REVERSE LOGISTICS (RL) IMPLEMENTATION AMONG CONTRACTORS IN AUSTRALIA: PRACTICES AND BARRIERS

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This paper aims to investigate the perceptions of Australian contractors concerning the prevailing practices and barriers to the implementation of reverse logistics (RL). A review of literature identified 18 practices and 16 barriers to the implementation of RL. Using a triangulated data collection approach, 6 semi-structured interviews and 49 questionnaires were used to collect data. The quantitative survey data was subjected to descriptive and inferential statistics with correlation analysis to examine the strength of relationship among the barriers, whereas content analysis was employed for the interview data. The results indicated the following barriers as most significant: (i) lack of incorporation of salvaged materials by designers; (ii) regulation restrictions to usage of recovered materials and components; (iii) potential legal liabilities; (iv) higher costs; and (v) longer time associated with deconstructing buildings. Relative to the prevailing practices, the top five ranked were as follows: (i) reduction of waste on projects; (ii) clearer understanding of the benefits; (iii) clearer understanding of the challenges; (iv) clearer understanding of the different aspects of reusing building materials; and (v) Enhancing the green image of the organisation. The results of the interviews also confirmed the findings from the survey, and identified the following barriers: (i) lack of support from the government in terms of financial incentives to increase the competitiveness of reused and salvaged items in the market; (ii) The attached stigma and resistance of supervisors, designers, and some authorities towards using salvaged and reused materials; and (iii) Technical barriers associated with usage of salvaged materials. The majority of the interviewees identified economic issues as the major drivers of RL practices. The identified barriers could be used as a 'road map' for the development of appropriate solutions for the successful implementation of RL, and to improve the environmental related decision making processes of the contractors.

Keywords: reverse logistics, barriers, supply chain management.

INTRODUCTION

Reverse logistics is defined as *"the process of planning, implementing, and controlling the efficient, cost effective flow of raw materials, in-process inventory, finished goods, and related information from the point of consumption to the point of origin for the purpose of creating or recapturing value, or proper disposal"*. (Rogers

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and Tibben-Lembke, 1999, p. 271). From a construction perspective, some studies have identified reverse logistics as a mechanism for easing up the detrimental environmental effects. For example, Pokharel and Mutha (2009), acknowledges that the focus of RL is on waste management, material recovery (recycling), parts recovery or product recovery (through remanufacturing). However, construction and demolition (C&D) waste from the construction industry plays a pivotal role in the recovery rate of waste in South Australia (SA). In total, the construction activities contributed to over 2.2 million tonnes (over 50% by weight) of the materials resource recovered within South Australia. While the waste is generated from forward logistics activities such as waste management practices, some reverse logistics (RL) best practices associated with resource recovery within the SA construction industry continues to be problematic, and still remains under explored. As observed by Abdulrahman *et al*., (2014), there are limited RL studies focussed on developing counties. Elsewhere, in developed and developing countries such as the U.K and China respectively, the construction industry is renowned as the greatest contributor of C& D wastes (Oyedele *et al*. 2013; Wang *et al*. 2010). While the concept and principles of reserve logistics (RL) are not new as shown by the plethora of studies in other countries and industries (Steward and Kuska, 2004), the implementation of practices and principles has not reached satisfactory levels within the building industry (Schultmann and Sunke, 2007; Kibert, 2012; Leigh and Patterson, 2006). Furthermore, despite anecdotal evidence suggesting that local people have used materials and components salvaged from old buildings, the uptake of RL and studies examining the desirable practices are very limited within the Australian construction industry context.

The rest of the study is structured as follows: The following section presents and summarises a review of the literature on practices and drivers affecting RL implementation. Following the review is a summary and identification of gaps in RL knowledge. This is followed by the mixed methods methodological approach adopted for this research study. An explanation of the statistical methods employed for the quantitative part of the study and associated techniques for analysis of the qualitative data, as well as interpretation of the findings are presented. The final section addresses recommendations made and conclusions.

