufficient hazard identification; human error	Communication strengthening; occupational instruction and guidance; hazard identification
Insufficient safety devices	24%	Dangerous working practice; inappropriate warning signs; insufficient hazard identification	Safety devices; occupational instruction and guidance; hazard identification
Inappropriate warning signs	24%	Dangerous working practice; insufficient safety devices; insufficient hazard identification	Occupational instruction and guidance; hazard identification; safe work practices; written work instructions
Ignorance of rules and instructions	21%	Human error; working while machine is running; insufficient hazard identification	Occupational instruction and guidance; compliance with rules and instructions; hazard identification
Insufficient task planning	21%	Dangerous working practice; insufficient hazard identification	Hazard identification; safe work practices; appropriate warning signs

When comparing outsourced operations with in-house ones, no statistically significant differences were found. However, occupational instruction and guidance (p=0.052) as well as task planning (p=0.062) were recommended more often as corrective measures for the outsourced cases than for the in-house cases. Percentages for these two factors were 82% and 60% for outsourced tasks, and 52% and 29% for in-house operations, respectively.

5.4 Operational model of safety management

5.4.1 Structure of the operational model

The operational model consists of the introduction, the actual operations section and forms. The introduction familiarises users of the model with safety management in multi-employer worksites and the consideration of safety in service production. The operations section comprises three parts: a discussion on safety objectives and the present state of safety management in the company; planning and implementation of safety management procedures; and evaluation and improvement of safety performance. The model also includes the forms section containing different kinds of tools for supporting everyday safety management. (Figure 4)

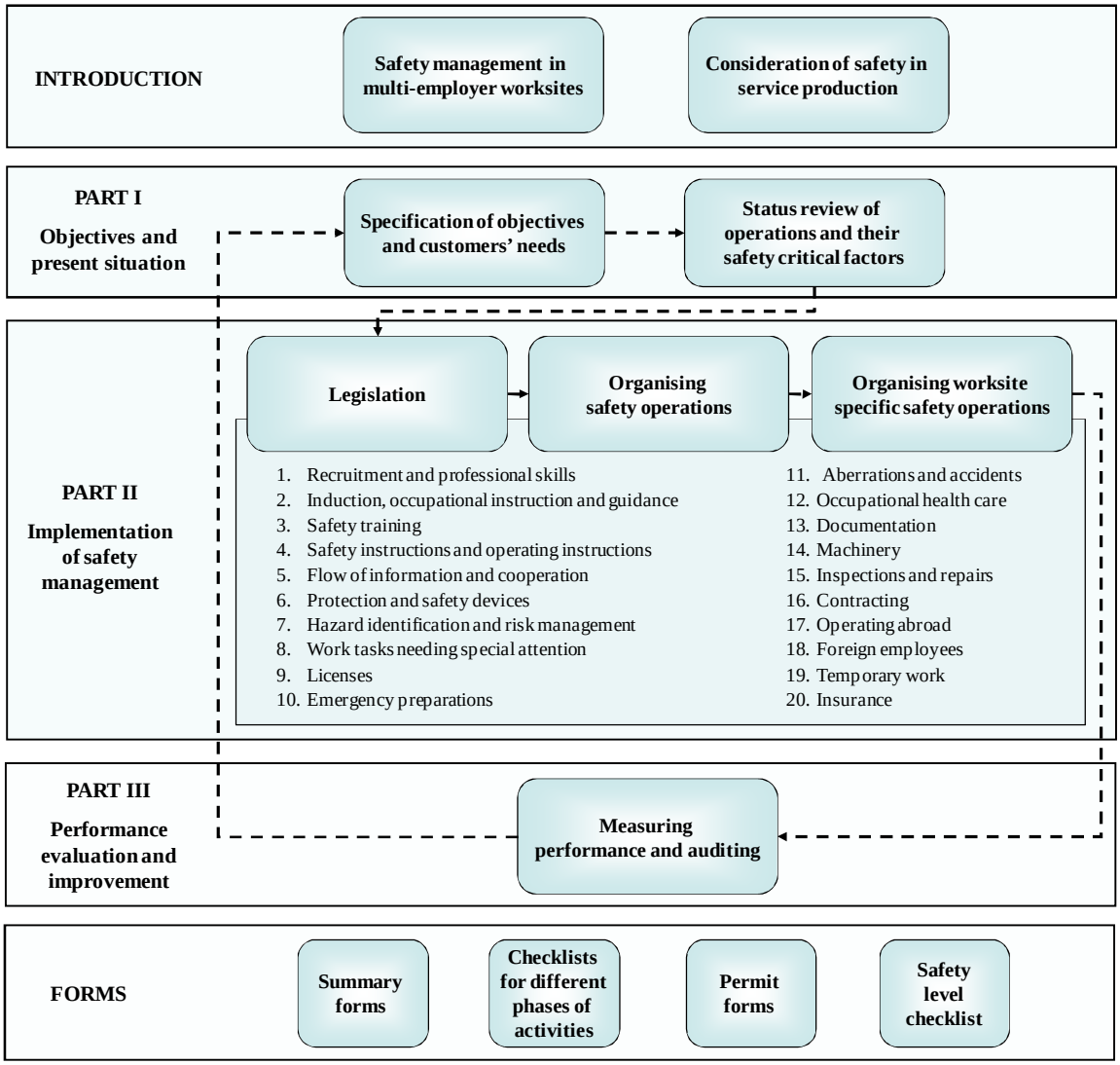

Figure 4 Structure of the safety management operational model

Introduction

This section introduces users of the operational model to the importance of safety management implementation at multi-employer worksites. The first part provides basic information on safety management and highlights the special features of safety management at worksites shared by multiple employers. The second part promotes management of safety during the different stages of the service project life-cycle. This part includes a short introduction to the implementation of safety as part of service development and production. It also encourages users of the model to take advantage of good safety practice in service offerings and discusses the benefits of safety in marketing of services. An extract from the Introduction is presented in Appendix E.

Operations section

The structure of the operations part is based on the principle of continuous improvement that is widely used in management guidelines (see BS 18004, 2008; ISO 9001, 2005; ISO 14001, 2004). The aim is that after the first iteration of the different parts, the company's safety performance is continuously improved by repeating the necessary phases. The first part of the operations section provides the user with a framework for reviewing the company's goals and customers' needs and also for assessing the status of their own safety performance. Safety objectives are defined in terms of the desired safety level. On the basis of the customer needs review, service providers can plan their strategies to fulfil both the internal and the customer needs and requirements. Next, during the initial status review, the users are instructed to chart the operations produced for the customers as well as the supporting and enabling operations required for the core operations. The purpose of this review is to identify all the operations in order to observe their safety critical factors. The model includes an example of the typical operations performed by a service company in manufacturing.

The second part of the operations section deals with the implementation of safety management. The subject is approached through a detailed discussion of the critical fields of safety at multi-employer worksites (Figure 4). These twenty fields consist of factors generally considered by service providers to be the most difficult to implement successfully or factors that commonly contribute to accidents at multi-employer worksites in the manufacturing field. The chapters dealing with these critical fields are divided into three: legislation; organising of safety operations in service provider companies; and safety operations at varying worksites. The first of these describes the legislative requirements covering basic levels of safety practice. The model summarises the relevant legal paragraphs; the texts can be found in their entirety in the appendix to the model. The organisation of safety operations is described in terms of general procedures and specific information on the implementation of safety measures on-site. Both the general and worksite-specific sections contain clear practical examples for implementing the measures as well as good practices for supporting them. The chapters also contain sources of additional information. The twenty chapters in the operations section range between three and twelve pages in length. An example of one of the chapters is presented in Appendix F.

The third part concerns the evaluation of safety performance and the continuous improvement of safety measures. This part discusses the importance of monitoring and the evaluation of safety performance and also presents methods for measuring and auditing the performance. This part is also divided into three sections: legislation, company's own performance, and worksite-specific

operations. Practical examples and a list of additional information are also included. Service providers can utilise the information and methods contained in this section to assess the effectiveness of the implemented safety measures and also to determine the further improvement needs.

Forms

There are four kinds of forms in this section of the operational model: summary forms, checklists for different stages of activities, permit forms, and a safety level checklist. The summary forms are tools for checking safety in everyday operations but they can be also used for documentation purposes. The summary forms deal with the twenty critical areas discussed in part two of the operation section, and the safety measurement and auditing activities presented in part three. They include listings of the issues that need to be considered within a particular field such as recruitment or safety training. The checklists for different stages of activities highlight important issues in terms of the critical factors. The checklists are intended to be reviewed with the customer during the various stages of the project, namely the beginning stage, delivery stage and ending stage of the service projects. With these checklists users can ensure that important issues are reviewed and that both parties are aware of their safety responsibilities. The permit forms are constructed for the five common tasks that involve specific risks: hot work, work in a confined space, driving a forklift truck, lifting and electrical installations. The safety level checklist itemises the safety issues that should be considered before performing work tasks so that all parties sharing the worksite are aware of the relevant safety issues. The checklist can also be used to show a partner the safety level and safety measures implemented in the organisation. An example of these forms is presented in Appendix G.

