

Re-examining Agile Supply Chain Practices in Post Recession Fashion Retail

Dr Jon Spragg CMILT

Department of Clothing Design and Technology
Manchester Metropolitan University



In Association with
The Chartered Institute of Logistics and Transport (UK)



January 11, 2012

Published by: The Chartered Institute of Logistics and Transport (UK)

ISBN: 978-1-904564-41-6

Copyright: ©The Chartered Institute of Logistics and Transport (UK)
and Manchester Metropolitan University, UK.

Contents

1	Forward	3
	1.1 Motivation for Research	3
	1.2 Fashion Supply Chain	3
	1.3 Research Aim and Design	4
	1.4 Research Objectives	4
	1.5 Research Method	5
	1.6 Deliverables	5
	1.7 Research Tools	6
	1.8 Research Risk	6
	1.9 Researcher	6
2	Introduction	7
	2.1 Literature Review	7
3	Exploring Evidence of Integration in the Global Fashion Supply Chain	10
	3.1 Research Instrument	10
	3.2 Survey Analysis	11
	3.3 Cluster Analysis	13
	3.4 Measures of distance	14
	3.5 Hierarchical Clustering	14
	3.6 Principal Component Analysis	18
	3.7 Text Mining	21
	3.7.1 Research design	21
	3.7.2 Text analysis	21
4	Conclusion	26
	4.1 Future Research	26
5	Acknowledgement	27
6	APPENDIX A	31
	6.1 Sourcing and Distribution Survey Results	31
7	APPENDIX: B	44
	7.1 Python code for extracting agility themes from <i>just-style</i> articles	44

1 Forward

1.1 Motivation for Research

The Chartered Institute of Logistics and Transport (UK) provided funds to research agile supply chain practices in post-recession fashion retail. The research, reported here, re-examined the factors that motivated fashion retailers to employ agile supply chain strategies in the current post recession period. The current; retail biased; research agenda locates agility with time compression strategies and quick response, not cost. This current research agenda and agile supply chain theory was examined with respect to the motivational factors that drive merchandising decisions in the industry. Both academics, [Christopher and Peck, 2004, Christopher et al., 2009, Towers and Bergvall-Forsberg, 2009, Hines, 2004], and fashion retailers ¹ have stressed lead time reduction as the key motivator for agility within the fashion supply chain. The research, for which funding was sought investigated the alternative proposition that agile supply chain practices in fashion retail are more to do with merchandise inventory cost; and who in the supply chain carries the burden of that cost; than time compression strategies. It will be argued that agile supply chain practices in fashion retail are more a reflection of buying power than coordination between partners.

1.2 Fashion Supply Chain

The fashion and garment industry is characterised by volatile markets, short product life cycles and high levels of competition between retailers. This business environment drives retailers to explore audacious business strategies and novel marketing channels to increase value for investors and defend market share. In recent years, the fashion supply chain research agenda and literature has been dominated by researchers with a marketing and retail bias. They stress the importance of a supply chain that is highly responsive to changing market demand by employing local sourcing strategies, advanced communications technology, frequent merchandise replenishment strategies, and low inventory management processes. These practices have been further driven in recent years by the phenomenon of fast fashion [Bruce and Daly,

¹Sir Philip Green (Arcadia Group), in a BBC 4 Radio Broadcast, when asked about TopShop's strategy for trading in a recession, said that the agile supply chain was key and "... speed was more important than price". However Jane Shepherdson, from the clothing brand Whistlers, implied later in the broadcast that fashion retailers in the UK would survive the recession by shifting costs onto Asian suppliers. *Straight to the Top*, Radio 4, 2nd March 2009.

2006] which places emphasis on merchandise novelty and high turnover of stock. In consequence, agile merchandising has been viewed as positive while the business interests of other stake holders in the fashion supply chain; logistics and manufacturing; have not been exhaustively researched. It seems, that the current research agenda is an example of the authority of the retailer within sourcing networks extending to the academic community. The concept of agility in supply chain management urgently needs to be revisited in the post recession era to understand the emerging relations between retailers and suppliers, and the accompanying risks and stresses these emerging relations are placing on supply chain coordination, synchronization and long-term sustainability of fashion retail networks.