LITERATURE REVIEW

Practices affecting the implementation of RL

In order to present a detailed and structured review of the practices affecting RL, it is necessary to describe how these ‘practices’ are framed and conceptualised in the construction industry. The following three groupings: (i) Industry; (ii) organisation and (iii) project were selected based on the propositions as set out in the seminal work in RL and the model of the environment forces affecting RL activities as proposed by Carter and Ellram (1998). According the same study (Carter and Ellram, 1998), it identified and viewed the operational task environment for the RL as distinctly comprising of following four factors: input, regulatory, output and competitive. The study further argued that the task environment was surrounded by the macro environment which consisted of the general social, political, legal and economic trends (Carter and Ellram, 1998 pg. 94). This macro environment could thus be equated to the ‘industry’ level of prevailing RL practices whereas the ‘organisation’ RL practices were associated with such groupings as the suppliers (input), buyers (output), government agencies such as the EPA (regulatory) and competitors

(competitive). The final listing of the RL practices and associated studies is presented in Table 1 and based on the extensive review of literature by Hosseini *et al*. (2014).

Table 1: Practices for RL and similar studies

Practices	Previous studies[1]
OrgPrac1=Clear understanding of the benefits of deconstructing buildings	Crowther, (2001); Sassi (2004, 2008); Addis, (2006b); Guy *et al*. (2006)
OrgPrac2=Awareness of deconstructing procedures	Greer (2004); Schultmann and Sunke (2007b)
OrgPrac3=Understanding of challenges associated with deconstruction	Pulaski *et al*. (2003); Sassi (2004); Guy *et al*. (2006); Leigh and Patterson (2006); Gorgolewski (2008); Weil *et a*l. (2008); Saghafi and Teshnizi (2011); Kibert (2012)
OrgPrac4=Understanding of different aspects of reusing buildings	Greer (2004); Schultmann and Sunke (2007b)
IndsPrac1=Availability of salvaged building products, components and materials	SA Government (2012)
IndsPrac2=Availability of deconstruction and dismantling service providers	SA Government (2012)
IndsPrac3=Existing demand for salvaged and used building products	O'Brien *et al*., (2002); Addis (2006a); Gorglewski (2008); Hiete *et al*. (2011);
IndsPrac4=Facilities to recover the used products after deconstruction	Schultmann and Sunke (2007b)
IndsPrac5*=Regulatory and financial incentives in favour of deconstruction	Carter and Ellram (1998);Kibert et al. (2000a); Guy and McLendon (2002); O'Brien *et al*., (2002); Smith *et al*. (2007); Saghafi and Teshnizi (2011); Huscroft *et al*. (2013).
IndsPrac6*=Regulatory and financial incentives for promoting use of salvaged materials	
IndsPrac7=Quality control compliance for used products	Tibben-Lembke and Rogers (2002); Sassi (2004); Dowlatshahi (2000); Nordby *et al*., (2009); Da Rocha and Sattler (2009); Kibert (2012); Densley *et al*., (2012); Yeheyis *et al*. (2013)
ProjPrac1=Deconstruction is implemented in our projects	Crowther (2001)
ProjPrac2=Utilisation of salvaged materials in new buildings	Chini and Bruening (2003); Razaz (2010)
ProjPrac3=Reducing the amount of waste generation as part of strategic objectives	Genchev *et al*. (2012); Zero Waste (2011)
ProjPrac4=Enhancing the green image as part of strategic objectives	Addis (2006b); Laefer and Manke (2008); Kralj and Markic (2008).
ProjPrac5=Organisational support for using salvaged materials in new buildings	Carter and Ellram (1998); Dey *et al*. (2011)[2]; Genchev *et al*. (2012); Huscroft *et al*. (2013)
ProjPrac6=Organisational support for deconstructing buildings	Carter and Ellram (1998); Dey *et al*. (2011)[2]; Huscroft *et al*. (2013)
ProjPrac7=Organisational support for designing buildings based on designing for RL principles	Carter and Ellram (1998); Dey *et al*. (2011)[2] ; Huscroft *et al*. (2013)

Notes: *The review of the literature for the two industry practices is combined due to the common denominator of 'regulatory and financial incentives'; [1]Previous studies arranged in chronological order, and for the full listing of references, please refer to Hosseini *et al*. (2014); [2]Supply chain logistics related study

Barriers affecting the adoption and implementation of RL

The literature on developing and developed countries and across different industries such as services, manufacturing and construction is replete with a number of studies on the major barriers affecting the implementing of RL. Drawing upon the approach undertaken by Ho *et al*. (2012) study aimed at examining the major factors that may influence industries to implement reverse logistics, these barriers can be categorised into internal (i.e. intra-organisational) and external (inter-organisational). Similarly, the seminal study by Carter and Ellram (1998) though focussed on the drivers than the

barriers, conceptualised the drivers into 'internal' and 'external' and linked the 'company factors' to internal whereas the 'task environment' as external. According to Hosseini *et al*. (2014), the barriers (see Table 2) associated with RL can be categorised into the following three groups: (i) organisational barriers (OrgBr), (ii) operational barriers (OperBr) and (3) Social (SocBr).

