Adoption of Reverse Logistics in South Australian Construction Projects: Major Drivers

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Abstract

This paper aims to investigate and analyse the perceptions of South Australian construction practitioners on drivers associated with adoption of reverse logistics (RL). To this end, semi-structured interviews were conducted with eight practitioners to collect data and the interview transcripts were analysed using the NVivo (*version* 10) software package. The study takes advantage of integration of qualitative and quantitative analysis of interview transcripts to rank the drivers on the basis of their relative importance. Results suggested that factors associated with regulations and obligations could act as the most important drivers to promote adoption of RL. The drivers associated with financial gains were identified as the second important category of drivers in RL adoption. Furthermore, environmental concerns were regarded as "slightly important" for practitioners in the South Australian construction context. The study concludes with presenting a model mapping the factors affecting the level of influence of drivers in construction projects in South Australia (SA).

Keywords: adoption, construction industry, drivers, reverse logistics, South Australia.

Introduction

The large share of the construction industry in consuming world's resources and the massive amount of waste dumped into landfills have become serious issues for many countries (Gorgolewski, 2008). Apart from environmental aspects, the construction industry is still deemed inefficient largely because of the deficiencies with its supply chain management (SCM) (Segerstedt & Olofsson, 2010). This is a contemporary issue for the Australian construction industry as according to recent evidence, industry should take advantage of all viable measures for enhancing the efficacy of its SCM (Allen Consulting Group, 2010).

In response to such issues, adopting reverse logistics (RL) would be a remedial solution that could ease up the detrimental environmental effects in tandem with boosting efficiency (Schultmann & Sunke, 2007a; Aidonis et al., 2008; Kibert, 2012). Nevertheless, RL has yet to become commonplace in the construction industry (Kibert, 2012) and even has been described as an 'unexploited' area (Nunes et al., 2009).

As any unconventional strategy, promoting the adopting of RL within the construction context might not materialise without factoring in the intentions of stakeholders

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(Akbarnezhad et al., 2014). Yet, RL is still an under-researched area within the construction context (Chini & Bruening, 2003; Hosseini et al., 2013) and the body of knowledge is not able to provide the field with such information. Moreover, a wide range of drivers for adopting RL rest on the local circumstances and the social values prevalent in the community (Schultmann & Sunke, 2007b). Thus, in view of the lack of such studies in SA, investigating the drivers for RL becomes very relevant and the first step towards promoting RL. That is, the findings would facilitate translating cradle-to-cradle principles such as RL for practical implementations within the construction industry as stressed by van Dijk et al. (2014). Besides, this would raise the general awareness of RL major aspects in construction projects as a prerequisite for extensive adoption of RL within the construction context in other countries as recommended by Hosseini et al. (2014a). It is noteworthy of mentioning that conducting the present study in SA would provide a wealth of knowledge for the field due to maturity of SA in dealing with C&D waste and enforcing environmental regulations as a leading state in international levels (UN-HABITAT, 2010).

Literature Review

Definitions

As defined by Govindan et al. (2012, p.204) "reverse logistics is the process of moving goods from their typical final destination to another point, for the purpose of capturing value otherwise unavailable, or for the proper disposal of the products.". For the construction industry, Nunes et al. (2009, p.3717) defined RL as "how the area of business logistics plans, operates and controls the flow of logistics information corresponding to the return of post-sale and post-consumption of the goods to the productive cycle through reverse distribution channels, adding value of various types to them: economic, ecological, legal, logistical, corporate image, etc.".

Table 1. Major drivers associated with adopting RL

Category		Drivers	Scholarly support
Environmental	Drivers	Reducing consumption of raw materials and energy Reducing waste Reducing pollution Facilitating meeting the requirements of environemntal regulations	(Schultmann & Sunke, 2007a; Gorgolewski, 2008; Sassi, 2008; Densley Tingley & Davison, 2012)
Financial Drivers		Reducing costs through use of less raw materials and energy Increasing revenue through selling recovered materials Reducing the costs of landfilling and disposal	(Addis, 2006c; Leigh & Patterson, 2006; Hiete et al., 2011)

Social Responsibility	Drivers	Improving health in the community (due to reducing pollution) Creatring more number of jobs Enhancing the image and reputation of the businesses that adopt RL	(Addis, 2006c; Leigh & Patterson, 2006; Aidonis et al., 2008; Denhart, 2010)

Drivers for adoption of RL

The major drivers of RL within the construction context as identified in previous studies are shown in Table 1.