5.4.2 Utilisation and utility of the operational model

Four of the five service provider companies responding to the utilisation questionnaire had exploited the operational model in their organisation. The company that had not used the model reported that there had not been enough time to implement the information of the model for everyday operations. The four companies using the model had all exploited the legislation section and three of them had used the safety organising sections. The forms were exploited by every second service provider using the model. In the case of the sections discussing safety critical factors, service providers had typically utilised information on the following fields: protection and safety devices, safety training, work tasks needing special attention, contracting and temporary work. Three of the four service providers who had used the model had exploited information on these fields. On average, the service providers utilised information relating to 12 of the 20 critical fields. The reasons given by the service providers for using the operational model were as follows: to increase their knowledge and thereby assist others; to back up the compilation of instructions; and to assist in formulating supply contracts and operation practices with customers. The model was utilised by safety departments and managers, for example, customer managers, heads of supplies, and service managers.

Three of the four service providers using the model considered it to be relatively valuable for the improvement of safety performance in their organisation. The reasons they gave were that the model provided new ideas for the management of safety in the organisation; the information in

the model is valuable though its utilisation is slow in a large company; and that the company was not able to fully utilise the operational model due to changes in the management. One service provider reported that the model was only in limited use in their organisation due to an overhaul of its own safety model. Two of the companies also considered the operational model to be somewhat valuable when cooperating with partners. The other two companies considered the benefits of the model to be marginal. The service providers giving more positive feedback considered safety to be in the customers' interest. They reported that the model provides relevant information for cooperation and that it had already been utilised in supply contracts. The less positive assessments were attributed to ongoing changes in the supply organisation and the fact that safety cooperation was seen as a novel concept by both the service provider and its partners.

The service providers who had utilised the model assessed it as fulfilling requirements quite well. The average score was 3.8 on a 1–5-scale (poor–well). The best scores were given for the following aspects of the model: comprehensiveness, improving knowledge of legal requirements, opportunity for creating common working practices in different units of the organisation, and its adaptability for safety management with service providers. The lowest, though still positive scores were given for the following factors: consideration of performance with other parties, practicality, supporting the improvement of in-house safety performance, and consideration of different operators' work tasks. (Table 11)

Table 11 Service providers' opinions on the success within the requirement set for the model

Requirement set	**Score** (1–5)
Comprehensiveness of approach	4.50
Enables construction of uniform practices in different units of the organisation	4.25
Increases knowledge of legislation requirements	4.25
Adaptability for management of safety with service providers	4.00
Support in applying and interpretation of legal requirements	3.75
Consideration of challenges regarding management of safety	3.75
Adaptability for management of safety in worksites	3.75
Ease to use	3.75
Applicability for organisation's own needs	3.75
Promotion of continuous improvement	3.75
Promotion of safety cooperation with other parties	3.75
Usability in smaller companies	3.75
Worksite-specific adaptability	3.50
Support in improvement of organisation's safety performance	3.25
Consideration of different operators' work tasks	3.25
Practicality	3.25
Consideration of performance with other parties	3.00

The results of the experiences were very similar for both service providers and customers in terms of utilisation and utility, though certain differences were found. However, no statistical analysis was performed due to the small number of respondents. Both customer organisations

responding to the utilisation questionnaire had employed the operational model. However, compared with the service providers, they had utilised it to a lesser extent, confining themselves on average to only five of the 20 critical fields. Both of the customers had utilised information that was limited to induction training, occupational instruction and guidance, and hazard identification and risk management. Neither of the customers had exploited the forms. The customers had used the operational model for communicating safety issues with their partners. They reported that the model helped to clarify and summarise safety management information and thus it was assessed as somewhat valuable in safety management improvement. The customers gave slightly higher scores for compliance of the model with the requirement set than the service providers but in all cases the difference was only a couple of tenths at most.

6 DISCUSSION

6.1 Review of the results

6.1.1 Main results

Consideration of safety and safety management problems at multi-employer worksites

The results of this study show that both the service providers and customers participating in the study were rather satisfied with the consideration of safety and safety related cooperation realised at multi-employer manufacturing worksites. For example, communication, hazard identification, and induction were frequently mentioned as forms of implemented cooperation. It is interesting to note that, in the literature, all these factors are cited as the ones that are rarely implemented effectively at multi-employer worksites (see Chapter 2.4). It may be that the positive perceptions are due to the size of the participating companies since poor safety performance is often reported as a common problem in small service provider organisations (e.g. Holmes et al., 1999; Holmes & Gifford, 1997; Lin & Mills, 2001). Further, the organisations participating in the research project were voluntary participants and thus presumably motivated to improve their safety performance. The finite response rate of the questionnaire may also indicate that the organisations in the study are more advanced in safety management and therefore have more positive opinions than organisations operating in the manufacturing industry in general.

Another interesting outcome of the results regarding consideration of safety and safety management problems is that many of the issues that were considered to be commonly implemented, such as communication, hazard identification, and instructions, were also considered as problematic to implement at multi-employer sites. Though there is no simple explanation for this, there are a number of possible reasons. One reason for such opinions may be that these issues have been given priority in the respondent organisations with the result that they are currently functioning well. However, achieving this high level of safety may have been difficult. Another reason can relate to the perceptions that consideration of safety is highly partner-related. Thus while organisations may consider that safety issues have received the appropriate attention in general, with some partners safety issues may have received less attention, particularly in terms of the factors considered to be problematic. Further, the problematic nature of these factors may be due to certain specific situations, like turnover of work shifts and urgent works tasks, rather than to managing these issues in general.

Another interesting result is that the service providers and the customers reported rather similar problems in the management of safety at multi-employer worksites. Examples of such problems were ensuring an adequate flow of information, the implementation of hazard identification and risk assessment as well as coordination of different performers' operations and simultaneous work tasks. Therefore, both of the parties face problems in the same areas of safety management

even though managing safety can be considered more challenging for service providers than customers due to the variety of worksites and variation in practices. It has been reported that cooperation in multi-employer worksites is essential for ensuring a sufficient level of safety (e.g. Mynttinen, 2006; Sauni et al., 2005) but it may also have other advantages. The benefits for both parties could, for example, be a reduction in overlapping procedures and a better use of resources. Cooperation also helps the parties sharing the worksite achieve the safety objectives more easily.

Fatal accidents in outsourced operations in the manufacturing industry

It is widely reported in the literature that service provider employees are more vulnerable to accidents and prone to utilise dangerous working practices than the customer's own personnel (see Chapter 2.4.3). According to the present study, about 40% of all fatal occupational accidents at Finnish manufacturing worksites at the beginning of the 2000s involved service provider employees. Precise figures on the extent of utilisation of external workforce are not available, but Tekes (2006) has estimated that during the first years of the 2000s about every fourth worker at manufacturing worksites was an external employee. Compared with this estimate, the results of this research show that service provider employees are at much greater risk of a fatal occupational accident in manufacturing worksites than those employed by the customer company. This result, therefore, supports previous studies and also demonstrates that the accident prevalence among external employees is quite pronounced at Finnish manufacturing worksites. This study also supports the view that dangerous working practices are a common cause of accidents involving service provider employees; it was mentioned as a contributory factor in half of the accident reports reviewed. However, this factor cannot be considered as service provider-specific as it was also the most common contributory factor for accidents involving customer personnel. Further, ignoring rules and instructions, which can also be considered as a dangerous working practice, was a more common contributor to accidents involving customer employees than those involving service provider personnel.

Previous studies have given several reasons for the higher service provider accident rate, one of these being the hazardous nature of external employees' work tasks (see 2.4.3). According to the accident analysis carried out in this study, service provider employees were more likely than in-house employees to work in maintenance, repair, tuning and adjustment tasks and also cleaning working areas or machines at the time of the accident. Maintenance tasks are generally seen as having especially high risk (e.g. Hale et al., 1998; Lind, 2009). However, such tasks are also those most likely to be undertaken by service providers (e.g. Ali-Yrkkö, 2007). Further, several other factors considered in the literature to contribute to the higher accident rates among service provider employees (see 2.4.3) were similar to the issues that the respondents in this study considered difficult to implement when operating at multi-employer worksites. For example, the respondents identified the coordination of work tasks, defining responsibilities, constant haste and variation in practices as issues that have the potential to cause safety problems at manufacturing worksites shared by several employers.

The higher accident rate among service provider employees raises the question whether the accidents occur because the contributory factors of accidents have not been identified or because they have not been properly managed. A comparison between the most common contributory factors in fatal occupational accidents involving service provider employees and those factors

perceived as difficult to manage reveals several similarities. One conclusion that can be drawn is that service provider organisations are indeed aware of the safety risks but that they do not want to or do not know how to manage them. This conclusion points to the need for additional support for implementation of essential and effective safety management measures in service provider organisations.