Table 2: Major barriers associated with RL

Description	*Scholarly Support*[1]
OrgBr1=High costs of adopting RL	Jindal and Sangwan (2011); El Korchi and Millet (2011); Tan and Hosie (2010); Lau and Wang (2009); Del Brío and Junquera (2003)
OrgBr2=Uncertainty about the results	Jindal and Sangwan (2011); González-Torre *et al*., (2010); Zilahy (2004)
OrgBr3=Restraining organisational policies (e.g. overlooking design for reverse logistics	Abdulrahman *et al*., (2012); Ravi and Shankar (2005); Rogers and Tibben-Lembke (1998)
OrgBr4=Lack of awareness within the organisation	Jindal and Sangwan (2011); *Presley et al.*, (2007); Post and Altma (1994)
OrgBr5=Immaturity and low investment in knowledge management and information systems	Zhu *et al*., (2008a); Ji (2006); Ravi and Shankar (2005); Rogers and Tibben-Lembke (1998, 2001)
OrgBr6=Lack of human resources with necessary qualifications	Ravi and Shankar (2005); Hillary (2004); Post and Altma (1994)
OrgBr7=Inappropriate organisational structure (and size)	González-Torre *et al*., (2010); Post and Altma (1994)
OrgBr8=Lack of support from management	Jindal and Sangwan, (2011); Zhu *et al.*, (2008); Ravi and Shankar (2005); Rogers and Tibben-Lembke (2001)
OrgBr9=RL is not a priority in the organisation's investments	Presley *et al*., (2007); Rogers and Tibben-Lembke (1998, 2001)
OrgBr10=Resistance to change in the organisation	Jindal and Sangwan (2011); Ravi and Shankar (2005); Hillary (2004)
OperBr1=Deficient structure of the industry for adopting RL	Qiang *et al*., (2013); Del Brío and Junquera (2003); Rogers and Tibben-Lembke (2001)
OperBr2=Lack of support from parties in the supply chain	Qiang *et al*., (2013); Jindal and Sangwan (2011); González-Torre *et al*., (2010)
OperBr3=Inadequacy of technologies (emphasis on information communications technologies	Jindal and Sangwan (2011); Ji (2006); Ravi and Shankar (2005)
OperBr4=Lack of standardised processes and lack of shared understanding of the best practices	Abdulrahman *et al*., (2012); Lau and Wang (2009)
OperBr5=Lack of knowledge in the industry	Jindal and Sangwan (2011); Ji (2006); Ravi and Shankar (2005)
OperBr6=Unfavourable business culture	Hillary (2004)
SocBr1=Perceptions about the low quality of products of RL	González-Torre *et al.*, (2010)
SocBr2=Lack of support from professional associations, non-government organisations	Hillary (2004)
SocBr3=Inappropriate governmental regulations	Jindal and Sangwan (2011); Abdulrahman *et al*., (2014)*; González-Torre *et al*., (2010); Tan and Hosie (2010)
SocBr4=Bureaucratic problems in granting of licences and location permits	Zilahy (2004)

Notes: [1]For full listing of references, please refer to Hosseini *et al*. (2014)

RESEARCH METHOD

To investigate the perceptions of Australian contractors concerning the prevailing practices and barriers to the implementation of RL, the following research methods were employed in the study.

Measurement instrument

The questionnaire distributed to the South Australian construction contractors (SACC) comprised four distinct sections as follows: The first section covered the demographics. The second section was designed to evaluate the prevailing practices for RL implementation. The third was aimed at capturing the drivers for incorporating RL in the building lifecycle, and finally the fourth section was focused on identifying the barriers (see Table 1) to the implementation of RL. The three sub instruments (practices, drivers and barriers) were all measured on a 5-point Likert scale where 1 = strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; and 5 = strongly agree. Thus (3) represented indifference, i.e. neither agree nor disagree. The findings reported here relate to only the first, second and fourth sections of the questionnaire dealing with the demographics, practices and barriers respectively. It was also beyond the scope of this study to report all the results.

