Journal of Cleaner Production 98 (2015) 166–174

Contents lists available at ScienceDirect

Journal of Cleaner Production

journal homepage: www.elsevier.com/locate/jclepro

Integrated Product Service Offerings for rail infrastructure – benefits and challenges regarding knowledge transfer and cultural change in a Swedish case

Sofia Lingegård*, Mattias Lindahl

Linköping University, Department of Management and Engineering, Environmental Technology and Management, 581 83 Linköping, Sweden

ARTICLE INFO

Article history:
Received 15 January 2013
Received in revised form
11 June 2014
Accepted 12 June 2014
Available online 23 June 2014

Keywords:
Rail infrastructure
Long-term contracts
Supplier–buyer relationships
Knowledge transfer

ABSTRACT

The aim of this paper is to investigate potential benefits and challenges regarding knowledge transfer and cultural change from the provider and buyer perspectives when using IPSOs for Swedish rail infrastructure. Considering material use and the importance of availability of the tracks makes rail infrastructure an interesting candidate for a business model based on a life-cycle approach, which can result in a reduction in cost and environmental impact.

The concept of the Integrated Product Service Offering (IPSO) has in several business areas proven to be a means with potential to reduce the environmental impact of products and services, increase cost efficiency and quality, and act as a driver for change. The business model, which is based on a life-cycle approach, focuses on the function instead of the initial price of the product.

Among the main findings are the lack of information and knowledge transfer that act as a barrier for innovation, and that the buyer's conservative business culture makes it difficult to implement new types of contracts. Since IPSO contracts require improved information transfer, they could potentially stimulate innovation as well as processes for evaluation of the contracts. By involving the contractors in the design phase their knowledge could be used in a better way, creating a feedback loop from practice to design.

The empirical part, focusing on the rail infrastructure industry in Sweden, has been collected using individual interviews and a group interview approach.

1. Introduction

Building and maintaining rail infrastructure requires large quantities of materials, and the environmental impact from the upstream production stages is significant (Svensson and Eklund, 2007). Steel, concrete and crushed rock are the three materials that contribute to the majority of the environmental impact, and these are mainly used for steel rails, concrete ties and ballast material (Svensson and Eklund, 2007). There is an aggregated need for maintenance in the Swedish rail infrastructure system, and previous studies conclude that proactive maintenance is a key factor to create a robust infrastructure system (The Swedish Transport Administration, 2013). At the same time, corrective maintenance is increasing in Sweden (Government Offices of Sweden, 2010). This causes problems with the availability of the tracks, due to errors in the system that need to be taken care of. Furthermore, the government focuses on transferring transports from road to train traffic (Government Offices of Sweden, 2010), while the prognosis expects a strong increase in transport of both people and goods on the rail infrastructure through 2050 (The Swedish Transport Administration, 2013). Considering the 40–60 year use phase of the rail infrastructure and the cost of the maintenance, it would make sense to try to decrease the maintenance cost by e.g. using more durable materials.

The Swedish Transport Administration (STA) is the authority that is the dominant actor and owns 80% of the rail infrastructure in Sweden. The infrastructure is managed by the law of public procurement. Availability of the tracks is the overall parameter that is used to measure the result of the STA. In this paper, the buyer of the infrastructure is the STA, while the providers are the contractors that realize the construction and maintenance of the infrastructure. The terms “contractor” and “STA” will be used interchangeably with provider and buyer respectively in this paper, depending on if empirical information or general theory are presented and discussed.

* Corresponding author. Tel.: +46 13285663.
E-mail addresses: sofia.lingegard@gmail.com, sofia.lingegard@liu.se (S. Lingegård).

http://dx.doi.org/10.1016/j.jclepro.2014.06.039
0959-6526/

Every time maintenance is performed or an error corrected, it affects the availability of the tracks to some degree. The parts of the rail infrastructure system that cause most of the delay hours, 60%, are contact wires, shifters, signal control, tracks and positioning systems (The Swedish Transport Administration, 2012). Mismanagement of the rail infrastructure in Sweden over the past decades has led to a poorly maintained infrastructure and an inefficient organization (Alexandersson and Hultén, 2008; Thompson et al., 1998; Tullberg, 2000).