As captured in Table 1, implementing RL makes construction companies capable of reusing materials and products extracted from existing buildings. This diverts huge amounts of used items from landfills, which is imperative to consider sustainability in the construction context. It has been observed that implementing RL in a construction project could use about 85% of the materials extracted from an old building. Accordingly, associated costs of construction projects could be about 30%-50% lower (see Gorgolewski (2008) for details of calculations). Communities would suffer from less health problems due to exposure to less pollution as a result of adoption of RL. Additionally, businesses that adopt RL will get an image uplift. Apart from findings of previous studies, as implied by Schultmann and Sunke (2007b), a wide range of RL drivers are interrelated with socioeconomic and cultural aspects, which might glaringly differ for construction practitioners in SA. This necessitated investigating such drivers within its natural context in SA as described in following.

Research Methods

Drawing upon a qualitative approach becomes relevant in this study taking into account the exploratory nature of research purposes alongside the novelty of the topic in the built environment field as discussed by du Toit and Mouton (2012). This is further justified considering the objective of this paper to discover the drivers of South Australian practitioners to adopt RL, which entails a rigorous exploration of their real-life needs. As such, one of the most effective methods for assessing needs in its natural context is proven to be conducting interviews as a qualitative approach (du Toit & Mouton, 2012). The study adopted a semi-structured interview approach taking into account the findings of previous studies as the questions and as a priori list of themes for analysing data. Each interview lasted approximately one hour, and all the interviewees were selected based on their willingness to partake in the study. This led to a small sample size of 8 interviewees as captured in Table 2. Despite such a limitation, deploying self-selected cases might yield valuable results due to their motive to express feelings or opinions about the research question as stated by Simms and Rogers (2006). Besides, according to Bazeley (2013), size of the sample in qualitative research becomes irrelevant due to the fact that the value of the study is based on quality of data.

It is widely acknowledged that using computer packages such as NVivo would enhance the rigour of qualitative data analysis procedures (Bazeley, 2013). As such, analyses of data were conducted using Nvivo 10. As stated by Lewins and Silver (2007) Nvivo 10 is one of the main available software packages for analysis of unstructured data. Nvivo 10 falls within the category of packages for analysing qualitative data termed by Bazeley and Jackson (2013) as QDAS (qualitative data analysis software). Nvivo has been developed by QSR International, equipped by a set of tools to assist researchers in analysing

qualitative data as well as presenting the findings and associating quantitative explanations with qualitative information (Bazeley & Jackson, 2013).

To investigate the level of importance of drivers, the ability of NVivo in terms of converting qualitative data into quantitative coding was deployed according to the procedure recommended by Bazeley (2013). Whenever one part of a transcript was coded as one of the drivers, the same passage was also coded as an importance code. Levels of importance for each driver was categorized into three themes comprising *very important, important* and *slightly important*. Afterwards, befitting queries were run to investigate how each driver was considered to be important, and also compare how different respondents had seen the importance of the drivers as explained in below.

Table 2. Profile of respondents

Title	Designation	Type of business	Years of experience
A	CEO and owner	Salvaging and demolition	25
B	Executive manager	Construction	15
C	Managing director	Consulting	20
D	Executive manager	Salvaging, recycling, demolition	9
E	Marketing manager	Salvaging, recycling	21
F	Senior environment protection officer	Environmental regulation	N/A
G	Architect	Designing	6 in SA (Overall 13 years)
H	Builder	Construction, renovation and refurbishment	15

Major Drivers

The patterns emerging from the interview transcripts on major drivers of RL as perceived by respondents are illustrated in Table 3. The findings of the study reaffirmed the nature of the drivers for RL as detected by previous studies. Besides, a couple of new themes emerged through analyses of transcripts as discussed in below.