Operational model of safety management

It was noted earlier that the safety management guidelines available may be too burdensome to adopt, particularly for small organisations (e.g. Makin & Winder, 2008) and that they are complicated to implement (Mitchison & Papadakis, 1999). This operational model was planned to facilitate the management of safety by introducing a more practical and usable approach for safety management in service provider organisations operating in the manufacturing worksites. The utilisation and utility questionnaire showed that the constructed operational model responds to the needs of service providers in many respects. For example, the model was considered helpful in simplifying complex safety management matters, guiding the implementation of safety management in the organisation, and harmonising the diverse sources of safety information. The questionnaire, however, also revealed some limitations of the model. The respondents considered, for example, that service production-specific matters could have been discussed in greater detail. However, the model sought to include several factors essential for safety management and treat them comprehensively in terms of a legal, theoretical and practical viewpoint. At the same time, the model also included a range of tools for everyday use so that it eventually became quite extensive. The fact that thorough utilisation of the model would have required substantial resources may have hindered its full exploitation. However, the model consists of several parts, each dealing with a particular topic such as legislation, assessment of performance and everyday tools, which can be accessed separately. Moreover, the implementation of safety management is discussed in twenty subsections, dealing with topics such as hazard identification, training and communication, allowing topic-specific utilisation. Therefore, even if it cannot be assumed that all organisations, particularly smaller ones, could exploit the operational model wholesale, the model does provide valuable information, procedures and tools that can be used to the extent that is needed at the user organisations. Further, to facilitate the use and exploitation of the operational model, additional support material was later developed after completion of this research project. This material comprises a guidebook and training material dealing with the salient points of the model (see Vasara et al., 2010; Hyytinen et al., 2010).

The operational model of safety management was designed mainly from a service provider viewpoint but it also discusses the implementation of cooperation in multi-employer manufacturing worksites. This service provider-oriented approach is quite novel for safety management models. The Centraal College van Deskundigen VCA has provided safety management material for industrial manufacturers and service providers, which also enables a certification of a safety management system (see SCC - SHE Checklist Contractors, 2008). The operational model of the present study differs from this certifiable system by providing wider ranging and more detailed procedures and information on the implementation of safety management. The model here provides a selection of tools and forms that can be utilised to ensure safety and document the implemented safety measures in everyday operations. Though the model differs from previous safety management models, it still conforms to the principle of

continuous improvement presented in these guidelines. As a result, the model constructed here can be utilised alongside the other guidelines to provide a different perspective to the topic.

The multi-perspective approach distinguishes the operational model constructed here from earlier safety management guidelines. For example, traditional safety management system models require organisations to ensure compliance with the legal requirements but, due to a generalist approach, they do not deal with specific requirements. In contrast, the operational model of this study deals specifically with the legal requirements that are relevant to service providers realising services for manufacturing organisations. Even though discussion of legislation may have benefits for the model users, it can have drawbacks as well, such as when the legislation is changed. This means that users must keep abreast of the regulations to ensure that any possible updates are accounted for in safety management planning.

6.1.2 Contributions of the study

Scientific contributions

This study contributes to the scientific community by yielding knowledge about safety management in outsourced operations in the manufacturing industry. The main scientific contribution is the new information on the following topics: consideration of safety, safety management problems and the accident factors involved in outsourced operations at manufacturing worksites. In terms of consideration of safety, this study sheds light on how safety is taken into account during the different stages of service projects/processes and provides a review of its success. According to the results, safety issues are handled well at the contract stage and are also usually taken into account during the work tasks at customers' worksites. However, safety issues are often overlooked once work tasks have been completed or the contract is near expiry. Consideration of safety also varies greatly between different organisations. Further, this study presents a description of the safety management problems of particular concern to service providers operating in manufacturing business. The most common problems involve communication, implementation of risk assessment, and coordination of different performers' operations and simultaneous work tasks. In the case of accidents, this research yielded information on the typical accidents associated with outsourced tasks in manufacturing worksites and their contributory factors as well as recommendations for their prevention. The typical contributory factors were utilisation of dangerous working practices, insufficient hazard identification, human error, deficient instructions, and poor guidance. The typical corrective measures recommended for these factors were appropriate occupational instruction and guidance, identification of hazards, working according to safe work practices, and supervising the safety of work.

Service provider-specific information with a manufacturing approach is new to the field. This approach enabled a novel comparison to be made between perceptions on safety problems and the actual contributory factors of accidents. It also presents information on whether accidents are due to unidentified or unmanaged hazards. According to the results, the perceived problems corresponded closely with the factors contributing to the accidents. It can, therefore, be assumed that service providers are aware of the critical factors involved in safety management but they are unable to manage safety properly. In addition to the service provider approach, this research

presents a comparison between customer information on the consideration of safety and accident factors. The comparison shows that consideration of safety and the safety management problems encountered were largely similar for both service providers and customers. In the case of consideration of safety, the only factor that showed a statistically significant difference was hazard identification, while in the case of safety management problems the deviating factor was supervision. In terms of accident factors, there were a few statistically significant differences between outsourced and in-house operations. These related to inappropriate warning signs and flow of information as well as machine malfunction.

Practical contributions

In addition to the scientific contributions, this study provides useful results for the service provider organisations. The results for consideration of safety, problems encountered and accident factors can be used in service provider organisations for planning safety management procedures. For example, the information on typical accident factors provides a good basis for accident prevention work and it can be utilised, for example, when planning the allocation of safety management resources and measures. The results on the common problems of safety management and deficiencies in consideration of safety and cooperation can also be applied when implementing safety management to ensure that common problematic and neglected areas of safety management are taken into account.

The major practical contribution of this study is the operational model of safety management that was constructed specifically for service providers operating at manufacturing worksites. This model transforms theory into practice by representing the results of scientific study in a concrete form. The model focuses on the needs of service providers and the safety management problems they encounter. Further, the operational model introduces a novel two-dimensional approach by considering safety management in terms of the service providers' own operations and the cooperation on site. In addition, the model contains innovative tools to assist in the everyday management of safety, and it also summarises the relevant legislation in an easily exploitable form. The model can be utilised in the improvement and implementation of safety management in service provider organisations with manufacturing customers. Further, the model can be applied when demonstrating safety levels to the customer and when advertising good safety performance during the marketing process. Even though the model has been constructed specifically for service providers operating in the manufacturing industry, it is also applicable in other kinds of service provider organisations. Customer organisations, too, may find the model beneficial for various purposes such as planning safety cooperation with their service providers or reviewing service providers' compliance with legal requirements.

6.2 Study evaluation

6.2.1 Methodology review

Survey on consideration of safety and safety management problems

The initial review of consideration of safety and the perceived safety management challenges was made by interviewing representatives of companies operating in the manufacturing industry.

The interviews were conducted as theme interviews. The benefit of such interviews is that the data accumulates through the interviewees' experiences and the responses are not confined to predefined alternatives (see Kurkela, 2011). This approach was, therefore, well-suited to the purpose of reviewing the perceived problem field. The interviews involved 39 people from 13 companies. The interviewees freely discussed their company's safety performance and raised several significant problems of safety management in multi-employer worksites. However, the scope of the problem field remained slightly narrow due to the small number of participating companies. Another disadvantage was that, despite representing different business sectors, the interviewees operated mainly in large service provider or manufacturing companies. Further, since participation in the research project was voluntary, the interviewees cannot necessarily be regarded as representative of Finnish manufacturing companies in general. They were likely to have paid greater attention to the safety matters and therefore to have given a more positive picture of the topic than a typical cross-section of Finnish manufacturing organisations.

The information gained from the interviews was supplemented with a questionnaire. This was sent to 347 individuals of whom 89 responded. Despite the fairly low response rate, the respondents were typical of the companies in terms of size and branch. The data from the questionnaire was also comprehensive since most of the respondents completed it thoroughly. As intended, the questionnaire data supplemented the information gained from the interviews. Although the questionnaire yielded relevant information on the topics reviewed, there were also certain limitations in terms of the material collected that adversely affected the data analysis. The modest scope of the questionnaire data made it difficult to interpret the dependencies between different groups of respondents and therefore only very large proportional differences between respondent groups could be seen as statistically significant. Therefore, in this study certain relevant differences between the various groups may not have received the same degree of attention they might otherwise have had if the sample had been larger. In addition, the large number of non-respondents has probably skewed the results more than if the entire target group had responded.

Review of fatal accidents

The contributory factors and the corrective measures recommended for accidents at manufacturing worksites were studied by reviewing reports compiled for fatal occupational accidents. This approach was adopted because, compared with other accident data, only such reports include details on whether the work tasks performed at the time of the accident were outsourced or not. Further, these accident reports also reveal whether the outsourced task was performed at the customer's worksite or elsewhere, such as at the service provider's own premises. The accident data relates to 83 cases, of which about 40% occurred during outsourced operations. Despite the modest amount of data, it covers all fatal workplace accidents reported at Finnish manufacturing worksites during the period 1999–2008 and, therefore, it does provide a complete picture of the reviewed accident field. One limitation of the accident data utilised in this research is that it discusses only fatal accidents. However, the accident information can be considered relatively uniform, regardless of the severity of the accident. For example, Lind's (2009) study on maintenance accidents shows that the same contributory factors prevail in the case of both serious and fatal accidents even though the frequency of these factors slightly varies. As a result, the analysis of fatal accidents can be seen as a relevant source of information on the

reviewed topic. One clear advantage of this approach was the possibility to determine if the perceived safety management problems recorded in the interviews and questionnaire corresponded to those factors leading to accidents.

