
This item was submitted to [Loughborough's Research Repository](#) by the author.
Items in Figshare are protected by copyright, with all rights reserved, unless otherwise indicated.

A systems approach for forward and reverse logistics design: maximising value from customer involvement

PLEASE CITE THE PUBLISHED VERSION

<http://dx.doi.org/10.1108/IJLM-07-2015-0118>

PUBLISHER

© Emerald

VERSION

AM (Accepted Manuscript)

PUBLISHER STATEMENT

This work is made available according to the conditions of the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International (CC BY-NC-ND 4.0) licence. Full details of this licence are available at: <https://creativecommons.org/licenses/by-nc-nd/4.0/>

LICENCE

CC BY-NC-ND 4.0

REPOSITORY RECORD

Jaaron, Ayham A.M., and C.J. Backhouse. 2019. "A Systems Approach for Forward and Reverse Logistics Design: Maximising Value from Customer Involvement". figshare. <https://hdl.handle.net/2134/20557>.

A Systems approach for forward and reverse logistics design: maximising value from customer involvement

Abstract:

Purpose- There is significant potential for adding value by involving customer in the design process and delivery of logistic services. In order to add value to the overall logistic system, this paper proposes applying an integrated systems approach for the design of forward and reverse logistics services in order to build a self-organising service that can maximise efficiencies and in particular reduce reverse logistics costs.

Design/methodology/approach- Two exploratory case studies were conducted in the logistics systems of housing repair and maintenance sector in the UK. Data were collected using semi-structured interviews, observations, and documented evidence.

Findings- The findings of the cross-case analysis suggests that systems approach expressed as the Vanguard Method (Seddon 2008) has a direct impact on enhancing forward logistics performance and reducing reverse product flows by nourishing three dimensions for learning from demand-driven analysis; capturing customer clean information, demand predictability and categorisation, and failure demand analysis.

Research Limitations- Findings from exploratory case studies cannot be easily generalised. Hence, further case studies are needed to enrich the findings, and to facilitate their industrial applications. Further, the paper explores the utilisation of the Vanguard Method only in the area of housing repairs and maintenance logistics services. It would be valuable for future studies to further investigate the utilisation of the Vanguard Method in other logistics services settings.

Originality/value- The paper demonstrates an important dynamics of how logistics services can incorporate customer demands into the logistics design process.

Keywords: logistic services, logistic services design, reverse logistics, forward logistics, service operations, learning logistics, service design, customer demand.

1. Introduction

With the recent global wave of service-sector growth, logistics activities have become a vibrant industry to support service organisations (Yu, 2010; Lin and Pekkarinen, 2011; Eichengreen and Gupta, 2013). To ensure gaining sustainable competitive advantage and customer satisfaction, a service organisation may choose to set up its own forward logistics function, hire a third-party logistics service provider, or use a combination of both (Piplani and Saraswat, 2012). However, many researchers have reported that logistics industry is not among the most developed industries even in developed countries, and that it lacks innovation in finding solutions for ever evolving customer requirements (Chapman et al., 2002; Mena et al., 2007; Lin and Pekkarinen, 2011; Dowlatshahi, 2012). Arguably, this is due to the fact that product returns, **being an essential part of the reverse logistics activities (Lee**

et al., 2012; Zhang et al., 2013), have recently become a significant concern for most organisations including service firms. They are viewed as an unavoidable cost of inefficient forward logistics, minimizing any chance of increasing benefits or cost savings (Dowlatshahi, 2012; Min and Ko, 2008). Reverse logistics, *in this sense*, usually reduce organisations' current assets as it lowers returned products inventory value, and it lengthens order cycle time due to reshipping of ordered items. It also causes organisations to lose sales and thus sales revenues (Min and Ko, 2008). Several products may return into the supply chain of a company if it is different from the one ordered by customer or due to dissatisfaction with functionality. A product may also be returned due to forward logistics imperfection in packaging or shipping or simply due to customer incorrect information and human errors (Guide et al., 2006; Piplani and Saraswat, 2012). As of 2003, the amount of reverse product flows was found to be 12 percent of the total products sales in the US (Toktay, 2003). Recently, this has become even worse as Bernon and Cullen (2009) explained that many firms in the UK experience up to 30 percent product returns by their customers, and that the total cost of retail reverse logistics is valued at 6 billion British Pounds every year. Also, Min et al. (2005) indicated that handling product returns can comprise up to 4.5 percent of the total logistics cost alone in the US. Despite these alarming facts, most organisations do not give attention to return merchandise until things get out of control (Min and Ko, 2008).

As reflected by the work of Jayaraman et al. (1999), the optimal solution for the logistics services problems is dependent on finding a suitable design of both forward logistics and reverse logistics of products in a closed loop system. A closed loop logistics system is where products first flow outbound to a customer (i.e. forward logistics), and then those same products are returned back to provider (i.e. reverse logistics) (Jayaraman et al., 1999). This view is also shared by Lin and Pekkarinen (2011) who explained that it is only through effective closed-loop logistics service design and offering high quality service variety to customers that forward logistics industry can better understand customer requirements and reduce returned products. The authors further indicated that proper closed-loop logistics service design tools are urgently needed to provide various customised services to satisfy and retain current customers; similar to manufacturing companies who strive to provide and manage product variety (Pil and Holweg, 2004). Consequently, according to Choy et al (2008), essential pillars for designing a successful forward logistics service function, that is capable of learning from returned products, are listening to customer wants and then translating these wants into logistics service design.

However, while the customer involvement in the process of logistics service design is of paramount importance to reduce reverse product flows and increase efficiency of forward logistics (Olhager, 2010; Lin and Pekkarinen, 2011; Rollins et al., 2011), there seems to be scarcity in the current literature of efficient models of operation that can involve customer demands and wants into the design process of logistics service. In fact, majority of logistics service models have extensively focused on environmental aspects of reverse logistics network such as recycling, reuse, refurbishment, and product recovery (Jayaraman et al., 2003; Min et al., 2005; Valle et al., 2009; Piplani and Saraswat, 2012), ignoring other important aspects such as customer involvement in the design process to build a learning logistics service. With this in mind, this paper aims at closing the aforementioned gap by offering an innovative systems engineering approach that is capable of designing forward logistics service against customer demand. **The reverse logistics addressed in this study are those new materials, items, or products returns that are avoidable by any organisation; caused by lack of supportive information, human errors, demand incorrect handling, not understanding the customer demand, or simply caused by inefficient design of the forward logistics operations.** The presented systems engineering approach in this paper is developed by Vanguard Consulting in England (Seddon, 2003). The term “the Vanguard Method” will be used to describe this logistics service design system throughout this paper. This approach is witnessing a significant take-up in the service sector, where it offers a considerable impact on improving the efficiency and competitive advantage of organisations (Jackson et al., 2008; Jackson, 2009). The Vanguard Method is centred on three core elements: (1) interrelationships of employees interaction and social exchange, both within their teams and between organisational parts, (2) dynamics of the organisation that requires a significant amount of coordination, and power delegation to team members, (3) wholeness of the organisation where departments are dependent on each other and the whole to guarantee the interconnectedness of people (Jaaron and Backhouse, 2014; Seddon, 2008; Jackson et al., 2008).

This research inquiry uses a qualitative exploratory case study approach, in order to induce novel understandings of the relationships between using the Vanguard Method in the design of forward logistics service and **reduced reverse product flows**. Two exploratory case studies are presented in this paper. The case studies were conducted in the logistics systems of housing repair and maintenance sector in the UK. The paper is focused on post-the Vanguard Method application in the case study organisations. It is suggested that the Vanguard Method

implementation for the design of forward logistics services is likely to enhance forward logistics performance and reduce reverse product flows. Therefore, the research question sought to be answered in this paper is as follows.