1.3 Research Aim and Design

The purpose of the research was to define a framework for evaluating the motivation for fashion retailers in employing agile supply chain practices. The current research agenda argues that agility is primarily a *time compression strategy*, an example of consumer driven supply chains [Hines, 2004]. The research attempted to explore this hypothesis and the alternative hypothesis that the key practice of agility in retail management; frequent merchandise inventory replenishment; is driven primarily by inventory cost and the ability of retailers to shift that cost onto suppliers.

1.4 Research Objectives

The research logic was inductive: employing exploratory data analysis to explore the motivational factors in employing agile supply chain practices in fashion retail.

In order to conduct the research a sample of British fashion retailers and a sample of suppliers to the British clothing industry was identified. Data from the fashion retailers was collected via an online survey, using the Likert scale, to establish motivational factors with respect to agile practices. Questions were asked on sourcing, procurement, stock replenishment management, and relations with suppliers in an attempt to understand the merchandising drivers within the retail business. It was anticipated that data collected from suppliers to the British clothing industry, via structured interviews and accounts (where possible), would discover the cost burden of maintaining inventory for frequent merchandise replenishments and establish an appropriate weighting scheme for the inferential analysis. Based on the structured interviews with suppliers to fashion retailers weightings would be determined for the various activities of the agile supply chain; sourcing,

inventory management, and delivery scheduling; to support the *cost* versus *time* structure of the survey.

1.5 Research Method

It was anticipated that the research would be undertaken in three, four month, phases. The first phase would define a theoretic framework for structuring the research based on existing retail supply chain models and structured interviews with suppliers to the British garment industry. The second phase would employ the framework to structure a survey that will be delivered to fashion retailers in the UK asking them about their agile practices: stock replenishment strategies, sourcing and procurement procedures, and supplier compliance regulations. The final phase would employ inferential analysis (Kendal τ correlation and factor analysis) to determine the true drivers of agility in fashion retail. The final phase attempted a redefinition of fashion retail agility that matched the practices of the industry.

1.6 Deliverables

It was anticipated that the case studies developed during the research will become the basis of teaching material in logistics research methods for master level students at the Department of Clothing Design and Technology, Manchester Metropolitan University. Furthermore, the progress and issues raised during the research will be reported in a weekly research blog published on the Hollings International Fashion Logistics Group's (HIFLG) website (www.hollings.mmu.ac.uk/hiflg) and will be made available to LRN/CILT networks for discussion. It was also anticipated that a number of peer-reviewed research papers will emerge from the research.

The research will culminate in a Workshop, *Rethinking Agility in the Retail Supply Chain* which will offer a forum for those who participated in the research to reformulate a theory of agile supply chain management that will rebalance the research agenda to better reflect the role of suppliers and manufacturers in retail logistics. It is hoped that the workshop will lead to the creation of a network of researchers for investigating other issues in retail logistics from a non-retail bias.

1.7 Research Tools

The research used open source tools, such as the R² and the programming language Python³ for statistical analysis, data manipulation and visualisation.

1.8 Research Risk

The Department of Clothing Design and Technology, Hollings Faculty, Manchester Metropolitan University links with professional associations and international trade bodies facilitated the data collection component of the research.

Advanced Processing Ltd⁴, a garment logistics company based in Halifax, Yorkshire, agreed to participate in the research. Access to suppliers to the British garment industry (both in the UK and Turkey) was therefore not considered an obstacle to the implementation of the research method. However, a good response from retail supply chain operations managers is more problematic given the underlying research agenda. Nonetheless, contacts have been made with fashion retail supply chain managers, it was believed that if the questionnaire was sensitively structured with regards to the parameters of retail decision making then this would not be a serious issue. The research sought to correct logistics theory and update the research agenda not judge retail business practice.

1.9 Researcher

Jon Spragg has worked on a number of high profile research projects; as a Visiting Scientist at the Robotics Institute, Carnegie Mellon University, Pittsburgh, USA, he worked on the *DARPA* (Defence Advanced Research Projects Agency) funded project for investigating mixed initiative scheduling architectures (www.ozone.ri.cmu.edu) and re-scheduling algorithms [Spragg and Kelleher, 1996].

²www.r-project.org

³www.python.org

⁴www.advancedsupplychain.com

2 Introduction

2.1 Literature Review

The fashion logistics literature and research agenda are dominated by a few central themes that have been championed by an influential core of industrial consultants and academics who have defined the research agenda:

- Lean and Agile Retailing
- Network-based supply chains
- Coordination and synchronization of management processes
- Integration and alignment of supply chain processes

These strategic concerns are made operational in the literature with discussions that emphasise the importance of:

- Lead-time reduction strategies
- Frequent merchandise inventory replenishment
- Technology that supports high visibility across supply chain processes
- The unhindered flow of inventory through supply pipelines.