Construction of the operational model

The operational model of safety management was constructed through a development process that consisted of five flexible and partly overlapping stages. The model development process can be considered user-centred design in that the researchers were responsible for producing the content of the model and the representatives of the cooperating organisations commented on the constructed drafts at different stages and steered the development process in the desired direction. The benefit of this kind of an iterative development process and the participation of users is an end product that responds to user needs and has improved usability (see ISO 13407, 1999). In the project, the successive reviews of the cooperating organisations also enabled the continuous enhancement of the drafts. This helped to maintain practicality and keep the requirements of everyday operations to the fore throughout the construction process. This approach made it possible to combine both the scientific and practical viewpoints and to produce an operational model responding to practical needs by utilising scientific knowledge. The comprehensive background research carried out in the literature review, company interviews, questionnaire and accident analysis provided the essential information for creating the structure and selecting the main themes of the operational model.

Utilisation and utility of the operational model

A user survey is a common method for reviewing the utilisation and evaluating the utility of development project outcomes. In this study, the utilisation and utility of the safety management operational model in the participating organisations were reviewed by a web survey conducted 17 months after launch of the final version of the model. Although the method used can be considered suitable for this kind of review, this study suffers from a common problem of questionnaires, a small number of responses. However, the questionnaire provided very constructive responses on whether organisations had utilised the model, which sections they had exploited and how the model conformed to the requirements set.

6.2.2 Achievement of objects

This thesis had two objectives. The first was to review safety management implementation at multi-employer worksites in manufacturing industry by studying consideration of safety during different stages of service projects/processes, the problems encountered in safety management and the factors involved in accidents at manufacturing worksites. This objective also included an examination of the differences between the opinions of service providers and customers and also the differences between accidents occurring during outsourced and in-house operations. The second objective was to develop an operational model of safety management on the basis of the information obtained from the first phase.

In terms of the first objective, the study yielded a wide range of information on the areas of interest. The study identified the types of safety issues that are taken into account in the contract, implementation and final stages of a service project/process. The study also identified some of

the most problematic areas associated with safety management in multi-employer manufacturing worksites. In addition, the study provided a comprehensive review of the contributory factors for accidents and recommended corrective measures. Importantly, the research provided an insight into the perceptions of service providers and customers and shed light on the differences between accidents occurring during outsourced and in-house operations. The first objective can, therefore, be considered to have been fulfilled.

In the case of the second objective, this study provides a comprehensive set of information, procedures and tools in the form of an operational model to support the implementation of safety management in service provider organisations operating at multi-employer worksites. The model was constructed from the information gathered during the first stage of the research. The field tests and the feedback indicate that the model fulfils the requirements set and supports the implementation of safety management in service provider organisations. Despite positive user experience, the size of the operational model could also make it challenging to use, particularly in smaller organisations, and companies with little history in safety management. In short term projects, effective utilisation of the model assumes that, for the most part, management of safety has already been performed. Nevertheless, despite a few limitations, the model contains a valuable set of data on the essential fields of safety management in service provider organisations. Thus the second objective can also be seen as fulfilled.

6.2.3 Validity and reliability

Validity

Validity refers to whether the research focussed on the phenomenon that it was planned to study (Heikkilä, 2001; Järvinen, 2004). The first subject reviewed in this research was the implementation of safety management, which was studied in terms of consideration of safety, the problems encountered and accident factors. This research area was approached by means of company interviews, a questionnaire, and accident analysis. The second research topic involved the operational model of safety management, its utilisation and utility. This part employed a model development process and a user questionnaire.

The company interviews were conducted as theme interviews in which the topics were discussed extensively. The interviews provided an overview of the subject rather than information that could be generalised to all service provider organisations. In terms of validity, a limitation of these interviews was that the participants were volunteers in the research project. Thus they cannot be considered representative of the target population but rather as a group of organisations that was interested in and had given consideration to safety management issues. The results of the interviews cannot, therefore, be generalised to apply to all service providers operating in Finnish manufacturing industry. However, in terms of validity, their interest in safety can also be seen as positive since the interviewees showed readiness to engage in discussions of the reviewed topics and thus provided much authentic information.

The safety management questionnaire was conducted to supplement and enlarge knowledge of the topics discussed in the company interviews. The questionnaire was, therefore, devised according to the results of the company interviews though it also took into account the review of

the literature. The questionnaire can, as a result, be considered as comprising relevant themes and questions in order to study the reviewed subject matter. In addition, its validity is supported by the fact that the questions themselves were clearly formulated since the responses were both comprehensive and logical. Further, the target group of the safety cooperation questionnaire consisted of parties providing maintenance services and also buying them. Maintenance operations are generally acknowledged as tasks that are commonly outsourced in manufacturing industry and which also carry particular safety risks. The target group can thus be assumed to have much experience of safety in outsourced services in manufacturing. However, there are certain factors which may diminish the validity of the results. For example, the relatively low number of organisations responding to the questionnaire may indicate that in the participating organisations safety issues have gained more attention than in the target group in general. Therefore, no generalisations from the results can be made with accuracy for Finnish manufacturing industry as a whole. However, as in the case of interviews, this aware and safety-oriented group may have provided more data and informed opinion on the subject than the target group in general.

The accident analysis was done by examining the accident reports and extracting relevant information. The reports are compiled on the basis of accident investigations by a group of experts from different fields. They are considered reliable and comprehensive accounts of the accidents and they also report, for example, the contributory factors and recommended corrective measures. The reports provide clear descriptions of the accidents and the details are easily accessed for analysis to assure the validity of the information.

The operational model development process is more a combination of the prior information and the results of this study than an attempt to produce totally new information. The information used in constructing the model has been obtained from various scientific studies and reliable practical sources. The structure and the content of the model are based on previous research on the topic and on the actual needs of the end users. The content and the structure of the model can, therefore, be considered valid for their purposes. Since the construction of the model was an iterative user-centred development process that involved the active participation of users, it can be claimed that the end product addresses the very issues that are seen as important in service provider organisations. Moreover, the user questionnaire was implemented to study the usage of the operational model and accomplishment of the requirements set. The questions in the questionnaire were straightforward and thus easy to understand and answer. Though, the respondents represented the same organisations that had also participated in the development of the operational model, the topics in the questionnaire were such that prior experience of the model did not really affect the responses. One limitation is that even those organisations that had utilised the operational model had not, for various reasons, done so it in its entirety, preferring only to use certain parts. Therefore, although the content of the model was deemed relevant and useful, the questionnaire did not make it absolutely clear whether the entire operational model would be beneficial in improving safety management in service provider organisations.

Reliability

Reliability refers to the accuracy of the results obtained in the study and whether the research is reproducible (Heikkilä, 2001). In terms of consideration of safety and safety-related problems,

reliability can be assessed by comparing the results of the interviews with those of the questionnaire. The correspondence between the results of these two methods supports the reliability of the results for the topic. The similarities with the results of the accident analysis and the prior literature are also indicative of the reliability of the results. However, the company interviews were half-structured theme interviews where only certain major topics were discussed and so the interviews differed slightly from one organisation to another. This approach may not be conducive to the repeatability of fully congruent interviews. In addition, the results of the interviews and the questionnaire are closely related to the prevailing situation both in the organisation and in society in general. Therefore, the results for consideration of safety and safety problems are context and time dependent so that repeating these studies might provide somewhat different results. However, this kind of limitation of repeatability does not impugn the reliability of the results obtained in this study.

In the case of accident analysis, reliability can be considered as assured in terms of information credibility and repeatability. First, the accident data gathered is based on verifiable and official accident reports, which can be regarded as reliable sources. During the collection process no assumptions were made about the information presented in the actual reports. The reports were carefully examined by one researcher and rechecked by another. However, despite such rigour it is possible that certain items of information may have been overlooked. The amount of detail overlooked would certainly have been minimal and have had little bearing on the results. The data collected were analysed using carefully selected statistical methods that provided unambiguous and objective results.

The operational model for safety management can be seen as providing reliable information on the subject, since it was constructed according to the relevant material in collaboration with organisations that have a frontline view of safety management in service production and multi-employer worksites. In the case of model utilisation and utility questionnaire, parallels can be seen between the company interviews and the questionnaire. The results of this questionnaire also describe a prevailing situation at a particular point in time that may hinder attempts to obtain corresponding results in the future. The credibility of the results could also be called into question by claiming the respondent organisations had given a distorted and more favourable version of safety reality in their organisations. The same claim could also be made about the other questionnaire and the company interviews conducted here. However, such criticisms are probably invalid because all the organisations had participated voluntarily in the research project and were motivated to improve their safety performance with the help of the material to be produced. The participants would have little to gain by providing distorted accounts that could undermine the effectiveness of the operational model they intended to use in their organisations.

6.3 Recommendations for further research

As mentioned above, very little research has been conducted on safety management in outsourced services from a service provider viewpoint. This research has examined the topic in a Finnish manufacturing context and produced new information on the subject. However, the field is enormous and precludes an all-embracing approach so that this research is a first attempt to gain an insight into the multidimensional world of safety in service production. Further research

is needed to produce more detailed knowledge on the subject and also to proceed to the new fields of this research topic.