RQ: How does the Vanguard Method of logistics service design build a forward logistics service that is capable of reducing reverse logistics?

In the first section of this paper, the concepts of logistics services are further scrutinised based on a review of existing literature. In the second section, the Vanguard Method's philosophy and methodology are presented with a focus on its implementation principles. Next, the research methodology is explained, and the case studies of two UK organisations are presented. Finally, results are shown and conclusions discussed.

2. Designing Logistic Services: forward-reverse perspective

In the context of operations and supply chain management, reverse product flows caught much attention in the recent literature due to the fact that most companies view returned products as a nuisance (Lee et al., 2012). Rogers and Tibben-Lembke (2001) define reverse logistics as *“the process of planning, implementing, and controlling the efficient flow of materials, in-process inventory, finished goods, and related information from the point of consumption to the point of origin”*. Following this definition, Guide et al. (2006) define reverse logistics as the process of handling returned items from the end customer to the original provider or manufacturer. Similarly, Hazen et al. (2015) define the term as the flow of products from a consumer towards a producer in a channel of distribution. However, based on these definitions, the definition of reverse logistics adopted in this paper is the reverse flow of new products, items and materials from the point of the end customer to the point of the provider. Recent research studies in this area were mainly conducted due to pursuit for cost savings, delivering social responsibility of organisations, and the need of organisations to stay in compliance with legislative requirements of environmental degradation. These were reflected in the work of Nagel and Meyer (1999), Beullens (2004), Srivastava (2007), Min and Ko (2008), Mutha and Pokharel (2009), and Zhang et al. (2013) who have stressed that handling reverse logistics activities, and particularly returned products, constitute a huge portion of the total logistics function costs in companies. As it would be expected, much of the logistics services design studies are heavily focused on mathematical modelling and optimisation concepts for the proper choice of cost-effective reverse logistics network design. This is evident in the work of Thierry (1997), Krikke et al. (1999), Jayaraman et al (2003),

Min and Ko (2008), Barros et al. (1998), and Aras et al. (2008) that ignore the role of customer in improving the reverse logistics. Nevertheless, there is growing popularity in recent literature to study reverse logistics activities in conjunction with forward logistics operations in a **closed-loop logistics system** (Kim et al., 2006; Pati et al., 2008; Zhang et al., 2013). Chang and Liao (2011) proposed routing strategies that can design forward distribution in line with reverse logistics activities with the aim of reducing the operating cost of transportation and increasing market competitive advantage. Also, Piplani and Saraswat (2012) developed a mathematical model to optimise the reverse logistics in a repair and refurbishment network by determining which facilities are to be used in both forward and reverse flows of modular products. Further, Salema et al. (2006) derived a mixed-integer programming model for designing reverse logistics network based on the location of warehouse to optimise the forward logistics function and to reduce the cost of handling returned products. However, it is argued that **closed-loop logistics systems** studies in the literature ignore linking forward logistics design and management with reverse logistics improvement. This has been perceived by Chang and Liao (2011) as a sub-optimal behaviour that can cause organisations to lose market competitive advantage and reduce financial profits. They also explained that literature has very few related studies that provide tools to integrate forward logistic design with reverse logistics. It is as reflected by the recent work of Zhang et al. (2013), the compatibility and integration of forward logistics operations design with reverse logistic activities is a significant enabler for cost reduction opportunities and better use of organisational resources. This is also closely related to the work of Lin and Pekkarinen (2011), of using Quality Function Deployment (QFD) concepts in designing logistic services, who indicated that one of the top essential requirements for successful logistics services design, in terms of enhanced performance, is the involvement of customers into the forward logistics service design by translating customer' requirements into logistic operations design. Generally speaking, many organisations are showing increasing interest in developing tools that incorporate customer demands and requirements as an important input to the design of forward-reverse logistics systems (Valle et al., 2009; Olhager, 2010), and that managing customer-related knowledge and open communication, both inside firms and with customers, is believed to be the cornerstone for successful design of logistics services that can handle reverse products flows effectively (Rollins et al., 2011). However, there is severe lack in the current literature of empirical research on designing logistics services based on customer requirements and sharing customer-related knowledge (Rollins et al., 2011; Lin and Pekkarinen, 2011).

Reverse logistics is far more complicated and uncertain than forward logistics operations. This is due to the customer demand volatility and availability of multiple channels of product returns to companies (i.e. direct returns to company versus indirect returns to suppliers) (Min and Ko, 2008). Owing to this, logistic services need a market-responsive supply chain design that is capable of understanding customer requirements in the forward logistics, and then absorbing any product returns' demand volatility and uncertainty (Olhager, 2010). This highlights the importance of having a well-designed team-based logistics service, where providing core team members with specific traits such as, open communication, decision making ability, and an environment where team members can develop willingness to contribute to organisational success, is vital for achieving a market-responsive supply chain.

This paper builds on the work of Zhang et al. (2013), which links the success of managing logistics in cost-efficient manner with the integration of forward-reverse logistics design. It also builds on the work of Lin and Pekkarinen (2011), which indicates that customer requirements involvement in the design process of forward logistic services, in **closed-loop logistics system**, is crucially important element in order to ensure service quality and enhanced operational performance. Therefore, it is argued in this paper that the implementation of systems engineering approach for the design of forward logistic services in a **closed-loop logistics system** is likely to enhance forward logistics efficiency and effectiveness and reduce reverse product flows through organisational learning. This theoretical framework will guide the research presented in this paper.

3. The Vanguard Method

Logistics service designs are inherently complex; it involves the interaction of processes, policies, customers, individuals, teams, departments, systems, and field suppliers (Cardoso et al., 2013). This complexity, and the associated actual failures of recent service design models, is perceived by Lin and Pekkarinen (2011) to have slowed down research on logistics design tools. Complex systems' literature suggests that managers can focus on the parts in order to manage the whole (Bolta, 2009). This reductionist approach calls for breaking a situation into smaller fragments; solving each smaller problem separately before these smaller solutions are assembled together to provide an overall solution. This way of dealing with problems does not necessarily provide the optimum solution for the system as a whole (Capra, 1996). Ackoff (1981) stated that managing system parts without understanding their interactions makes the

system lose its essential properties, and causes managers to face unintended consequences. Therefore, if logistics services as a complex system are viewed in this reductionist way, discontinuous forces of silo working would prevent efficient handling of forward logistics and, therefore, would hinder logistics service learning of why products are returning to the provider. According to Taleb (2012), the interactions between system parts are essential to produce new ideas or properties that convey information to these parts through stressors. This conceptualisation gave initiation to the work of Seddon (2003), described here as the Vanguard Method, of implementing systems design principles into service delivery systems. The Vanguard Method is, therefore, centred on three core elements: interrelationships, dynamics, and wholeness (Jaaron and Backhouse, 2012; Seddon, 2008; Jackson et al., 2008). A detailed account of the philosophy is reported in the work of Seddon (2008) and Jackson et al. (2008), and will be explained in this section as well.

The Vanguard Method is based on the view that organisations are holistic systems serving a purpose that is “always seen in terms of its customers” (Marshall, 2010). Therefore, customer demand is the focal point for redesigning the organizational service systems and not the functional hierarchies (Seddon, 2008; Jaaron and Backhouse, 2010). The Vanguard Method depicts a culture characterised by the formulation of a self-managing teams. The teams are created from the workplace itself to lead the intervention into business processes (Jackson et al., 2008). The teams require spending a considerable amount of time to understand business processes and the main purpose of the system from the customer perspective (Seddon, 2008). This begins by studying the demand coming into the business, over a period of time, to find out what matters to the customer the most, what do they want from the system. Once the purpose of the system “from a customer perspective” is defined, attention is given on how the organisational parts can be linked together to deliver that purpose (Jackson et al., 2008). The study of the demand provides two different categories of demand usually available in logistics services. First, value demand which is what the logistics service has been established to serve and what the customers want which is of value to them. Second, failure demand which is the demand that logistics service was not able to serve due to the lack of information or supporting operations.