Data analysis

This paper aims to investigate the perceptions of Australian contractors concerning the prevailing practices and barriers to the implementation of reverse logistics (RL). The Statistical Package for Social Sciences (SPSS) computer program was also used to analyse the data generated by the research questions. In order to analyse the data as provided by the questionnaire, the following two statistical methods were used: (1) frequency analysis and (2) ranking analysis. Review of the literature shows that such approaches have been adopted before in survey related studies (Chileshe and Yirenkyi-Fianko, 2012). Rank differentiation was employed for the practices and barriers having the same mean score through utilisation of the lowest standard deviation (Chileshe and Yirenkyi-Fianko, 2012). The results of the validity and internal consistency for both sub instruments were as follows: 0.875 (F-statistic = 16.569 sig. = 0.000); and 0.887 (F-statistic = 8.002) for the practices and barriers sub instruments respectively. The results were deemed as acceptable in light of the Cronbach values exceeding the recommended of 0.7 (Nunnally, 1978).

Characteristics of the sample (quantitative study)

A total of 539 questionnaires were distributed using two modes of administration: (i) Postal survey administered to 260 contractors randomly drawn from the Civil Contractors Federation (CCF) and Master Builders Association (MBA) of South Australia (SA); and (ii) email survey comprising 286 questionnaires to representatives and contracting organisations belonging to a number of professional bodies such as the AIB, AIPM and AIA. A total of 49 completed questionnaires were returned as follows: 23 via email and 26 via post thus generating an overall response rate of 9.09%. While this number might be deemed as small when compared to the overall population of contractors within the selected sample, in comparison with previous studies (Lim and Ling, 2012; Yong and Mustaffa, 2012), this sample size was adequate, and further complimented by the qualitative data. For example, the study by Lim and Ling (2012) only had a sample size of 32 respondents whereas Yong and Mustaffa (2012) employed a smaller sample size of 14 respondents. In both studies, only the quantitative approach was employed. Some characteristics of the respondents at the organisational level based on the principal type of construction work showed that the majority 15(31.3%) of the respondents were involved in more than 2 types of construction work (CW), followed by 7(14.6%) in residential. The rest were evenly spread across commercial (12.5%); more than 3 types of CW (12.5%). The least of the respondents (8.3%) were involved in industrial type of work. The respondents

comprise 27 (56.3%) executives (C.E.O, President and Vice president), 8 (16.7%) project managers, 5 (10.4%) other category of senior management, 3 (6.3%) site engineers, an equal number 2 (4.2%) of field superintendents and supervisors and 1 (2.1%) construction manager. The proportions of the respondents in terms of organisation size (number of employees) were: The majority 65.3% (32) had less than 24 employees, followed by 24.5% (12) with more than 25 but less than 114 employees. The minority, 10.2 % (5) had more than 115 employees. The following sub sections now presents a discussion on the qualitative study protocol.

Study protocol (Qualitative approach)
All the interviews except for one were conducted in the interviewee's respective organisations. While there was a possibility of recording the actual sessions, this approach was discounted. As pointed out by King and Horrocks (2010), people are uncomfortable about being recorded and hence it is important to obtain consent to do so. Instead, the responses as made were written down by one of the two researchers conducting the interviews. The profile of the interviewees is shown in Table 3.

Table 3: Descriptions of the organisations involved in the semi-structured interviews and matching to Carter and Ellram (1998) framework

Interviewee	Task environment (TE) and role[1]		Position & experience (Individual* / Organisation)
	TE	Role	
A	Output	Buyer	Marketing manager (Established since 1993)
B	Competitive	Competitor	Managing director (*20 years' experience)
C	Regulatory	Interest aggregator	Executive manager (Operational since 2005)
D	Output	Buyer	CEO and owner (25 years in business)
E	Input	Suppliers	Executive manager (*15 years' experience)
F	Regulatory	Government agencies	Senior environment protection officer

Notes: [1]Reference to Carter and Ellram (1998) Framework; A = Organisation owning the largest salvage yard in Australia; B = Medium sized construction company active in projects for the South Australian (SA) government; C = Provider of legal services to SA construction companies; D = Leading salvaging organisation in South Australia; E = Largest recycling facility in South Australia particularly in recycling concrete and production of recycled aggregates; and F = South Australia's primary environmental regulator (Environmental Protection Authority (EPA)).

As can be seen from Table 3, the interviewees' represents the broader spectrum of the stakeholders identified within the seminal study of Carter and Ellram (1998).