It could be inferred from Table 3 that drivers which are related with requirements and necessities are ranked as very important by the respondents. That is, meeting the requirements associated with such drivers is obligatory. This refers to contractual requirements and environmental regulations and acknowledges the statements by Gorgolewski (2008) regarding the influential role of such drivers. Other items in 'very important' rank refer to cases in which consumers have no choice but to purchase salvaged items in RL process such as when size, type or shape of product becomes unique. Likewise, as stated by **interviewee A**, customers come for purchasing salvaged items when a building project involves making small alternations to houses. Addis (2006b) refers to this by stating that small-scale builders in need of limited items source their goods from salvage yards. Presumably, in such cases purchasing salvaged items in limited volumes

might be more cost-effective as opposed to buying virgin items that might not be available in small quantities.

This is the case also when people look for high quality products. To underpin this, **Interviewee H** regarded quality as one of the main driving forces for people purchasing structural salvaged items. Similarly, the growing interest for high quality salvaged items in Canada was mentioned by Earle et al. (2014, p.27) postulating "Interest is growing as the inventories of old grow woods and certain species of wood are becoming increasingly more difficult to acquire. As mentioned about high quality architectural items such as posts, beams, and trusses are popular reuse items.".

Table 3. Ranking RL drivers based on scaled codes

Drivers	Very important	Important	Slightly important
Disposal savings	8.57%	87.35%	4.08%
Enhancing long-term performance	100%	0%	0%
Transportation savings	50%	50%	0%
Value for money	51.48%	48.52%	0%
Contractual requirements	100%	0%	0%
Environmental incentives	9.18%	29.59%	61.22%
Environmental regulatory requirements	100%	0%	0%
Enhancing marketing competitiveness	100%	0%	0%
Green image	0%	100%	0%
Mentality and culture of contractors	18.52%	81.48%	0%
Supporting local economy	0%	100%	0%
Sustainability concerns	0%	89.61%	10.39%
History and story behind products	0%	100%	0%
Higher quality of salvaged items	1.96%	98.04%	0%
Small projects needing small amount of materials	0%	100%	0%
Technical incentives	0%	74.58%	25.42%
Uniqueness of products (size, shape, type of material)	100%	0%	0%

Interviewee A and **G** stated that some customers opt to purchase salvaged items or using salvaged items in their new buildings considering "the history, story and sentiment" or "good memories" of recovered items.

Attempting to enhance long term performance within the business environment by contractor was also considered a very important item as in Table 3. Such finding reconfirms the premise of Carter and Ellram (1998, p.97) asserting "the primary driver from outside the firm include pressure from the regulatory and output sectors of the firm's task environment.".

The drivers associated with profit and savings are perceived as important or very important. This reflects the high priority of such items when it comes to drivers of RL in the South Australian construction industry. According to Hosseini et al. (2014b), drivers of RL associated with money are the most important ones for industry practitioners. Likewise, **Interviewee E** postulated that "people recycle as long as it is cost effective for them". Similarly, **Interviewee B** indicated that their company would consider sustainability providing that some type of financial gain is included. **Interviewee G** as a designer described the drivers of clients by opining that the first priority for our clients is budget. This acknowledges that apart from obligations for adopting RL, the most important drivers are those which result in financial gains for practitioners in the construction industry. Such insight has been acknowledged in the construction literature as according to Smith et al. (2007, p.12) RL is implemented if you "show them the savings". Likewise, Kuehlen et al. (2014) called for quantitative studies to show the benefits of RL in Germany.

The third category of drivers in terms of relative importance concerns the drivers associated with non-financial gains, environmental issues, supporting the local economy and enhancing the environmental image in the community. In comparison to the drivers associated with money and profit, this category was of noticeable lower importance as perceived by the respondents as captured in Table 3. Yet, drivers with the lowest importance were those concerning environmental concerns and incentives as evident from Table 3. This reflects the fact that such drivers should not be regarded as highly influential promoters of RL in the construction industry in SA.

Factors Influencing RL Drivers

According to Parrilli and Elola (2012), studies on drivers of novel practices should attempt to open the "black box of drivers", namely alongside identifying the drivers, the major aspects affecting the driver should be analysed. Interviewees discussed the drivers for them to adopt RL and in most cases went on to describe the major factors which could positively or negatively affect the level of influence of drivers for adopting RL in SA. As such, the main factors emerged within the interview transcripts are illustrated in Figure 1.