According to Seddon (2008), the Vanguard Method builds a system that is highly responsive to customers. This is achieved by removing waste found in the traditional processes through

the redesign of the service processes based on the customer point of view (Jackson et al., 2008). This will significantly reduce the frequency of failure demand (Jaaron and Backhouse, 2014). It is essential when designing processes against customer demand to study the system conditions of rules and regulation at place as well to understand why the system behaves in the way it does. This will produce a system where all rules and regulations are taken into considerations (Seddon, 2008). It is also essential at this stage to continually analyse demand in order to improve internal processes that would deal with failure demands (Jackson et al., 2008). Accordingly, this increases team members' learning in the system and provides them with enough knowledge to handle demand uncertainty and meet the purpose of the service system. **Figure 1 illustrates a conceptual framework of the Vanguard Method principles when designing service operations.**

[Figure 1 near here]

Figure 1. Conceptual framework of the Vanguard Method

Team members learning is “a cognitive precursor to adaptation” (Ilgen et al., 2005) that is necessary when faced with failure demands (Chiva and Allegre, 2009). In this regard, organisational teams, operating under difficult circumstances, also need to learn from their best knowledgeable individuals, this knowledge will then be used to improve performance in the face of disruptions (Ilgen et al., 2005). LePine (2003) found that team-based structures, equipped with empowerment and openness to communicate and interact, are critically important to activate their latent knowledge to perform better when the task environment changes. Owing to this, the role of team members in the Vanguard Method changes from controlled to full empowerment as the Vanguard Method requires employees to be self-directed by learning and then making their own rules and decisions to absorb failures (Seddon, 2008). Eventually, this way allows for more control on service processes because data is in the hands of the people doing the work (Korkmaz, 2012), and provides creativity in responding to the system's challenging environment (Jackson et al., 2008). **Table 1 presents the main features of the Vanguard Method as opposed to the traditional managerial thinking typically found in many organisations (Jaaron and Backhouse, 2012).**

[Table 1 near here]

The Vanguard Method embraces the principle that employees need to think, analyse, judge and make decisions on the work on hands. Therefore, team members training is not the focus in the preparation process for this kind of job, it is actually educating them on “why” a failure happen and then finding ways to eliminate it from the system. To accommodate for the requirements of the Vanguard Method, managers’ role shifts from command-and-control to supporters. This keeps managers very close to their employees to interact with their work when necessary. Bhat et al. (2012) provide a constructive view about the interactive leadership style and organisational learning. According to them, the capacity of an organisation to learn how to learn, to change old ways of doing things, and to produce original knowledge is positively related to interactive leadership styles. Due to this type of relationship and due to the whole service processes being owned by team members, the structure of the organisation changes. The organisation becomes organically structured (Jaaron and Backhouse, 2014).

The Vanguard Method in Practice

The above philosophy usually follows three main practical steps of “check-plan-do” for implementation. These steps are summarised in Table 2 below.

[Table 2 near here]

Check: This stage aims at understanding the system and why it behaves in such a way that failure demand is achieved. A specially formed team, called the check team, from the workplace collates information about what customers expect and want from the organization and what matters to them most, they need to be able to use views of different people involved in the problematic system to build the “real situation” (Checkland, 1995). Once the team understands the type of demand received and how capable the system is to respond to it, it can start to map the flow of processes in the system. For this purpose, a visual representation of each operation carried out in the workplace is developed as a flow chart. Identification of waste (actions not adding any value from the customer’s point of view) present in the service operations flow is then carried out (Seddon, 2008). All processes classified as waste are marked in red on the process flow chart. While processes that add value from a customer’s point of view are marked in green.

Plan: This stage starts with redesigning the processes flow charts taking into account what has been learned by considering the customer “wants” and then mapping out the new service system design. Typically, this stage is focused on minimizing non-value adding activities from a customer point of view. The final step in the “plan” process is to build performance measures and the future system success criterion. This is usually how good employees are in creating a value demand and the percentage of value demand out of the total demand received (Jaaron and Backhouse, 2012).

Do: At this stage the new design is used in an experimental environment with the check team using the new model after it has been discussed with the people doing the work. The new processes are induced gradually with careful observation of both employees’ reaction to it and customers feedback. The processes are tested, re-designed and re-tested again to make sure that customers get the best possible service before going fully live. This is much slower process than the check phase as the slogan at this stage is to “do it right rather than do it quick” (Jackson et al., 2008).

The Vanguard Method cycle starts with the “Check” stage in order to show business managers the failings of their current system, and to provide them with a solid evidence for the need to change the way they think and manage things (Jackson et al., 2008). To ensure continuous improvement of the new system, the check-plan-do cycle is a continuous cycle (Seddon, 2008; Jackson et al., 2008). It is, therefore, a learning system by itself: the process of acquiring knowledge and taking action to improve the situation is continuous (Jackson et al., 2008). In addition to continuously altering business processes to improve the service offered, the Vanguard Method Cycle involves the identification of new demands coming in to the service department. This is followed by designing new processes to ensure dealing with new demands as value demands (Seddon, 2008).

4. Research methodology

A case study approach is adopted in this research inquiry in order to build an understanding of the nature of the research phenomena (Voss et al., 2002). Case studies have the advantage of being able to answer questions like “what”, “how” and “why” (Yin, 2009). This accommodates the type of question presented at the beginning of this paper. Two case studies were chosen with the help of “extreme case sampling” technique (Patton, 2002; Creswell,

2004) that displayed evidence of full employment of the Vanguard Method in their logistics service operations. **An earlier research work conducted with the help of the Vanguard Method consultant of these two case studies helped researchers in confirming that the Vanguard Method is fully employed in their logistics operations, and also ensured easy access to both case studies.**

According to Aastrup and Halldorsson (2008), the use of case studies in logistics management research is an enabler for the causal depth required for understanding the real domain of logistics operations and its performance. Case study research design typically has the unique strength in providing a full range of evidence through the use of multi-sources of data, which can achieve data triangulation (Voss et al., 2002). For this purpose, the mixed methods design (Tashakkori and Teddlie, 1998) is used as the technique for conducting the research process. Three different sources of data collection methods are used in the two case studies; these are semi-structured interviews, archival documents, and observations. As the focus is on finding common trends in the way logistics services react to reverse logistics as a result of implementing the Vanguard Method, cross-case analysis was used to search for common themes (Bryman and Bell, 2007). Semi-structured interview with 17 people were conducted with an average length of one hour per person. Interviewees were a mixture of logistics senior managers, directors, middle managers, and logistics operations personnel. Interviewees were asked questions like “do you think the Vanguard Method has brought benefits to the way your logistics services are being delivered?”, “do you think your logistics department is better prepared now to deal with failure demands and reverse Logistics?”, and “Do you use the lessons learned from reverse logistics to make a better service for the future? How?”. **However, a complete list of interview questions is included at the end of this paper.** Interviews were tape recorded and transcribed in preparation for data analysis. Observations and notes were also taken to supplement the data collected through interviews. Observations and documents collection captured things that escaped the interviewees’ awareness during interviews. The data sources used in the two case studies are summarised in Table 3.