The operational model developed here is a first approach to service provider-specific safety management support material. Although the structure and content of the model were continuously improved during the development process, the model is not immutable. The users gave fairly positive feedback, but they also indicated that the model could be improved. Thus there is still room for further development of the model to enhance its practicality and usability in various ways. For example, safety management practices that have been deemed efficient in everyday operations could be included to a greater extent in the model and the model itself could also be realised as a web site. In addition, the provision of material in other languages should be considered in order to cater to the increasing numbers of foreign workers at multi-employer worksites. An interesting research topic would also be the effect of utilisation of the operational model in safety management. By studying this topic, it could be reviewed if the model supports the implementation of safety management by, among others, improving safety climate, decreasing accident rates and increasing commitment to improvement of safety among managers and employees.

As discussed earlier, fatal accidents can result from outsourced operations at manufacturing worksites. Among the various topics investigated, this study reviewed the contributory factors of the accidents and recommended corrective measures for their prevention. It would be worth investigating if these factors change over the years or do they remain the same from year to year. It would also be useful to identify the factors that have caused any possible changes. For example it would be helpful to know if such changes reflect only the achievements in safety work or are they also affected by the prevailing safety discussions and highlighted issues (e.g. safety campaigns). The accident review covers only cases until 2008, so it would be worthwhile to update the review at a later date to determine what improvement, if any, has occurred.

As an area of research, the integration of safety to service development and service production had received only a cursory review in one of the articles related to this thesis. The topic provides a good deal of scope for further investigation into the status of safety in actual service projects/processes. This theme could be approached, for example, through the following questions: What kinds of systematic service development and service production practices are utilised in service provider organisations and how is safety integrated with these? How could safety be better integrated into these processes? How would the incorporation of safety issues into service development and service production enhance safety performance in service provider organisations?

7 CONCLUSIONS

Though safety management in multi-employer worksites has gained attention in the scientific literature, very little attention has been given to the subject from the service providers' viewpoint. However, safety management is more challenging for service providers than for customers because service providers operate with several customers in multiple worksites, each of which has its own working practices. Therefore, service providers need to be able to adjust their activities to accommodate the needs and wishes of diverse customers. This research discusses safety management in outsourced services in the manufacturing industry. The objectives were to review the implementation of safety management at manufacturing worksites that are shared by multiple employers and to develop a safety management operational model targeted specifically at service providers operating with manufacturing organisations.

The review of consideration of safety showed that safety issues were generally well managed at the Finnish multi-employer manufacturing worksites participating in the study. Safety issues relating to service projects/processes were mostly discussed at the contract stage by typically defining the required safety courses and licences, work permits and personal protective equipment. Safety matters also received a good deal of attention at the implementation stage in the studied organisations. In this stage, the service providers were most satisfied with their customers' attitudes to safety and implementation of safety in everyday operations. However, consideration of safety after completion of work tasks or expiry of contracts was usually overlooked or neglected according to the service provider companies taking part in the study. Though safety and cooperation between different parties were managed well at some worksites, overall it varied a great deal among the different partners. The companies participating in this study were ones keen to achieve safety improvements in their operations. Thus the results for safety management implementation cannot be considered to be representative of all Finnish service providers working with manufacturing organisations but rather to describe the situation in companies advanced in safety management.

Despite the fact that consideration of safety was perceived as generally successful in the participating companies, both the service providers and the customers pointed out similar factors that hindered the management of safety at multi-employer manufacturing worksites. The most typical problems were insufficiencies in communication, implementation of risk assessment, and coordination of simultaneous and different performers' work tasks. In addition, the analysis of fatal occupational accidents at multi-employer manufacturing worksites showed that the contributory factors closely corresponded to the issues considered as challenging in safety management. The typical factors contributing to accidents occurring in outsourced work tasks related to insufficiencies in working practices, hazard identification, instructions and guidance, supervision and communication. The contributory factors were mostly the same for outsourced and in-house tasks. Differences between them were found only in the case of inappropriate warning signs, inadequate flow of information, insufficient hazard identification, and machine

malfunction. Despite the similarities, the results show that service providers' employees run a higher risk of a fatal workplace accident at manufacturing worksites than those employed by the customer company. The most commonly recommended corrective measures for prevention of accidents both for outsourced and in-house tasks related to the contributors mentioned above, namely appropriate occupational instruction and guidance, hazard identification, safe working practices and adequate supervision.

The results obtained by studying consideration of safety, the safety management problems encountered and the accident factors, all suggest that the participant organisations operating at multi-employer worksites recognise the important issues involved in safety management. However, in many cases, the organisations still have difficulty managing such issues in an appropriate way. If service provider companies well-versed in safety management have problems in managing the causes of accidents, the situation in the majority of companies cannot be any better. Therefore, service provider companies should be given additional support to implement safety management measures to help solve the prevailing problems. However, even though several models and procedures for managing safety have been launched, it can be considered that these instructions are either not exploited appropriately in the target organisations or they fail to meet the needs of these organisations.

The operational model of safety management constructed here sets out to address these problems. The model follows the principle of continuous improvement by approaching the topic by discussing objectives and the present situation of safety performance, implementation of safety management, and the evaluation and improvement of safety performance. The model is aimed specifically at service provider companies operating at manufacturing worksites. The purpose is to support the implementation of safety management in the service providers' own operations as well as in realising safety cooperation with customers. According to the user surveys, the operational model developed here provides valuable support for safety management in service provider organisations and in the implementation of safety cooperation with customers. The model was particularly valued for its comprehensiveness, recapping of the relevant legislative requirements and the help it provided in the standardisation of practices in different units. Certain improvements were also suggested such as greater practicality and adaptability in different worksites. In order to respond to these suggestions, additional materials were developed after the research project to support the utilisation of information contained in the operational model.

In conclusion, this study showed that consideration of safety and safety cooperation have gained positive interest at some Finnish multi-employer manufacturing worksites; however the degree of interest varies greatly between different operators. Even though the management of safety has received recognition, many service provider companies still face problems in their attempts to manage safety in their operations. These problems are often also the same as those contributing to accidents, if poorly managed. The operational model of safety management presented in this study provides help in managing the typical risks factors and in implementing safety management practices, particularly in service provider organisations operating at manufacturing worksites.

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Company information

- Number of employees
- Line of business
- Worksites
- Type of work (planned operations / urgent tasks)
- Number of employees performing tasks simultaneously

- Number of customers
- Types of customers (big organisations, multiple sites from same company)
- Customer organisations' lines of business
- Varying sites / static sites
- Performance on own / customer premises

Provided services

- Core operations
- Operations supporting core functions (on-call duties, work planning, training, etc.)
- Operations enabling service production (protective equipment, information systems, etc.)

Safety regarding services provided

- How are things organised in multi-employer worksites?
- What kinds of things are implemented for safety (general / site specific risk assessment, training, procurements, safety material, information distribution, etc.)?
- How are safety aspects taken into account in marketing, planning and execution of the work tasks?
- What kind of safety cooperation is realised with the customer (risk assessment, incident report investigation, purchases, training, planning, definition of responsibilities, etc.)?
- What kinds of problems does cooperation with customer create (deviating working practises, new varying sites, etc.)? Have some solutions to these been found?
- Perceived improvement needs?
- Organising communication (common worksite meetings etc.)?
- Good practices?
- How has safety been reconciled with customer needs and profitability?
- Customers' safety requirements versus own safety requirements (variation between different worksites)?
- Are customers' performance and related risk factors known?
- How is supervision organised?
- Are situations / work tasks deviating from those planned agreed separately (e.g. hazardous ones)?

Accidents and deviations

- What kinds of accidents / deviations occur, how many?
- Is the customer informed of these?
- Are these investigated together with customer?
- Do you get information about accidents involving customer employees?

Safety cooperation survey

This survey charts safety cooperation and safety challenges at worksites shared by a customer and service provider(s). We invite you to answer the following questions according to your own experiences. If you wish, you can also print the survey form and return it completed to the following address:

Tampere University of Technology / Occupational Safety Engineering
Sanna Nenonen
P.O.Box 541
33101Tampere

The survey will take about 10 minutes to complete. Answers will be treated in confidence.

SAFETY COOPERATION

1) How would you rate safety cooperation in general?

- ☐ Working very well
- ☐ Working somewhat well
- ☐ Not working well but not badly either
- ☐ Working somewhat badly
- ☐ Working very badly

2) Does the quality of safety cooperation depend on the partner?

- ☐ No, cooperation works well with almost all partners
- ☐ Yes, the cooperation quality varies among partners
- ☐ No, safety cooperation does not work properly with most partners

3) What kinds of factors do you consider affect the quality of safety cooperation?

_____

_____

4) What safety related factors do you consider as the major challenges in cooperation between customer and service provider? You can choose multiple alternatives.

- ☐ Unclear objectives
- ☐ Differences in performers' working habits
- ☐ Possibility to intervene in malpractices
- ☐ Organisation of induction training
- ☐ Ensuring a sufficient flow of information
- ☐ Coordination of simultaneous work tasks
- ☐ Pointing out other performers' dangerous actions
- ☐ Task planning
- ☐ Multiplicity of work tasks
- ☐ Change of worksites
- ☐ Availability of working instructions
- ☐ Coordination of different performers' operations
- ☐ Hazard identification and risk assessment
- ☐ Organisation of supervision
- ☐ Determination of responsibilities
- ☐ Cooperation in investigation of near misses
- ☐ Cooperation in investigation of accidents
- ☐ Other, what? _____

5) How would you evaluate the following safety factors when operating with your partners?