Considering the large quantities of material used and the importance of availability of the tracks makes the rail infrastructure system an interesting candidate for a business model based on a life-cycle approach, which can result in a reduction in cost and environmental impact. Thus far, the STA has not had a life-cycle approach to its work. There is a need for the STA to start working with the environmental management of products when designing new products, i.e. before introducing them in the material supply chain, to reduce their environmental impact (Svensson, 2006). Certain contracting forms, such as performance contracting, can increase the drivers for change within industry and thereby increase cost efficiency and quality from a life-cycle perspective (The Swedish Agency for Public Management [Statskontoret], 2009). The fact that the provider has control over the whole life-cycle of the product provides incentives to realize more environmentally and economically sound development when considering the whole life-cycle (Lindahl et al., 2009). This type of contracting is also known as an Integrated Product Service Offering (IPSO), and implies that the provider has the responsibility to deliver a result, and therefore has incentives to optimize the use of energy and material. This implies that the provider needs to be in charge of the design phase, where materials are selected and most of the environmental impacts are set, as described in e.g. Lewis and Gertsakis (2001).

The IPSO has previously been used in several different types of industries. One example is Rolls-Royce, which instead of selling an engine to its customers now provides availability in the form of the number of hours the engine is in use (Baines et al., 2007; Erkoyuncu et al., 2011). Another example is a Dutch road infrastructure project where a type of IPSO was used, and where it was concluded that an integration of the life-cycle steps would be a logical approach for sustainable performance (Lenferink et al., 2013).

In many cases the provider of an IPSO knows more about the product than the buyer, creating an information asymmetry, see e.g. van Amstel et al. (2008). Also, during the use phase the provider can gain more knowledge about the product and use it in the design phase to make improvements (Meier et al., 2010; Sundin and Bras, 2005). Since the design and use phases are not in the same contract for rail infrastructure or executed by the same actor, it is relevant to investigate the information and knowledge transfer and see if it can be improved by a change in business model to IPSOs. In this paper, information is seen as data while knowledge includes skills that have been acquired.

However, to become a service provider, considerable changes have to be made within the organization, capabilities and management of the firm (Oliva and Kallenberg, 2003). Earlier research has pointed out the difficulties associated with a traditional mindset among customers (Alonso-Rasgado et al., 2004). The need for investigation of knowledge transfer and cultural change provides the focus for this paper. The aim of this paper is to investigate potential benefits and challenges regarding knowledge transfer and cultural change from the provider and buyer perspectives when using IPSOs for Swedish rail infrastructure.

The composition of this paper is as follows. In Chapter 2, the methodology of the study is presented, followed by Chapter 3, where the life-cycle perspective for product development and the concept of the IPSO are described. Chapter 4 presents an overview of the current procurement situation in Sweden for rail infrastructure, based on the literature study as well as empirical information from the respondents. The results from the interviews regarding IPSOs are presented in Chapter 5, followed by the discussion in Chapter 6. Finally, conclusions and future research are presented in Chapter 7.

2. Methodology

This paper has an exploratory nature, since IPSO contracts are not commonly used in rail infrastructure and little has been published in this area. The main empirical data have been collected using individual interviews and a group interview.

The individual interview study was performed to gain knowledge about the provider and buyer perspectives, as well as to get an overview of the industry. The interview guide was based on the results from a previous literature study (Lingegård, 2010, 2011), along with an initial interview with a respondent within the STA familiar in the subject of contracts. Two slightly different interview guides were used, one for the STA and one for the contractors. The analysis of the information was made by a comparison among the respondents from the STA, within the group of contractors as well as between the contractors and the STA.

2.1. Selection of respondents

In total, 14 respondents were individually interviewed, and the respondents themselves suggested others as potential respondents during the study. Within the STA, the respondents included representatives on a managerial level of both the construction and maintenance parts of the organization, as well as a respondent from the top management group. The respondents from the STA are presented in Table 1. Since the STA is the dominant buyer in Sweden the respondents' views are representative for the buying side. Respondents from Investments represent the investment and construction of the infrastructure, both for new infrastructure projects and larger reinvestment projects. The Maintenance respondents are involved in the long maintenance phase of the infrastructure projects. The respondent from Procurement represents a supporting function for purchasing materials. These divisions are of primary interest for this paper and they are currently not cooperating. When the results from the STA respondents were converging and saturation had been reached, with all respondents highlighting similar areas of interest, the interview study for the buyer perspective was concluded.

The respondents at the STA provided contact information to most of the contractor respondents; others were contacted directly. Six out of seven of the respondents from the contractors' organizations worked in the marketing or business divisions of the companies. The respondents within the organization of the contractors are presented in Table 2, and represent most of the

Table 1
The respondents within the Swedish Transport Administration (STA).

STA divisions	Position	Interview time (min)
Procurement	Supply Chain Advisor	63
Maintenance	Operative Maintenance Control	50
Maintenance	Procurement Manager	37
Maintenance	Business Developer	66
Investments	Operative Procurement	42
Investments	Operative Control and Coordination	62
Investments	Top Manager	66