[Table 3 near here]

5. Research sites

The first case study was conducted in the premises of the general insurance division of one of the UK's leading provider of a wide range of banking and financial services, focused on personal and commercial customers. The company's name and place are excluded to maintain anonymity. However, the company will be denoted as 'Case A' throughout this paper. The general insurance division is a leading provider of home claims services in the UK with a large logistics services to support the business. The home claims business has more than 76 suppliers that deliver all sorts of building and repair services to the insurance customers. The division started a Vanguard Method intervention in September 2013 that covered all the home claims services and its logistics services. The intervention was deemed necessary as the business experienced a high level of demand failure that reached up to 60 percent in the summer of 2013, of which 50 percent were returned repair items and materials from suppliers and customers. The new service design focused at delivering what the customer wants at the shortest time possible by minimising the non-value adding activities in the logistics system. As a result, the business has reduced logistics services failure demand to be 12 percent at the time of this research. **The purpose of the new service system, that governs the work of the employees at the insurance division and their suppliers, is "understand the customer demand, verify that this is the customer, and deliver value at the right time".** The insurance division and their suppliers collectively experimented with new ways of working based on doing work right first time, at a time that suited the customer. In such an environment, it was decided that there are three main steps in the process of delivering value, namely understanding what the customer exactly wants and when, transfer clean information to suppliers' craftsmen to diagnose the problem and get right materials ready, and complete all necessary works at the time chosen by the customer. In effect, employees at the insurance division were allowed and trusted to handle customer calls without any pre-set targets in order to get all necessary information about their demand, and how and when they like the demand to be delivered. In order to allow suppliers deliver the exact demand as wanted by customers, all gathered information from a customer is immediately transferred to a supplier for proper allocation of craftsmen. Large screens are available at suppliers' headquarters to provide transparency, and to allow the system to work as a single piece flow, with each craftsman getting one job at a time to avoid bottlenecks and delays. Due to passing clean information to suppliers, craftsmen were able to stock their vans with what is needed to complete the job first time. Craftsmen are also able to seek help from other craftsmen available to deliver any missing materials or items while attending the customer property. Furthermore, the suppliers provide the name and contact details of the craftsman assigned to each job to the insurance division. This ensures timely sharing of any further information that becomes available from customer, and allow for further follow up contacts. The insurance division employees are able to have a conference call that joins the customer and the supplier to further clarify the demand before hand, if needed, and to check if there are any other works that need to be done during the visit. The suppliers designed their system such that their craftsmen arrive within 10 minutes of the customer's specified time for an appointment 95% of the time.

The second case study chosen was Flagship Housing Company. The company is one of the UK's leading housing companies that owns, manages, and maintains more than 22000 homes for people in East Anglia region of England. However, the company used to face an increasing number of complaints from their customers who are dissatisfied with the repair service they were receiving; this was accompanied by large number of building materials returns and fittings replacements. The company took the decision to follow the Vanguard Method into their housing repairs system design in November 2012, with the aim of redesigning the repair service from the customer's perspective. At the time of the study, there were 203 craftsmen, who carry out repair work, 19 drivers to deliver materials to sites, and around 50 office staff who receive customer repair demands and support craftsmen work. At the operations department, large screens are used; customer demands received are logged into the system screen, this makes it easier for the office team to assign repair demands to craftsmen at a time determined by the customer; as the new purpose of working at the housing repairs system is "repair completed at my convenience". In order to work in this way, office staff was encouraged to speak freely with customers to try to get as much correct information as possible without any call handling targets or constraints. Also, the craftsmen were allowed to decide the best way to complete a repair in the first visit to property. However, it was discovered that craftsmen needed a service which can deliver building materials directly to them whilst they are attending a property to keep their working principle of completing a repair first time. In response to this, the company set up a new separate firm, called Repair First Time "RFT", to deliver needed materials to craftsmen exactly on time. This has had a dramatic impact on the design of the logistics services of the company which is currently designed around six main stages. First, making sure that customer demands are received as clean as possible, by getting clear information about the repair, name, address, and creating appointment as determined by the customer. Second, clear information is passed to craftsman when he is ready for the next job. Third, the craftsman accesses the property at the time determined by the customer to confirm repair demand details are correct, and to also check if there are any other repairs needed that can be completed in the same visit. Fourth, the craftsman performs the repair using the materials he has in his van stock. If the craftsman does not have the required materials with him (e.g. doors, windows, paints), then the craftsman calls the operations office to order delivery of materials, whilst attending the property, using a specially created electronic stock catalogue on an iPad provided by the company. Fifth, the operations office passes the list of required materials and associated customer details to RFT Company where ordered materials are prepared for delivery by RFT's drivers. Sixth, the craftsman completes the repair and report the operations office on the list of materials used and on the completion of the repair.

6. Data analysis and results

In this qualitative exploratory study, the collection of archival documents contained internal performance reports about the logistic systems' performance at the two research sites; before and after the adoption of the Vanguard Method. These reports were particularly useful for understanding logistic systems' indicators improvement as a result of implementing the

Vanguard Method. This has also provided validity for data collected through semi-structured interviews (Bryman and Bell, 2007). Table 4 illustrates main logistic systems' indicators measurements and improvements achieved at both case studies.

[Table 4 near here]

Furthermore, the process of data analysis followed the steps of Miles and Huberman (1994) for coding and then analysing interview data for each single case. The analysis process started by transcribing and studying the qualitative data (i.e. reading and listening to the audio taped interviews, and revising field notes and archival documents). Pattern matching and exploring the interview data were adopted as the major technique for cross-case analysis. The objective of multiple case analyses is to search for similarities and differences and to expand the understanding of similarities and differences across cases (Miles and Huberman, 1994). For this purpose, the results from the qualitative analysis of each single case were directly compared with the other case study results to explore the factors that can help reduce reverse logistics and improve forward logistics performance. The coincidence of the patterns would enhance the internal validity of the case study (Yin, 2009). The emerging patterns (i.e. themes) from data analysis are presented below.

Capturing Clean information

The aim of this theme is to demonstrate the value of the Vanguard Method in **creating a workplace that only captures** accurate information about customer requirements and, thus, delineating the effect of this accuracy on minimising reverse logistics. It was evident in the research results of both research sites **that redesigning the workplace following the Vanguard Method has made it possible to get** customer clean information with full details about what the customer exactly require, during customer first contact. **They regarded this change as significantly important in reducing reverse logistics** and improving the whole service performance. At the home insurance division of 'Case A', **interviewees stated that the work before the introduction of the Vanguard method consisted of a conventional 'front-office/back-office' design, where employees in the front office, typically a call centre, receive customer demands while adhering to a pre-set targets for call waiting and call handling times. Interviews stated that employees had to be quick in handling calls in order not to violate targets. According to them, this limited their ability, in many cases, to get clean information about customer details and their demands. Employees would then create electronic requests and route them to the relevant functional claim advisor team in the back office, where claim advisors were again separated into functions based on the geographical areas in the region. The back office was responsible for passing customer demands to suppliers responsible for providing building and repair services to the insurance customers. Interviewees explained that it was not possible for claim advisors to verify the information received from the front office; as their scope of work does not include talking to customer. It is as stated by a claim advisor: "...we were working in silos, we did not know if the case I received contains the correct**