	Agree	Somewhat agree	Somewhat disagree	Disagree
Safety is given consideration in every situation	☐	☐	☐	☐
Partner takes safety proposals into consideration	☐	☐	☐	☐
Division of responsibilities is clear	☐	☐	☐	☐
Safety is given sufficient attention in joint meetings	☐	☐	☐	☐
Explicit instructions of work tasks are available	☐	☐	☐	☐
Occupational health services provide enough cooperation (e.g. within workplace surveys)	☐	☐	☐	☐

6) How often are the following factors realised when cooperating with your partners?

	Always	Sometimes	Rarely	Never
Customer familiarises service providers with worksite safety	☐	☐	☐	☐
Customer familiarises service providers with work task safety	☐	☐	☐	☐
Dangerous tasks are pre-planned with partner	☐	☐	☐	☐
Safety is taken into account already at the contract stage	☐	☐	☐	☐
Accidents are investigated together with the partner	☐	☐	☐	☐
Safety performance is assessed on expiry of contract	☐	☐	☐	☐
Safety performance is assessed at the end of work tasks	☐	☐	☐	☐
Hazards are identified together with the partner	☐	☐	☐	☐

7) Which of the following objectives and practices are used in your organisation?

	Yes	No
Notification of hazardous situations / near misses	☐	☐
Check list for pre-task hazard identification	☐	☐
Zero accident objective	☐	☐
Work permits within hazardous work tasks	☐	☐

CONTRACTS AND INSURANCE

8) What safety issues are defined at the contract stage? You can choose multiple alternatives.

- ☐ Required work passes
- ☐ Traffic arrangements
- ☐ Reporting near misses and accidents
- ☐ Required personal protective equipment (e.g. helmet, eye shield, personal fall protection)
- ☐ Required tools and equipment
- ☐ Scaffolding arrangements
- ☐ Communication practices
- ☐ Safety objectives
- ☐ Level of safety operations (e.g. safety parameters)
- ☐ Required safety courses and licences (e.g. fork lifting permit, occupational safety card, hot work permit)
- ☐ Work supervision
- ☐ Required education or professional skills
- ☐ Hazard identification and risk assessment
- ☐ Persons in charge
- ☐ Others, what? _____

9) Are the safety issues defined in contracts also discussed in person?

- ☐ Yes
- ☐ No

10) What insurance does your organisation have for work tasks performed at customers' worksites?

- ☐ Liability insurance
- ☐ Transport insurance
- ☐ Property insurance
- ☐ Contract insurance
- ☐ Loss-of-profits insurance
- ☐ Other, what? _____

CERTIFICATION

11) Has your organisation certified or is it in the near future certifying its operations according to some of the following standardised systems? You can choose multiple alternatives.

- ☐ ISO 14001 – environment management system
- ☐ ISO 9001 – quality management system
- ☐ OHSAS 18001 – safety management system
- ☐ Other, which one? _____

12) If your organisation has certified or is currently certifing its operations, has the system clarified performance in the organisation?

- ☐ Yes
- ☐ No

OPERATIONS ABROAD

13) If your organisation operates abroad, from which sources have you acquired information about safety operating abroad? You can choose multiple alternatives.

- ☐ Travelling notifications from Ministry for Foreign Affairs of Finland
- ☐ Traveller's health booklet
- ☐ Brochure "Työkomennus ulkomaille" published by the Finnish Centre for Pensions
- ☐ Guidebooks of insurance companies
- ☐ Guidebook "Ulkomaantyön riskit hallintaan" published by the Centre for Occupational Safety
- ☐ Elsewhere, where?_____

14) On which topics relating to operating abroad have you not been able to find the necessary information?

_____

_____

NEED FOR ADDITIONAL INFORMATION

15) On which topics relating to customer - service provider safety cooperation would you like to have additional information?

_____

_____

BACKGROUND INFORMATION

16) What is the number of employees in your organisation?

- ☐ 1–9 employees
- ☐ 10–49 employees
- ☐ At least 50 employees

17) Which of the following personnel groups do you belong to?

- ☐ Top management
- ☐ Middle management
- ☐ Line management
- ☐ Employee

18) Do you have safety-related duties (such as safety manager or environmental manager)?

- ☐ Yes
- ☐ No

19) Does your organisation provide services or operations for other organisations?

- ☐ Yes
- ☐ No

20) Is provision of services or operations the main business of your organisation?

- ☐ Yes
- ☐ No

21) What services or operations does your organisation provide?

_____

_____

22) In which lines of business do your partners operate? You can choose multiple alternatives.

- ☐ Agriculture, hunting and forestry
- ☐ Fishing
- ☐ Mining and quarrying
- ☐ Manufacturing
- ☐ Electricity, gas and water supply
- ☐ Construction
- ☐ Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods
- ☐ Hotels and restaurants
- ☐ Transport, storage and communication
- ☐ Financial intermediation
- ☐ Real estate, renting and business activities
- ☐ Public administration and defence, compulsory social security
- ☐ Education
- ☐ Health and social work
- ☐ Other community, social and personal service activities
- ☐ Private households with employed persons
- ☐ Extra-territorial organisations and bodies

23) Does your organisation procure services or operations from external providers?

- ☐ Yes
- ☐ No

24) What services or operations does your organisation procure from external service providers?

_____

_____

Variables	**Values** (possible ESAW-code)
Type of operation	Outsourced operation In-house operation
Background information	Age of the victim Company branches Company size Employer of the victim Experience of the victim Number of victims Persons contributing the accident Profession of the victim
Working process	Production, manufacturing, processing (11) Storing (12) Remodelling, repairing, extending, building maintenance (24) Setting up, preparation, installation, mounting, disassembling, dismantling (51) Maintenance, repair, tuning, adjustment (52) Cleaning working areas, machines (53) Waste management, disposal, waste treatment of all kinds (54) Monitoring, inspection of manufacturing procedures, working areas, means of transport, equipment (55) Other auxiliary activity (59) Movement (61) Other working processes (99)
Specific physical activity	Operating machine (10) Working with hand-held tools (20) Driving/being on board a means of transport or handling equipment (30) Handling of objects (40) Carrying by hand (50) Movement (60) Presence (70)
Deviation	Deviation due to electrical problems, explosion, fire (10) Deviation by overflow, overturn, leak, flow, vaporization, emission (20) Breakage, bursting, splitting, fell, collapse of material agent (30) Loss of control of machine, means of transport or handling equipment, handheld tool, object, animal (40) Slipping, stumbling and falling, fall of persons (50) Body movement without any physical stress (60) Shock, fright, violence, aggression, threat, presence (80)
Mode of injury	Contact with electrical voltage, temperature, hazardous substances (10) Drowned, buried, enveloped (20) Horizontal or vertical impact with or against a stationary object (30) Struck by object in motion, collision with (40) Contact with sharp, pointed, rough, coarse material agent (50) Trapped, crushed etc. (60) Other contacts (99)

Contributory factors	Accidental start-up
	Dangerous work practice
	Deficiencies in ergonomics
	Deficiencies in instructions and guidance
	Deficiencies in occupational hygiene
	Deficiencies in written work instructions
	Deficiencies in personal protective equipment
	Environmental factors
	Human error
	Ignorance of rules and instructions
	Inadequate flow of information
	Inadequate safety management
	Inadequate supervision
	Inappropriate education or experience
	Inappropriate warning signs
	Inappropriate working plane or passage
	Insufficient hazard identification
	Insufficient safety devices
	Insufficient task planning
	Machine malfunction
	Misunderstanding of instructions
	Recklessness
	Working in a hurry
	Working under the influence of alcohol
	Working while machine is running
Recommended corrective measures	Adequacy of personal protective equipment
	Appropriate tools and machines
	Appropriate warning signs
	Appropriate working plane and passage
	Care
	Communication strengthening
	Compliance with rules and instructions
	Determination of responsibilities
	Hazard identification
	Improvement of occupational hygiene
	Improvement of working environment
	Machine design
	Machinery inspections and maintenance
	Occupational instruction and guidance
	Prevention of accidental start-ups
	Safety management and safety cooperation
	Safe work practices
	Safety devices
	Sufficient education or experience
	Supervision
	Switching off machinery
	Task planning
	Verifying that installation is dead
	Written work instructions

Utilisation and utility survey

The following survey looks at the utilisation and utility of the safety management operational model developed at Tampere University of Technology in cooperation with organisations operating in manufacturing industry. The aim of the survey is to chart how the model has supported improvement of safety management and the kinds of issues in the model that should be enhanced. The results of this survey will be presented as a part of a doctoral thesis discussing safety management in outsourced services.

Thank you for your cooperation!

1) Has an operational model for safety management been utilised in your organisation?

- ☐ Yes
- ☐ No

2) If model has not been utilised, what are the reasons for this?

_____

_____

3) What sections of the operational model have been utilised in your organisation?