SUVEY RESULTS AND DISCUSSION

Ranking of the practices

This sub section examines the ranking the practices according to their three sub classifications (industry, organisational and project-level). Table 4 summarizes the results of the analysis. The highly ranked practice was *"reducing the amount of waste generation as part of strategic objectives (mean score = 4.082, std dev. = 0.886)"*. This finding was consistent with literature regarding the main objectives of RL (Addis, 2006; Hosseini *et al*. 2014). Interestingly, the findings of the fourth ranked practice, namely *"existing demand for salvaged and used building providers"* contradict previous (Addis 2006; Gorglewski 2008; Hiete *et al*. 2011). For example, the study by Hiete *et al*. (2011) found that supply and demand in recovered building materials market does not necessarily match. Thus, it is necessary to buy desired reclaimed materials once they show up in the market (Gorgolewski, 2008). This might be very early in the project to ensure their availability in due course.

Table 4: Ranking of practices desirable for RL implementation

Practices	MS[1]	SD[2]	R[3]	OR[4]
Industry related				
Availability of salvaged building products, components and materials	3.796	0.735	1	7
Availability of deconstruction and dismantling service providers	3.714	0.707	2	11
Existing demand for salvaged and used building products	3.571	0.890	4	13
Facilities to recover the used products after deconstruction	3.694	0.713	3	12
Regulatory and financial incentives in favour of deconstruction	2.792	1.031	6	17
Regulatory and financial incentives for promoting use of salvaged material	2.729	1.001	7	18
Quality control compliance for used products	2.857	0.913	5	16
Organisational related				
Clear understanding of the benefits of deconstructing buildings	4.061	0.827	1	2
Awareness of deconstructing procedures	3.750	0.887	4	10
Understanding of challenges associated with deconstruction	4.020	0.750	2	3
Understanding of different aspects of reusing buildings	3.898	0.848	3	4
Project related				
Deconstruction is implemented in our projects	3.510	0.893	6	14
Utilisation of salvaged materials in new buildings	3.204	1.060	7	15
Reducing the amount of waste generation as part of strategic objectives	4.082	0.886	1	1
Enhancing the green image as part of strategic objectives	3.837	0.746	2	5
Organisational support for using salvaged materials in new buildings	3.776	0.848	5	9
Organisational support for deconstructing buildings	3.776	0.743	4	8
Organisational support for designing buildings based on DfRL principles	3.796	0.676	3	6

Notes: MS[1] where the higher the mean, the more important the practice for RL; SD = Standard deviation; [3]R = overall ranking based on full sample and within the individual grouping of the RL practices classification; [4]OR = Overall ranking based on the full practices.

Similarly, Addis (2006) observed that one of the underlying problems associated with this practice is the aspect of spending money sooner than usual along with more problems associated with storage of products and materials. One of the probable reasons for the conflicting results is that, the market for recycling in South Australia is deemed mature with established facilities and strong players. The evidence for existing demand for salvaged and used building products (see Table 1: Industry Practice 3) is further provided by the Marketing Manager (Interviewee A) who commented: *"Number of customers is increasing. […] Customers are people who do small alterations to their homes, house builders, architects, contractors etc..[…] Definitely, the domestic sector is very huge compared to the commercial sector, both as customers and providers of salvaged materials […]"*. This observation was further reinforced by the supplier (Interviewee E) who acknowledged that market was booming, with more competitors making the supply harder to get. The industry level practice of *"quality control compliance for used products"* though ranked fifth (mean score = 2.857), was the least ranked (Rank=16th) based on the full practices. Studies such as Kibert (2012) and Nordby *et al*. (2009) have pointed to the lack of products or materials with a certificate or eco-label designated as preferable for builders.

However, some of the Interviewees have acknowledged this problem, and suggested some measures be put in place to improve this practice. While it is beyond the scope

of this paper to report on all of the interviewee's observation, in general some of the comments related to the testing of aggregates for asbestos (Interviewee D). With reference to the materials used on the construction of roads, Interviewee D further highlighted the problems associated with recycled and reused products as follows: *"There is also a bit of quality issue with recycled products. For example, bitumen mixed with tiny wood particles can have a mushroom effect on the surface of a road.....Some tradesmen don't like concrete made out of re-cycled aggregate. ...It sets quickly and compacts better. Maybe it's because of cement in those aggregates"*. Despite the higher ranking of this practice, some of the interviewees expressed reservation with the storage of extracted material and highlighting the role played by the regulator. The executive manager (Interviewee C) observed that *"storage of extracted materials from buildings is an issue since the EPA regards anything without immediate use as waste and asks to remove it from the site"*. These comments suggests that despite the efforts made at integrating and reusing recycled and salvaged products from the RL perspective, the issue of quality remains one of the main impediments to the adoption of RL. Furthermore, this appears not just to be confined to the South Australian construction industry context, but globally. For example, with the Brazilian context, a study conducted by Da Rocha and Sattler (2009 cited in Hosseini *et al*. 2014), aimed at identifying the major factors influencing the reuse of building components established that the variability or inconsistency of quality as a major constraint of their popularity.