information....it was very difficult for me to find a way to call a customer if I need to as my call centre colleagues, in most of the cases, forgot to record the telephone number of the customer on the electronic system". Similarly, people in the front office had no clue on how customer demands were dealt with in the back office, and whether demands were delivered by suppliers. Majority of call received by the front office was mainly repeated calls from customers inquiring about their requests and when it is likely that they get the repair work required. As a result, it was found that 60 percent of the demand received was a failure demand. It became clear to management that the service was not performing well due to lack of correct information and fragmentation of the teams. This was evident in the words of the senior manager of supply chain who stated that: *"we thought that the previous structure of the old world was best in the class with every team responsible for a certain chunk of the work...I started to see things with another lens when I received performance reports about the number of demands that our suppliers were not able to deliver as promised due to incorrect information, mainly caused by our own employees".* Further, interviewees stated that the introduction of the Vanguard Method made dramatic changes to the way that the work is done. All of the back office processes moved to the front office. Employees are now working within the same multidisciplinary team. A customer demand is now being answered by one claim advisor without adherence to any pre-set targets, and claim advisors were all taking calls from the same single queue. Demands are now transferred immediately to suppliers by the same claim advisor who received them after collecting all necessary clean information and details. Customer clean information principle is now used as the guarantee to deliver the right home repair when and how the customer wants it. It was also recognised that passing clean information to suppliers was at the top of their priorities to prevent any incorrect repair material deliveries or items rejection. For this purpose, the home insurance division used to email the respective supplier the full details of the customer, nature of repair, and clean information on when the customer wants the repair. To confirm that this was received and understood well by the supplier, the home insurance division used to make a follow up phone call to make sure the message was received correctly with any supplemental details as they become available. Furthermore, the home insurance division found it necessary in some cases to have a conference call joining the customer, claim advisor, and repair supplier for better transfer of information. Likewise, interviewees at Flagship Housing have indicated that clean information was cornerstone for their success in reducing reverse logistics. *The work before the introduction of the Vanguard Method was pretty much the same as found at home insurance division of 'Case A'. Customer demand used to be received by a telephony team following pre-determined prescriptions and targets. Interviewees revealed it was not always possible to capture all correct information from a customer as they had a large number of calls waiting to be dealt with, and that they had to rush to transfer demands to back office. The back office team was responsible for processing necessary paper work before contacting the craftsmen. Also, craftsmen had limited ability to talk to customer beforehand, and they had to find more information during attending the property; causing lots of delays and repeated visits to complete the service. This has been asserted by the logistics operations manager's own words: "our craftsmen were expected to access the property based on the information the back office provides...we did not think that passing the customer contact details before the visit would benefit a craftsman get cleaner information about the case".*

However, interviewees asserted that following the Vanguard Method principles was a major step in processing customer demand with the aim of getting as much clean information as possible about the requested repair. Both front and back offices are united in one bigger team who is able to handle customer demand one stop. This was done by collecting information from the customer about his address details, information about the repair, and when the customer wants the repair to be performed. This clean information is then shared with their craftsmen to do the repair exactly as requested. The senior manager of personal claims at 'Case A' highlighted this new working principle: *"our focus now is on doing things right one stop...we encourage our employees to spend as much time as it requires with a customer to get all correct information with full details...our goal is to forward only clean information for our craftsmen, as we believe this would keep our service promise of delivering value at the right time"*. Interviewees also explained that they have witnessed cases when reverse logistics have occurred, not only because of their customers' incorrect information capturing, but also because of their craftsmen incorrect repair materials orders. The Vanguard Method adopts the principle of viewing the whole logistics system as one piece flow. Therefore, it was necessary to design a process to eliminate craftsmen role in creating reverse logistics. For this purpose, RTF Logistics Company provided their craftsmen with an iPad device that has a specially created electronic stock catalogue. The catalogue is designed in such a way that each building item is associated with a unique code and a photo to help the craftsman order the exact required materials with confidence whilst they are attending the property. The ordered list of required materials is prepared by RTF where a unique barcode label is attached to each order to eliminate any possibility of picking up the wrong order by the delivery drivers. Figure 2 shows a representation of capturing and disseminating clean information in the logistics service of both research sites.

[Figure 2 near here]

Figure 2. Capturing clean information in the logistics service

Demand predictability and categorisation

The aim of this theme is to understand the role of continuous demand analysis in better predicting and categorising demands for forward logistics that could potentially reduce reverse logistics. Results at both research sites have revealed that before the implementation of the Vanguard Method the workplace has no tools available that could create learning in the customer demand received. In such environment, customer demand was seen as uncertain and impossible to predict. Interviewees explained that their managers seen this as an expected variety. However, interviewees believed that this demand unpredictability was caused by, first, lack of ability of customers to pull out what they wanted from the service system. Second, separating teams from each other; this hampered accumulative learning in the demand variety. However, the Vanguard Method implementation at both research sites has honoured the principle of the need of the system to match variety of demand thrown at it by its customers. This has been done by continuously analysing customer demand received to increase system predictability. Continuous demand analysis was an enabler to categorise the

most common repair demands coming in and, because of that, they were better able to design and deliver high quality logistics services to the customers. Interviewees at 'Case A' indicated that this principle of the Vanguard Method made it possible for them to predict more than 80 percent of their customers' repair demands as a result of demand analysis. This helped the home insurance redesign team to design responsive logistic operations against those predicted demands that would deliver what the customer need at the first time of repair; therefore, the logistics services system has witnessed dramatic decrease in returned items and rejected building materials. It was not a surprise that at the time of the study the logistics services failure demand has shrunk from 60 percent to only 12 percent. The senior manager of supply chain stated that: *"continuous demand analysis of the Vanguard Method is an essential tool for the survival of our logistics system...clarity helped us be prepared for those predicted demands by building our internal operations to deal with those demands one stop...demands with totally different nature are always recorded and considered an opportunity to build new operations"*. Similarly, results from Flagship Housing case study have revealed that demand analysis principle at their operations centre was able to identify the top common repair demands from their customers, allowing them to know what to stock in their craftsmen vans that is most required. Stocking craftsmen vans this way was very helpful in many cases to complete repair demands without even making an order delivery of building materials to the property, thus saving company's resources and reducing potential delivery of wrong items. This result was highlighted by the distribution centre manager of the company who stated that: *"demand analysis is powerful tool for our business, we only stock our vans with materials related to those demands that are constantly recurring, thus saving the company a lot of transportation money and time"*. Furthermore, RTF personnel identified another dimension where reverse logistics reduction is possible. They have explained that demand analysis and categorisation was a powerful source to learn demand seasonal trends (i.e., certain types of repairs are more required at certain time of the year, or even at some certain areas of their covered region). Due to this Vanguard Method clarity on demand trends, RTF was able to execute two crucial improvement tasks to their logistic operations to further reduce failure demand and reverse logistics. First, the distribution centre was at better level to enhance readiness against customer demands by better knowing how much to stock and what to purchase into their distribution centre; improving forward logistics by making the right building materials available. Second, RTF recognised the areas where some certain repair demands was coming from and, thus, placed their craftsmen closer to those areas with proper vans stock. At the time of the study, the Flagship Housing had only 22 percent failure demand as opposed to 56 percent before the Vanguard design intervention.

Failure demand analysis

In this final theme, the results present a perspective of logistics services that goes beyond mere design requirements. This theme portrays the role of the Vanguard Method in creating a logistics service design that can learn from reverse logistics analysis. In addition to the continuous demand analysis performed, the research results at both case studies illustrate the

importance of recording and logging any failure demand (i.e. reverse logistics of incomplete repairs or returned items) received into the IT system used. Interviewees indicated that this was done in the belief that employees are required to continuously improve their existing logistic operations by challenging the current processes to learn on how they can be improved. To make the learning process possible, the Vanguard Method redesign team at both case studies used to deeply investigate each reverse logistics case received. Consequently, this helped the team in identifying potential causes of the reverse logistic case. With this activity, team members were able to propose immediate corrective measures to be taken in order to avoid the same problem in the future and to minimise the number of unnecessary reverse logistics cases. It was evident at the operations centre of both case studies that logged failure demands are shared and discussed among team members and other employees on weekly basis, and on some occasions on daily basis if the case is urgent. *It is as commented by a claim advisor at 'Case A': "we are learning now from the system, those customer demands that are coming back to us again (i.e. failure demands) are learning opportunities...we try to find out what was the problem in the logistics system that caused this customer to call again requesting a replacement or item return...we share knowledge with our suppliers to help us follow the new operations...this way we stop similar demands from coming back again".* In fact, interviewees at Flagship Housing and RTF indicated that they used all sources of information to inspire internal understanding of problems hidden in their logistic services. Discussions with craftsmen and RFT drivers are used to provide valuable ideas for improvement and learning. In addition, interviewees viewed the focus on reverse logistics, specially the rare problems, as a rich source of information for the organisation to improve its logistic operations, and also vital for the organisation to stick to its working purpose, from a customer perspective, of "repair completed at my convenience". Figure 3 illustrates this perspective of learning from reverse logistics and failure demands.