Potential for on-site sorting

The salience of on-site sorting as a promoter for deconstruction activities was mentioned in Canada (Earle et al., 2014) and it was regarded as an attractive practice for the US as stated by Guy (2014). Likewise, as illustrated in Figure 1, six out of eight interviewees stressed that possibility of on-site sorting is a major promoter for drivers associated with RL. **Interviewee C** and **Interviewee E** opined that on-site sorting will facilitate achieving the benefits of RL by reducing the costs of the process. For this reason, **Interviewee C** stated that "regulations should encourage for sorting at source".

Nevertheless, respondents' views were contradictory on prospect of on-site sorting. **Interviewee E** and **B** contended that on-site sorting is possible in SA. Even more, **Interviewee F** postulated that on-site sorting is allowed according to contemporary regulations. However, **Interviewee A** mentioned that on-site sorting is not viable anymore

due to safety regulations and environmental codes. **Interviewee C** went on to imply that on-site sorting in SA might end up in receiving fines because this is regarded as dumping waste according to imposed regulations. It could be proffered that on-site sorting potential can enhance the effects of RL drivers as identified, yet there is a lack of knowledge about the regulations and the possibility of sorting on-site among the construction practitioners in SA.

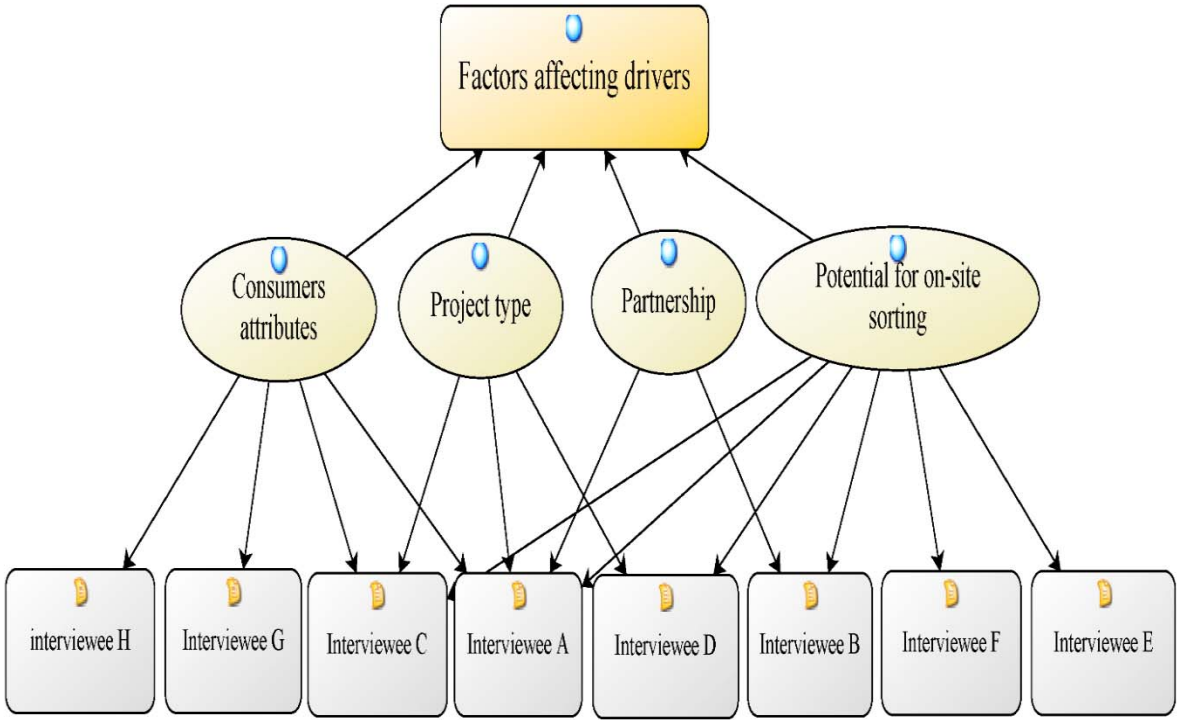

Figure 1. Major factors affecting the level of influence of RL drivers (Nvivo output model)