	Legislation	Organising safety operations	Forms
a) Recruitment and professional skills	☐	☐	☐
b) Induction, occupational instruction and guidance	☐	☐	☐
c) Safety training	☐	☐	☐
d) Safety instructions and operating instructions	☐	☐	☐
e) Flow of information and cooperation	☐	☐	☐
f) Protection and safety devices	☐	☐	☐
g) Hazard identification and risk management	☐	☐	☐
h) Work tasks needing special attention	☐	☐	☐
i) Licences	☐	☐	☐
j) Emergency preparations	☐	☐	☐
k) Aberrations and accidents	☐	☐	☐
l) Occupational health care	☐	☐	☐
m) Documentation	☐	☐	☐
n) Machinery	☐	☐	☐
o) Inspections and repairs	☐	☐	☐
p) Contracting	☐	☐	☐
q) Operating abroad	☐	☐	☐
r) Foreign employees	☐	☐	☐
s) Temporary work	☐	☐	☐
t) Insurance	☐	☐	☐

4) Were the previously mentioned issues familiar to or utilised in your organisation?

	Very familiar or much utilised	Somehow familiar or utilised	Slightly familiar or utilised	Not familiar or utilised
Legislation	☐	☐	☐	☐
Organising safety operations	☐	☐	☐	☐
Forms	☐	☐	☐	☐

5) How often have different sections been utilised in your organisation?

	Several times	A few times	One or two times	Not at all
Legislation	☐	☐	☐	☐
Organising safety operations	☐	☐	☐	☐
Forms	☐	☐	☐	☐

6) In which situations has the operational model been utilised (e.g. contract negotiations, orientation)?

_____

_____

7) Which parties have mainly utilised the operational model (e.g. supervisory personnel, safety personnel)?

_____

_____

8) How useful do you consider the operational model for the improvement of safety performance in your organisation?

- ☐ Very useful
- ☐ Quite useful
- ☐ Not useful and not useless
- ☐ Quite useless
- ☐ Very useless

9) What were the reasons you gave for the preceding assessment of the usefulness of the operational model for the improvement of safety performance?

_____

_____

10) Has the operational model been useful when operating with your partners (customer/provider)?

- ☐ Very useful
- ☐ Quite useful
- ☐ Somehow useful
- ☐ Slightly useful
- ☐ Not at all useful

11) What were the reasons you gave for the preceding assessment of the usefulness of the operational model when operating with the partners?

12) What issues do you consider were not covered in the operational model? What kinds of issues?

13) Do you consider that the operational model contains unnecessary issues?

14) How well you consider the following statements to describe the operational model? (1 = Disagree, ..., 5 = Agree)

		1	2	3	4	5
a)	Operational model supports improvement of organisation's safety performance	□	□	□	□	□
b)	Operational model aids applying and reading of legislation	□	□	□	□	□
c)	Operational model takes heed of the challenges in ensuring safety	□	□	□	□	□
d)	Operational model has a comprehensive approach to safety	□	□	□	□	□
e)	Operational model is suitable for improvement of safety at customer sites	□	□	□	□	□
f)	Operational model is suitable for improvement of safety when operating with service providers	□	□	□	□	□
g)	Operational model takes account of work tasks performed by different operators at multi-employer worksites	□	□	□	□	□
h)	Operational model enables development of uniform practices between different units	□	□	□	□	□
i)	Operational model takes account of operations with customer / service provider	□	□	□	□	□
j)	Operational model has a practical approach	□	□	□	□	□
k)	Operational model is easy to use	□	□	□	□	□
l)	Operational model can be applied according to organisation's own needs	□	□	□	□	□
m)	Operational model can be applied to worksite-specific conditions	□	□	□	□	□
n)	Operational model promotes continuous improvement of safety	□	□	□	□	□
o)	Operational model promotes safety cooperation with customers	□	□	□	□	□
p)	Operational model is suited for use in small companies	□	□	□	□	□
q)	Operational model increases knowledge of legal requirements.	□	□	□	□	□

15) The company you represent?

16) Did you answer to the survey as a member of a customer organisation or service provider organisation?

□ Customer organisation

□ Service provider organisation

2 SAFETY IN SERVICE PRODUCTION

2.1 SAFETY AS PART OF SERVICE PROVISION

A service needs to respond to customer needs to be successful. Increasingly, manufacturing companies are showing interest in their service providers' safety performance when evaluating potential partners. Customers look for safety in the provision of services.

During service development and production, safety should be seen as a part of the functional totality. Safety is not a separate matter that can be tagged on to a service only while realising it. Safety needs to be taken into account already in the service strategy, service idea and service product to allow the provision of safe service events. If safety is not been set as one of the objectives in service strategy, it will not be realised in service execution. Neglecting safety from service strategies reflects poor management and it can make safety seem unimportant to employees. In terms of the service idea, safety can easily be made comprehensible to the customer. Good planning and implementation can transform safety into an asset in service marketing and contract negotiations. Further, the service product needs to be safe so that the working methods can also be safe. Employees alone cannot be left responsible for ensuring safety at a customer's worksite.

Safety of service forms a part of overall service and it plays a role in the customer's perceptions of service quality. Customers do not expect occupational accidents and resulting delays but rather they expect the uninterrupted smooth running of operations. Safety matters should, therefore, be taken into account during the various stages of service development. The impact on safety of diverse changes, such as service improvements, new production methods and change of worksites, needs careful evaluation.

2.2 UTILISATION OF THE OPERATIONAL MODEL IN SERVICE PROVISION

The operational model is targeted to service provider companies to support the organisation of safety activities. When safety performance has reached a satisfactory level, it can be utilised as an asset in service marketing. The model can be utilised to illustrate the level of safety performance and future improvement plans in the company. A good safety level also indicates the quality of the overall performance. Concrete examples, such as operating according to the constructed model, help customers appreciate the service provider's efforts in promoting safety. Quality safety activities help to achieve a trouble-free, smooth and scheduled overall performance valued by customers.

2.2.1 Why safety is worth marketing

Safety performance is rarely employed in service marketing. However, a good safety level is often seen as an indicator of intelligent and high quality performance. In recent years, the expression of the company's ethical and moral values has gained great attention. By marketing their safety performance, companies have the opportunity to promote a positive image that projects a concern for the interests of their partners and associates.

Occupational accidents and diseases as well as interruptions all incur direct and indirect costs for the company. Breaks in production, accident investigations, sick leave compensation, substitutes and material

damages adversely affect a company's profitability. When operating in networks, problems in one company's performance have a knock-on effect in others. Companies cannot afford the costs and loss of image caused by unsafe performance. As a result, large companies in particular have started to give great attention to safety management and the safety standards of their service providers.

Conceptualisation of a service is often difficult for customers. Before service delivery, customers are often anxious about gaining value for money. Thus, it is important that the service provider explains details of the service pricing and treats safety matters as a single item of cost. The pricing of safety helps customers understand the composition of overall costs. If customers understand what they are going to achieve by paying the price asked, the perceived risk of service procurement decreases. This way also the threshold for purchasing the service is lowered.

2.2.2 Safety matters to be highlighted in marketing

Certificates and safety markings are effective tools in the marketing of safety. These can be used to show the company's concern for the environment, quality and safety of its employees. The use of third party certificates and safety markings helps to assure customers of the professionalism and quality of the service provider's operations. This improves the credibility of marketing communications.

It is worthwhile for service providers to explain the objectives of their safety operations to their customers and the way in which these objectives are monitored. This signals continuous improvement of operations and informs customers about what they can expect from long-term cooperation. It is important that customers are not given overly optimistic expectations since this can cause disappointments. Service providers need to give a realistic picture of the level and progress of their safety performance.

Companies need to measure and document their safety performance records to be able to employ safety in marketing. Customers should be informed about the safety results and it is also worthwhile to share these with all new customers. For example, occupational accident frequency information is often of interest to customers and it can even be a positive factor in the evaluation of the tenders.

The terminology of occupational safety has not yet become established in the business world and the terminology is utilised also in different contexts in different companies. By marketing occupational safety, service providers and customers learn to use a common safety language so that the terminology is eventually standardised and ultimately this helps to reduce misunderstandings.

The best marketing of safety is smooth and trouble-free performance. Therefore, discussions on safety matters with the customer both during and at the end of cooperation are important for the improvement of performance. Together with their customers, service providers should draft a document recording the quality of cooperation so that this can be used in marketing the service to future customers.

2.3 REFERENCES

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2 INDUCTION, OCCUPATIONAL INSTRUCTION AND GUIDANCE

What?	Introducing employees to the work tasks and work environment.
When?	Before new employee starts working and when work tasks, work practices or work equipment change.
To whom?	To all personnel groups including temporary employees.
Who is responsible?	The supervisor has responsibility for organising induction. In practice induction can also be given by other competent persons.