[Figure 3 near here]

Figure 3. Analysing reverse logistics

7. Discussion and conclusion

In this paper, two exploratory case studies have been used to empirically investigate the role of the Vanguard Method approach, for forward logistics services design, in enhancing forward logistics performance and **reducing reverse products flows**. The paper builds on the recent work of Zhang et al. (2013) of integrating forward logistics services design with reverse logistics operations to reduce reverse logistics cost, and the work of Lin and Pekkarinen (2011) of involving customer demands in the design process of forward logistics services for enhanced operational performance. While generalising findings from exploratory case studies is difficult (Cooper and Emroy, 1995), the paper demonstrates an important dynamics of the Vanguard Method that can provide an understanding of how forward and reverse logistics could be improved. It is evident in the results that the Vanguard Method approach is likely to enhance forward logistics performance **and reduce reverse product flows** by promoting three different dimensions for learning from demand-driven analysis. A

conceptual framework is presented in Figure 4 that demonstrates these dimensions. The results of this research are discussed in the context of logistics operations management and design to answer the research questions posed at the beginning of this paper.

[Figure 4 near here]

Figure 4. Conceptual framework of logistics' demand-driven analysis

The results from both case studies highlight the importance of clean customer information sharing in nurturing a successful logistics service design for efficient operations. This is particularly important as the Vanguard Method approach is based on interrelationships of employees' interaction and social exchange, both within their teams and between logistics service members. In this context, customer information sharing is a dialogue between all the logistics service members, including the customer, to ensure building close relationships that would guarantee minimised reverse logistics and reduced failure demands. As it was revealed by data analysis from both case studies, clean customer information was reliably shared by the adoption and creatively deploying up-to-date information and communications technologies. According to Chapman et al. (2002), sharing customer information through logistics communication technologies enable logistics services to transform from merely being materials handler to a decision-maker on what suits the customer the best. However, this new mind set of getting and then sharing only clean information about customer demands can only be achieved through decentralised, team-based informal structures. The Vanguard Method places the individuals to work within a team who are able to process an entire customer demand, and if necessary they can seek help from each other to capture correct information and complete a task. Logistics service employees are all now work within the boundaries of one team. The results also indicate that individuals at both case studies share the responsibility of the work with other team members along the logistics service chain. This adds a tremendous potential for transferring clean information that enhances logistics performance and reduces returned materials (Rollins et al., 2011). Further, team work has been found to lead knowledge sharing and learning emergence from customer demand due to the quality of decisions made on received demands. These views are shared by Larson et al. (1998) who link learning-oriented behaviour of organisations during work operations with information sharing across team members up and down the logistics service chain. In addition to this, research findings are in line with knowledge-based theory introduced by Gant (1996). This theory emphasizes the necessity of transferring the knowledge across the boundaries of the firm to support and enhance firm performance (Esper et al., 2010). In congruence with this, the Vanguard Method approach, in both case studies, built a one-piece flow of the system from the initial customer demand through to the delivery of the repair service to meet the requested demand, thus transferring the customer knowledge across the boundaries of the firm to support the work of logistics service operations.

Consistent with prior demand prediction and categorization studies (Eaves and Kingsman, 2004; Boylan et al., 2008; Syntetos et al., 2009), the second theme of demand predictability and categorisation has shown dramatic change in the management of repair materials inventory control systems at both research sites. Although the Vanguard Method has allowed a basic stock control solution for the warehouse inventory and van stock materials, results suggest that the logistics service benefits were substantial. Logistics managers were supported by the new working system to focus their attention on the most wanted building and repair materials and, therefore, stocked their distribution centres and vans with the required materials at the right quantities. This has resulted in preparing the logistics service operations with the necessary information and materials to satisfy the customer demands and deal with them at the first visit. For this particular reason, many of the factors that have caused reverse product flows cases have been blocked. This is simply because readiness and preparedness against customer demand lead to better allocation of logistics service resources needed to serve the customer (Valle et al., 2009). Furthermore, the results explicitly tackle the problem of demand uncertainty in reverse logistics, justified by customer demand volatility available in logistics operations (Vidal and Goetschalckx, 2000; Cardoso et al., 2013). This demand uncertainty is even more crucial when dealing with forward-reverse logistics service operations as the complexity and the associated demand uncertainty is even magnified. However, the treatment of this issue has not been given enough focus in recent research studies (Cardoso et al. 2013). It is proposed by the current findings that continuous demand analysis, guaranteed by the working principles of the Vanguard Method, has provided opportunities to overcome some of the limitations associated with demand uncertainty. Both research sites were able to pull information about the most common demand received by their logistics service, they were also able to identify information that would help in long term planning horizons such as customer demands seasonal trends and demand geographical distribution. This has provided learning opportunities in the logistic services to better understand their customers and eventually reduce unnecessary reverse logistics; saving the business substantial amount of resources.

The final theme presented in the results suggests that failure demand analysis of reverse product flows has a direct positive impact on the performance of the overall logistics function of the business. The growing apprehension of returned products, beyond mere reverse logistics that contribute to the minimisation of environmental detriment by recovering waste products of used materials, has been viewed by the Vanguard Method as an opportunity to learn on how the logistics service can be further improved. The results suggest that these opportunities include identifying problems in the logistics service operations hidden in the system, thereby providing valuable ideas for improvement and learning (Gutiérrez et al., 2012). Furthermore, deeply investigating failure demands of returned products has the potential of generating competitive advantage (Stock, 2001). However, this competitive advantage can be classified into two types of values; tangible values from the physical side of the returns, and intangible values from the information side associated with the returns (Jayaraman and Luo, 2007). It was shown in the results that reverse logistics analysis provided valuable information about problems available in the returned items. These problems included items performance, size, colours, hazardous nature, and quality level.

Reverse logistics analysis also helped both companies to find out the magnitude of each type of returned flow that can prioritise corrective actions in the forward logistics service system. In many cases, the analysis also provided significant information on customer expectations, preferences, opinions regarding reliability and quality of the repair materials and fittings. This has provided both companies with the capability to stock exactly what customers want.

Lastly, the current research findings have some prominent research contributions to the literature of forward and reverse logistics service design. First, majority of the current literature on logistics services design is heavily focused on mathematical modelling that neglect the critical role of customer in the design and development process of these services (Choy et al., 2008; Lin and Pekkarinen, 2011). This research work has introduced a novel logistics service design approach, based on customer demand involvement, which can significantly enhance forward logistics efficiency and reduce reverse product flows by promoting three different dimensions for learning from logistics demand-driven analysis. These dimensions are: capturing clean information from customer, demand predictability and categorisation, and failure demand analysis. It is argued in this paper that effective logistics service design, which can learn from and reduce reverse product flows, is possible following the Vanguard Method approach. Second, in many research studies customer knowledge and information is viewed as intra-organisational phenomenon where the sharing of knowledge happens between the organisational departments (Argote et al., 2003; Rollins et al., 2011), however, the presented logistics service design in this paper transfers the customer knowledge across the boundaries of the firm throughout the supply chain to enhance logistics function. Finally, since the Vanguard Method approach builds a system that is adaptive to demand volatility (Seddon, 2008); the present paper introduces important insights where reverse logistics are simultaneously considered with forward logistics design coupled with demand uncertainty. This has not yet been addressed adequately in the current literature (Cardoso et al., 2013).