Project type

Unlike what one would guess in regards to the support that should be provided by the government and corporations for RL, it became apparent that a major part of RL drivers are achievable only within the private sector and small projects. To emphasise the effects of project type **Interviewee A** stated that "we rarely come across a commercial building that uses us for salvaging". Likewise, **Interviewee D** implied that using salvaged products in projects funded by the government is troublesome as experience shows less trouble in working with the private sector. The same trend was observed in the US by Guy (2014, p.147) stating "the majority of deconstruction project clients are private homeowners". The same insight was indicated by **Interviewee A** opining that "the domestic sector is very huge compared to the commercial sector, both as customers and providers of salvages material".

The reason for this became fathomable when **Interviewee A** stated that they avoid high profile projects having big players in it, mainly because unions get involved and interfere with their industrial relations issues. As another cause, **Interviewee C** explained that there is enormous pressure on the builder and the demolisher to remove the old buildings and clean the site to start the project in commercial and governmental project due to contractual obligations. Such tight scheduling negatively affects the drivers for adopting RL in such projects. Therefore, it could be concluded that type of project in terms of the source of funding, its size and the nature of the contract could modify the level of influence of drivers of RL. It was also revealed that small and private projects are more likely to attract RL adopters as opposed to governmental and high profile projects.

Partnership

According to Addis (2006a) and Leigh and Patterson (2006), establishing a partnership between all the parties involving RL is necessary to assure its success. It was also asserted by Carter and Ellram (1998) that to overcome uncertainties, players in RL should increase the level of coordination with their main suppliers. This was endorsed by the statements of the interviewees, because they mentioned the great role of establishing partnership to enhance the positive aspects and drivers of RL. **Interviewee A** postulated that they have developed a good partnership for implementation of RL and their sources of information for such opportunities are their partners in the industry by stating "we have very good informal partnerships with contractors, architects, and demolishers. The demolition contractors call us whenever there is a potential for salvaging". Even more, **Interviewee B** described the whole process of RL as a partnership by opining "it is like a partnership". This establishes the salience of developing partnership for enhancing the drivers of RL within the construction industry. Additionally, the findings revealed the lack of formal arrangements to support parties involved in exchanging information regarding RL in SA.

Consumer attributes

It was revealed by Guy (2014) that consumers in deconstruction field are largely medium/high-income home owners in the US. This was endorsed by the respondents in SA as **Interviewee G** mentioned that rich clients are much more interested in implementing RL activities. Similarly, **Interviewee H** postulated that "most of the clients looking for salvaged items for the sake of vintage style are wealthy". This reflects the fact the financial strength of consumers is a determinant for drivers of RL. Another factor associated with demographic attributes of the consumers was age. That is, as asserted by **Interviewee C**, "mostly young practitioners in the building industry are against using old products and materials". In the same vein, **Interviewee A** pointed out that "baby boomers like salvaged products due to some intrinsic value they find in these materials". As a result, drivers of RL are not the same for all potential consumers in the community and differ in accordance to the age or income level. A corollary for this could be the necessity of considering different incentives and dissimilar policies for promoting RL within different groups of people in the community.

Conclusions

It was revealed that drivers should not be regarded as of equal influence for promoting RL adoption within the construction context. It also came to light that drivers stemmed from obligations and requirements have the strongest effect while drivers associated with environmental and social values could not be regarded as highly influential. Even more, it could be concluded that different regulations and government agencies have contradictory effects on RL adoption levels. As such, government regulations (i.e. the most potentially important drivers) would practically obstruct RL in many ways. Another major finding demonstrated the dependency of drivers on a wide range of factors. As such, different conditions, projects and people are influenced by different drivers for implementing RL.

Future studies should be aimed at unearthing the true perceptions and current practices commonplace concerning RL within the building lifecycle in different regions and countries. In addition, studies targeting the regulatory and technical aspects of using recovered and recycled items in new buildings would greatly contribute to the field. Another fertile ground for research would be investigating the measure for promoting inclusion of RL requirements within BIM as a novel area for encouraging sustainable construction.

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