2.1 LEGISLATIVE REGUIREMENTS

Under the Occupational Health and Safety Act an employer is required to familiarise a new employee and an employee changing work tasks with the work, working and production methods, work equipment and safe working practices. Orientation is also to be given for new work equipment and new working or production methods. (738/2002, section 14; see appendix 1, section 2.1.1)

According to the Occupational Health and Safety Act, the recipient of labour shall be responsible for orienting employees. (738/2002 section 3; see appendix 1, section 2.1.2)

2.2 ORGANISING SAFETY OPERATIONS

2.2.1 The meaning of induction and occupational instruction and guidance

The purpose of induction and occupational instruction and guidance is to acquaint the employee with his/her work task, the work environment and working conditions. This gives the employee confidence in his/her work performance as a part of the work community. Induction refers to the presentation of general operational practices given at the start of employment. With the help of induction, the employee learns to know his/her work place, work community and its working practices as well as his/her job description and expectations regarding these. Occupational instruction and guidance is a part of induction and relates to the actual work tasks and their realisation. Occupational instruction and guidance involves, among other things, appropriate work methods and work practices as well as the knowledge and competence required for performing of work tasks. Safety issues relating to the work, such as, possible hazards, ergonomic working postures, and use of personal protective equipment are also introduced. Occupational instruction and guidance is also organised later during employment if necessary.

> ***Practical example**: In order to properly introduce safety issues about the work tasks, safe performance should not be discussed merely in general terms. Safe work practices should also be introduced in detail, for example, by presenting potentially hazardous situations and demonstrating appropriate work methods.*

2.2.2 When to arrange induction or occupational instruction and guidance

Induction and occupational instruction and guidance should be arranged when a new employee starts work or the works tasks are replaced by new ones. Induction is also appropriate when new machinery or substances are introduced. Situations that require induction and occupational instruction and guidance are also conditions diverging from normal (e.g. organisational changes or atypical working methods) and rare work tasks. In addition, induction and occupational instruction and guidance should be reviewed if an employee neglects safety instructions or other irregularities in performance are identified.

Induction and occupational instruction and guidance should be given to all personnel groups. Temporary employees (e.g. summer trainees, substitute employees and leased labour) and employees returning to work after longer absence (e.g. long sick leave and parental leave) should also be inducted to and instructed on their work tasks and practices in the work community.

2.2.3 Planning and realisation of induction or occupational instruction and guidance

The content and schedule of the induction and occupational instruction and guidance need to be planned beforehand. However, the final realisation of the induction and occupational instruction and guidance is determined by the education, work experience and knowledge of the employee to be inducted or instructed. The requirements of the work tasks and work methods also need to be taken into account.

> ***Practical example:*** *In order to facilitate assimilation of the induction, its content and realisation can be divided into two parts: one part discussing work performance and work environment, and the other part relating to the safety of the work. The first part is realised before starting work and the second one during work task realisation.*

A form containing the issues to be induced should be drafted. This enables the systematic treatment of the essential matters. The induction matters need to be discussed with the employee in person. Further, the induction and occupational instruction and guidance should be realised by exploring the workplace, discussing with employees and familiarising them with the realisation of work tasks. In addition to the spoken induction, the same information should be also given in writing.

> ***Practical example:*** *A work partner system, whereby the company trains experienced employees to act as working instructors.*

> ***Practical example:*** *A learning objective is defined for the induction period. At the end of the induction period, the learning result is compared with the objectives. Induction is continued if needed.*

2.2.4 Organising induction or occupational instruction and guidance

The supervisor is responsible for the organisation and supervision of the induction. However, the supervisor can delegate the actual realisation of induction and occupational instruction and guidance and related tasks to other competent persons (e.g. a colleague of an employee to be inducted). In this case, the supervisor should ensure that the person giving the induction and occupational instruction and guidance is trained and competent for the assignment. It is also recommended to utilise the knowledge of occupational health and safety personnel and occupational health services in carrying out the induction and occupational instruction and guidance. Employees undergoing induction are also responsible for their learning and are expected to clarify uncertainties in their understanding.

2.2.5 Monitoring and documentation

The effectiveness of the induction and occupational instruction and guidance needs to be monitored during the realisation process and afterwards. During the induction and occupational instruction and guidance it should be checked that the employee has assimilated the information and that the realisation process is appropriate. After the induction and occupational instruction and guidance, it should also be determined whether the induction and occupational instruction and guidance were sufficient and whether the methods utilised were appropriate. The person giving the induction and occupational instruction and guidance should carry out these assessments with the employee. Assessments can be made, for example, through discussion, survey and observation.

> ***Practical example:*** *After a couple of months since the realisation of an induction given to a new employee, the employee's knowledge is evaluated. The information is reviewed with the employee and additional induction is given if necessary.*

The induction or occupational instruction and guidance need to be documented. This can be done, for example, using forms filled in during the induction or the lists of participants. After the induction, the completed forms are signed by the employee and employer and archived.

> ***Practical example:*** *The first development discussion is held after the probation period. During this discussion it is decided if the induction given has been sufficient or if an additional induction is needed.*

2.3 ORGANISING WORKSITE-SPECIFIC SAFETY OPERATIONS

2.3.1 Organising induction or occupational instruction and guidance

The purpose of the induction is to ensure that the worksite conditions, hazards and rules are known by all the employees working at the site. The customer needs to make certain that the service providers working at the site have got a site specific induction. The service providers are responsible for ensuring that their own employees have sufficient knowledge of general safety matters.

The induction can be implemented by the service providers' own trained personnel but the employees can also participate in inductions arranged by the customer. It is important that service providers familiarise their employees with work-related hazards and safe work performance themselves even though the customer would require the employees to participate in their inductions.

Worksite-specific safety instructions and rules as well as the service provider's responsibilities should be discussed already at the contract stage. This involves, for example, participation in the induction training sessions and the monitoring of safety. Service providers need to ensure that their employees have familiarised themselves with the customer's safety material before the start of work.

Occupational instruction and guidance should be organised before works tasks commence at the worksite. The work task-related instructions and safe working procedures are inducted during the occupational instruction and guidance sessions. These sessions need to be organised by the customer if employees from more than one service provider are involved in the work project. In other cases, it is the service provider who has responsibility for occupational instruction and guidance. Appropriate documentation (e.g. induction form, list of participants and programme) needs to be drafted to record the obligation to arrange the induction.

Practical example: *The induction training is verified by withholding a site admission permit until the employee has completed the induction satisfactorily.*

Practical example: *Employees should be required to repeat the induction training if they have not worked at the worksite before or the site conditions have changed significantly.*

2.4 ADDITIONAL INFORMATION

Guide for planning and realisation of induction

The guide includes practical information on planning, realisation and monitoring of the induction. The guide is for the use of personnel administration, supervisors, workplace trainers, mentors, and liaison staff in the area of occupational safety and health.

Available in http://www.tyoturva.fi/julkaisut/tiedot/27030.html

Inducting temporary employees

The guide supports the planning and realisation of the induction and occupational instruction and guidance for temporary employees. The guide also discusses the topics that are to be included in the induction and occupational instruction and guidance at a general level.

Available in http://www.tyoturva.fi/julkaisut/tiedot/25044.html

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B1 MATTERS TO BE AGREED BEFORE THE COMMENCEMENT OF WORK

Worksite / work task	**Date**

MATTERS TO BE AGREED	***Additional information***
Recruitment and professional skills	
- How are the professional skills of the employees operating at multi-employer worksites ensured?	
Induction, occupational instruction and guidance	
- Who is responsible for inducting employees to the worksite? - Which practical matters need to be inducted to promote safe working practices?	
Safety training	
- Who is responsible for the training of workers in safe working practices at the worksite? - What kind of safety training does the work require?	
Safety instructions and operating instructions	
- What kinds of instructions are given to the operators? - Which party draws up the safety plans? - How are other parties informed about the instructions and plans?	
Flow of information and cooperation	
- Who is responsible for drawing up and distributing a list of contact persons? - Who supervises work at the multi-employer workplace? - Who has responsibility for the service provider's workers? - Who is responsible for arranging cooperation? - Have the meeting practices been agreed? - What information systems does the service provider use?	
Protection and safety devices	
- Who pays for the tools, protections and personal protective equipment? - Who pays for the project-specific tools and protections? - Where may the service provider store his tools?	
Work tasks needing special attention	
- Do the workers know what work tasks require special attention? - Is work permit practice created for these kinds of work tasks? - Is work permit practice regarded as complicated?	

Licenses	
- Are employees aware of the licenses required for work tasks? - Are the qualifications of the workers appropriate for safe work performance?	
Emergency preparations	
- Are the employees aware of emergency procedures? - Have rescue exercises been arranged? - Have all the workers participated in these exercises?	
Aberrations and accidents	
- How are accidents and aberrations reported? - How does the accident investigation process proceed? - Who is responsible for the investigation of accidents? - Is information about the accident reported to the customer?	
Occupational health care	
- Are the workers aware of occupational health care practices?	
Documentation	
- What issues need to be documented during the delivery stage? - Who is responsible for the documentation of these issues? - Are the necessary matters documented?	
Machinery	
- Are there tools in use which must be regularly checked? - How are periodic inspections arranged and who is responsible? - Are inspections by official authorities required?	
Inspections and repairs	
- Are subcontractors or independent workers hired? - How has their supervision been arranged? - How is the customer informed of these?	
Operating abroad	
- Are the preconditions for work safety in place?	
Foreign employees	
- Are the employees aware of the safety issues related to their work? - Has adequate attention been paid to employees' language skills?	
Temporary work	
- Is a temporary workforce used? - How is the supervision of the temporary labour arranged? - How is the customer informed of this?	
Insurance	
- Is there sufficient insurance cover for the operations?	

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ISBN 978-952-15-2776-0
ISSN 1459-2045