8. Research limitations and future work

This paper has a number of limitations that calls for a number of future research directions. While this study has presented significant insights and contributions to designing logistics services incorporating customer requirements, the findings from exploratory case studies cannot be easily generalised. Hence, further case studies are needed to enrich the findings, and to facilitate their industrial applications. Further, the paper explores the utilisation of the Vanguard Method only in the area of housing repairs and maintenance logistics services. It would be valuable for future studies to further investigate the utilisation of the Vanguard Method in other logistics services settings, such as manufacturer-retailer supply chains, or in freight forwarding industry where customer involvement in the logistics design plays a crucial role in reducing reverse logistics activities (Zhang et al., 2013). In addition, further research is required on financially quantifying the impact of reducing reverse logistics activities as a result of designing forward logistics service following the Vanguard Method, as opposed to reverse logistics that have originally been initiated due to lack of customer demand understanding.

References

- Aastrup, J. and Halldórsson, A. (2008), “Epistemological role of case studies in logistics: A critical realist perspective”, *International Journal of Physical Distribution & Logistics Management*, Vol. 38 No. 10, pp. 746-763.
- Ackoff, R.L. (1981), *Creating the Corporate Future*, John Wiley and Sons, New York.
- Aras, N., Aksen, D. and Tanugur, A.G. (2008), “Locating collection centers for incentive dependent returns under a pick-up policy with capacitated vehicles”, *European Journal of Operational Research*, Vol. 191 No. 3, pp. 1223–1240.
- Argote, L., McEvily, B. and Reagans, R. (2003), “Introduction to the special issue on managing knowledge in organizations. Creating, retaining, and transferring knowledge”, *Management Science*, Vol. 49 No. 4, pp. v-viii.
- Barros, A.I., Dekker, R. and Scholten, V. (1998), “A two-level network for recycling sand: A case study”, *European Journal of Operational Research*, Vol. 110 No. 2, pp. 199-214.
- Bernon, M. and Cullen, J. (2009), “Supply chain management”, *Financial Management*, February, pp. 42-43.
- Beullens, P. (2004), “Reverse logistics in effective recovery of products from waste materials”, *Reviews in Environmental Science and Biotechnology*, Vol. 3 No. 4, pp. 283-306.
- Bhat, A.B., Verma, N., Rangnekar, S. and Barua, M.K. (2012), “Leadership style and team processes as predictors of organisational learning”, *Team Performance Management*, Vol. 18 No.7/8, pp. 347 – 369.
- Botla, L. (2009), “Systems thinking: the Gandhian way”, *Journal of Human Values*, Vol. 15 No. 1, pp. 77-90.
- Boylan, J.E., Syntetos, A.A. and Karakostas, G.C. (2008), “Classification for forecasting and stock control: a case study”, *Journal of the Operational Research Society*, Vol. 59 No. 4, pp. 473-481.
- Bryman, A. and Bell, E. (2007), *Business Research Methods*, 2nd ed., Oxford University Press, Oxford.
- Cardoso, S.R., Barbosa-Povoa, A.P. and Relvas, S. (2013), “Design and planning of supply chains with integration of reverse logistics activities under demand uncertainty”, *European Journal of Operational Research*, Vol. 226 No. 3, pp. 436-451.
- Capra, F. (1996), *The Web of Life: a New Scientific Understanding of Living Systems*, Double-day: New York.
- Chang, T.S. and Liao, Y.F. (2011), “Routing strategies for integrating forward distribution and reverse collection”, *Journal of the Operations Research Society*, Vol. 62 No.6, pp. 971-981.
- Chapman, R.L., Soosay, C. and Kandampully, J. (2002), “Innovation un logistic services and the new business model: a conceptual framework”, *Managing Service Quality*, Vol. 12 No. 6, pp. 358-371.
- Checkland, P. (1995), “Model validation in soft systems practice”, *Systems Research*, Vol. 12 No. 1, pp. 47-54.
- Chiva, R. and Allegre, J. (2009), “Organizational learning capability and job satisfaction: an empirical assessment in the ceramic tile industry”, *British Journal of Management*, Vol. 20 No. 3, pp. 323-340.
- Choy, K.L., Chow, H.K.H., Tan, K.H., Chan, C.-K., Mok, E.C.M. and Wang, Q. (2008), “Leveraging the supply chain flexibility of third party logistics–hybrid knowledge-based system approach”, *Expert Systems with Applications*, Vol. 35 No.4, pp. 1998-2016.

- Cooper, R.D. and Emroy, C.W. (1995), *Business Research Methods*, 5th ed., Richard D. Irwin, Homewood, IL.
- Creswell, J.W. (2004), *Educational Research: Planning, Conducting, and Evaluating Quantitative and Qualitative Research*, 2nd ed., Pearson Education, Upper Saddle River.
- Dowlatsahi, S. (2012), “A framework for the role of warehousing in reverse logistics”, *International Journal of Production Research*, Vol. 50 No. 5, pp.1265-1277.
- Eaves, A.H.C. and Kingsman, B.G. (2004), “Forecasting for the ordering and stockholding of spare parts”, *Journal of the Operational Research Society*, Vol. 55 No. 4, pp. 431-437.
- Eichengreen, B. and Gupta, P. (2009), “Two Waves of Services Growth”, *Oxford Economic Papers*, Vol. 65 No. 2013, pp. 96-123.
- Esper, T. L., Ellinger, A. E., Stank, T. P., Flint, D. J. and Moon, M. (2010), “Demand and supply integration: a conceptual framework of value creation through knowledge management”, *Journal of the Academy of Marketing Science*, Vol. 38 No. 1, pp. 5–18.
- Gant, R.M. (1996), “Prospering in dynamically-competitive environments: organisational capability as knowledge integration”, *Organization Science*, Vol. 7 No. 4, pp. 375-387.
- Guide Jr, V.D.R., et al. (2006), “Time value of commercial product returns”, *Management Science*, Vol. 52 No. 8, pp. 1200–1214.
- Gutierrez Gutierrez , L.J., Bustinza, O.F. and Barrales Molina, V. (2012), “Six sigma, absorptive capacity and organisational learning orientation”, *International Journal of Production Research*, Vol. 50 No.3, pp. 661-675.
- Hazen, B.T., Overstreet, R.E., Hall, D.J., Huscroft, J.R. and Hanna J.B. (2015), “Antecedents to and outcomes of reverse logistics metrics”, *Industrial Marketing Management*, Vol. 46, pp.160-170.
- Ilgel, D.R., Hollenbeck, J.R., Johnson, M. and Jundt, D. (2005), “Teams in Organizations: From Input-Process-Output Models to IMO Models”, *Annual Review of Psychology*, Vol. 56 No. 1, pp. 517-543.
- Jaaron, A. and Backhouse, C. (2012), “The effects of lean thinking on service workers value productivity: a conceptual framework”, *Int. J. of Quality and Innovation*, Vol. 2 No.1, pp. 1-17.
- Jaaron, A. and Backhouse, C.J. (2014), “Service organisations resilience through the application of the vanguard method of systems thinking: a case study approach”, *International Journal of Production Research*, Vol. 52 No. 7, pp. 2026-2041.
- Jaaron A and Backhouse C.J. (2010), “Systems Thinking for public services: adopting manufacturing management principles”, in Zokaei, K., Seddon, J. and O'Donovan, B. (Ed.), *Systems Thinking: From Heresy to Practice*, Public and Private Sector Studies, Palgrave Macmillan, Basingstoke, pp. 147-174.
- Jackson, M.C. (2009), “Fifty years of systems thinking for management”, *Journal of the Operational Research Society*, Vol. 60 No. 1, pp. S24-S32.
- Jackson, M.C., Johnston, N. and Seddon, J. (2008), “Evaluating systems thinking in housing”, *Journal of the Operational Research Society*, Vol. 59 No. 2, pp. 186-197.
- Jayaraman, V., Patterson, R.A. and Rolland, E. (2003), “The design of reverse distribution networks: models and solution procedures”, *European Journal of Operational Research*, Vol. 150 No. 1, pp. 128-149.
- Jayaraman, V., Guide, V.D.R. and Srivastava, R. (1999), “Closed-loop logistics model for remanufacturing”, *Journal of the Operational Research Society*, Vol. 50 No. 5, pp. 497–508.
- Jayaraman, V. and Luo, Y. (2007), “Creating competitive advantages through new value creation: A reverse logistics perspective”, *Academy of Management Perspectives*, Vol. 21 No. 2, pp. 56-73.