Overall ranking of the barriers

This sub section examines the construction stakeholder's perception of the barriers inhibiting the implementation of RL (see Tables 5 and 6).

Table 5: Overall ratings of barriers to RL-Operational related

Barrier[1]	Mean score	Std. Dev	RAI[2]	Rank[3]	Overall ranking
OperBr1	3.286	0.935	0.657	1	=4
OperBr2	3.286	0.935	0.657	1	=4
OperBr3	2.592	0.956	0.518	7	16
OperBr4	2.776	0.771	0.555	5	13
OperBr5	2.837	0.746	0.567	4	12
OperBr6	2.776	0.771	0.555	5	13
OperBr7	3.000	0.875	0.600	3	10

Notes: [1]For detailed description of the operational barriers, see Table 2; [2]RAI = Relative agreement index; and [3]Rank based on the sub category grouping of the operational barriers

As can be seen from Tables 5 and 6,the organisation's reluctance to use salvaged materials due to the lack of design incorporation is ranked as the most important critical barrier within this category of *"industrial barriers"* as well based on all the sixteen barriers (Mean score = 3.563, RAI = 0.713; Std Dev = 0.848). Support of the high ranking of this critical barrier can be found in previous studies such as manufacturing related (Abdulrahman *et al*. 2014; Rogers and Tibben-Lembke, 1999); and a number of construction related studies (Hosseini *et al*., 2014). Table 6 further shows that apart from the *"Industrial barrier 3"* and *"Social barrier 1"*, the mean scores values for the remaining barriers were greater 3.000, thus implying some level of significance or importance.

Table 6: Overall ratings of barriers to RL-Industrial and social related

Barrier[1]	Mean score	Std. Dev	RAI[2]	Rank	Overall ranking
IndsBr1	3.163	0.943	0.633	3	7
IndsBr2	3.563	0.848	0.713	1	1
IndsBr3	2.776	0.823	0.555	5	15
IndsBr4	3.122	0.881	0.625	4	8
IndsBr5	3.417	0.919	0.683	2	3
SocBr1	2.878	0.780	0.576	4	11
SocBr2	3.167	0.907	0.633	2	6
SocBr3	3.021	0.887	0.604	3	9
SocBr4	3.449	0.868	0.690	1	2

Notes: [1]For detailed description of the industrial and social barriers, see Table 2; [2]RAI = Relative agreement index; and [3]Rank based on the sub category grouping of the industrial and social barriers

LIMITATIONS

While the study makes several contributions to supply chain management (SCM) and RL theory and practice, some limitations should be noted. This first limitation relates to the cross-sectional nature of the quantitative study. Against that background, caution should be exercised in the interpretation and generalization of the results. Future studies should employ larger samples. The second limitation relates to the restrictions of the population sample to only South Australia and the construction industry, as such the generalization of the findings to other industries might not be possible. The third limitation relates to the small sample size (n=49) for the survey which restricted the need for employing rigorous and refined statistical analysis such as factors analysis and Structural Equation Modelling (SEM). These techniques would have enabled the empirical validation of the identified practices, and eliminated the problems of multicollinearity which obscures the relationship among the practices.

CONCLUSIONS AND RECOMMENDATIONS

The purpose of this paper is to explore and identify the prevailing practices and barriers to the implementation of reverse logistics (RL, and asses the readiness of South Australian construction organisations when implementing RL practices. The findings from the quantitative study demonstrated a good level of readiness on the project level practices, as well as the organisational level. There were mixed findings with regard to the readiness of the regulatory related industry practices. This study established that despite the advocated benefits of regulatory and legislations as drivers for implementing RL practices (Carter and Ellram, 1998), this was not the case in the South Australian construction industry. While the review of the literature (Hosseini *et al*. 2014) identified an array of major regulations supporting reducing waste and recovering the value of used materials in South Australia, it is clear from the empirical evidence and qualitative data that, the available regulations could be regarded as pushing organisations away, than towards implementing strategies with the same objectives as RL. It is further recommended that further research be carried out to explore the relationships between the identified practices and improved organisational performance. Future research would assist organisations in understanding the linkages between RL practices and performance, and help provide theoretical explanations as to why certain practices may work well in one context but not another.

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