- Kim, K., Song, I., Kim, J. and Jeong, B. (2006), "Supply planning model for remanufacturing system in reverse logistics environment", *Computers & Industrial Engineering*, Vol. 51 No. 2, pp. 279–287.
- Korkmaz, O. (2012), "Differences in employees' perception of employee empowerment practices", *European Journal of Social Sciences*, Vol. 34 No. 1, pp. 43-57.
- Krikke, H.R., Kooi, E.J. and Schurr, P.C. (1999), "Network design in reverse logistics: A quantitative model", in Staehly, P. (Ed.), *New Trends in Distribution Logistics*, Springer, Berlin, pp. 45–62.
- Larson, J. R., Christinsen, C., Franz, T. M. and Abbott, A. S. (1998), "Diagnosing groups: the pooling, management and impact of shared and unshared case information in team-based medical decision making", *Journal of Personality and Social Psychology*, Vol. 75 No. 1, pp. 93–108.
- Lee, Y.J., Baker, T. and Jayaraman, V. (2012), "Redesigning an integrated forward-reverse logistics system for a third party service provider: an empirical study", *International Journal of Production Research*, Vol. 50 No. 19, pp. 5615-5634.
- LePine, J.A. (2003), "Team adaptation and postchange performance: effects of team composition in terms of members' cognitive ability and personality", *J. Appl. Psychol.*, Vol. 88 No. 1, pp. 27–39.
- Lin, Y. and Pekkarinen, S. (2011), "QFD-based modular logistics service design". *Journal of Business and Industrial Marketing*, Vol. 26 No. 5, pp. 344-356.
- Marshall, J. (2010), "Organisational change: evaluating systems thinking in the UK housing sector- A work in progress", in Zokaei, K., Seddon, J. and O'Donovan, B. (Ed.), *Systems Thinking: From Heresy to Practice*, Public and Private Sector Studies, Palgrave Macmillan, Basingstoke, pp. 108-131.
- Mena, C., Christopher, M., Johnson, M. and Jia, F. (2007), "Innovation in logistics services", Cranfield School of Management, Cranfield, available at: www.nesta.org.uk/library/documents/inno-in-service-logistics-report.pdf (accessed 03 July 2014).
- Miles, M.B. and Huberman, A.M. (1994), *Qualitative Data Analysis: An Expanded Sourcebook*, Sage, Thousand Oaks.
- Min, H., Ko, H. and Park, B. (2005), "A Lagrangian relaxation heuristic for solving the multi-echelon, multi-commodity, closed-loop supply chain network design problem", *International Journal of Logistics Systems and Management*, Vol. 1 No. 4, pp. 382–404
- Min, H. and Ko, H. (2008), "The dynamic design of a reverse logistics network from the perspective of third-party logistics service providers", *International Journal of Production Economics*, Vol. 113 No. 2008, pp. 176-192.
- Mutha, A. and Pokharel, S. (2009), "Strategic network design for reverse logistics and remanufacturing using new and old product modules", *Computers & Industrial Engineering*, Vol. 56 No. 1, pp. 334–346.
- Nagel, C. and Meyer, P. (1999), "Caught between ecology and economy: end of life aspects of environmentally conscious manufacturing", *Computers and Industrial Engineering*, Vol. 36 No. 4, pp. 781-792.
- Olhager, J. 2010, "The role of the customer order decoupling point in production and supply chain management", *Computers in Industry*, Vol. 61 No.9, pp. 863-868.
- Patton, M.Q. (2002), *Qualitative Research and Evaluation Methods*, 3rd ed., Sage Publications, London.
- Pati, R.K., Vrat, P. and Kumar, P. (2008), "A goal programming model for paper recycling system", *Omega*, *International Journal of Management Science*, Vol. 36 No. 3, pp. 405-417.

- Pil, F.K. and Holweg, M. (2004), "Linking product variety to order-fulfillment strategies", *Interfaces*, Vol. 34 No. 5, pp. 394-403.
- Piplani, R. and Saraswat, A. (2012), "Robust optimisation approach to the design of service networks for reverse logistics", *International Journal of Production Research*, Vol. 50 No. 5, pp. 1424-1437.
- Rogers, D. and Tibben-Lembke, R. (2001), "An examination of reverse logistics practices", *Journal of Business Logistics*, Vol. 22 No. 2, pp. 129-148.
- Rollins, M., Paekkarinen, S. and Mehtala, M. (2011), "Inter-firm customer knowledge sharing in logistics services: an empirical study", *International Journal of Physical Distribution and Logistics Management*, Vol. 41 No.10, pp. 956-971.
- Salema, M., Po´voa, A.P.B. and Novais, A.Q. (2006), "A warehouse-based design model for reverse logistics", *The Journal of the Operational Research Society*, Vol. 57 No. 6, pp. 615–629.
- Seddon, J. (2008), *Systems Thinking in the Public Sector*, Triarchy Press, Axminster.
- Seddon, J. (2003), *Freedom from Command and Control: A Better Way To Make The Work Work*, Vanguard Education, Buckingham.
- Srivastava, S.K. (2007), "Green supply chain management: a state-of-the-art literature review", *International Journal of Management Review*, Vol. 9 No. 1, pp. 53-80.
- Stock, J.R. (2001), "The 7 deadly sins of reverse logistics", *Material Handling Management*, Vol. 56 No. 3, pp. MHS5–MHS11.
- Syntetos, A.A., Keyes, M. and Babai, M.Z. (2009), "Demand categorisation in a European spare parts logistics network", *International Journal of Operations and Production Management*, Vol. 29 No. 3, pp. 292-316.
- Taleb, N. (2012), *Antifragile: Things That Gain From Disorder*, Random House, New York.
- Tashakkori, A. and Teddlie, C. (1998), *Mixed Methodology: Combining Qualitative and Quantitative Approaches*, Sage Publications, London.
- Thierry, M. (1997), *An analysis of the impact of product recovery management on manufacturing companies*, Ph.D. Thesis, Erasmus University, Rotterdam, The Netherlands.
- Toktay, L.B. (2003), "Forecasting product returns", in Guide, V.D.R. and Wassenhove, L.V. (Ed.), *Business aspects of closed-loop supply chains*.Carnegie Mellon University Press, Pittsburgh, PA.
- Valle, P., Menezes, J., Reis, E. and Rebelo, E. (2009), "Reverse logistics for recycling: the customer service determinants", *International Journal of Business Science and Applied Management*, Vol. 4 No. 1, pp. 1-17.
- Vidal, C. and Goetschalckx, M. (2000), "Modelling the effects of uncertainties on global logistics systems", *Journal of Business Logistics*, Vol. 21 No. 2, pp. 95-120.
- Voss, C., Tsikriktsis, N. and Frohlich, M. (2002), "Case research in operations management", *International Journal of Operations and Production Management*, Vol. 22 No. 2, pp. 195-219.
- Yin, R. (2009), *Case Study Research: Design and Methods*, 4th ed., Sage Publications, Thousand Oaks.
- Yu, Q. (2010), "Empirical research on relationship between logistics and economic growth", paper presented at the International Conference on *E-Product E-Service and E-Entertainment (ICEEE)*, 7-9 November 2010, Henan, China, pp. 1-3.
- Zhang, Z., Hui, Y.V. and Chen, H. (2013), "A forward and reverse logistics shipment planning model", *Journal of Operational Research Society*, Vol. 64 No. 10, pp. 1485-1502.