This research agenda is driven by the interests of fashion retailers and is dominated by "good practice" rather than data.

The research agenda that positioned analysis of the supply chain central to the competitive advantage of retail originated in the United States with the publication of Abernathy et al. *A Stitch in Time* [Abernathy et al., 1999] in 1999. Prior to this publication the industry was characterised by long lead-times and commercial practices that reduced the industry's competitiveness in the face of strong price competition from Asia. The text offered an alternative to tariffs and quotas that captured the imagination of both academics and business commentators.

Moreover, *A Stitch in Time* anticipated the euphoria that was to grip the industry in the early 2000's with the emergence of *fast fashion* and the Zara phenomena that was chronicled and lauded by the Harvard Business Review [Ferdows and Lewis, 2004]. The sentiments of this article were echoed in a number of case studies and business reports [Ghemawat and Nueno, 2006, Linguri, 2006, Tokatli, 2008], including Martin Christopher's 3rd edition of *Logistics & Supply Chain Management* [Christopher, 2005]. Indeed, there

was those who were so taken by that Zara model that they argued that supply chain agility could achieve what import tariffs and quotas could not achieve: the very survival of the Western apparel industry [Doeringer and Crean, 2006]. This is a view that is currently echoed in Draper's *Save our Skills* Campaign⁵.

The relationship between agile supply chain practices and the fashion industry is summarised by Christopher et al. in an unpublished article *Creating Agile Supply Chains in the Fashion Industry* [Christopher et al.]. Christopher argues that *demand forecasting* is redundant in fashion supply chain management. That the demand for fashion products is so volatile and short-lived that any attempt to predict the volume of sales for each stock keeping unit (SKU) is bound to fail.

The case for agile supply chain practices is therefore firmly associated with the requirements of retail markets. If you cannot predict demand pre-season and plan production and distribution then you need to ensure low inventories (to avoid obsolete stock at the end of the season that will need to be sold at a discount) and frequent replenishment of high turn-over stock in-season. Such retailer demands require high levels of collaboration and integration between different supply chain stakeholders. The agile supply chain literature is idealistic about how this collaboration is to be achieved. Indeed there is a dearth of research in this area on fashion supply chain practice. The conceptual models discussed in [Christopher and Peck, 2004, Hines, 2004, Ghemawat and Nueno, 2006] offer "good practice" but not insights into actual business behaviour.

Li & Fung, the largest apparel sourcing agents in the world, probably exemplify, in their business model, the purest implementation of an agile, network based, integrated supply chain [Fung et al., 2007].

Bulent Alkanli, Vice President at Li & Fung, Turkey, identified the challenges of orchestrating a networked based supply chain during a field trip to the Li & Fung Office in Istanbul, Turkey by the grant holder. The Li & Fung business strategy in Turkey replicates the business model successfully employed by the company in Hong Kong [Magretta, 2000]. However, whereas the the Asian model uses Hong Kong as a value-adding hub to undertake profitable design and quality control activities; sub-contracting low-value garment assembly activities to small garment factories in Bangladesh, Vietnam, Cambodia, and China; the Turkish model uses Istanbul as the value-adding hub, sub-contracting the low-value garment assembly activities to small factories in countries in North Africa and Eastern Europe. This network-based strategy allows Li & Fung not only greater responsiveness with respect to

⁵<http://www.drapersonline.com/news/save-our-skills/>

European Union markets but also to new emerging markets in Russia and the Middle East.

The business model employed by Li & Fung is heavily reliant upon supply chain integration: the company owns no factories or distribution fleets, it is instead heavily reliant on a network of small independent manufacturers for completing orders for its retail clients. The core business competencies of the company is in managing supplier relationships in diverse cultures for retail clients. Li & Fung provides value-added services for retail clients by working with retail merchandisers and buyers to identify garment designs that will sell in diverse markets, identify factories that can manufacture orders according to the compliance conditions of the retail client, schedule production in what Alkanli describes as a "virtual factory" (a network of small independent factories that are separated ownership and geography) and organise the back-end services of quality control and distribution for the retailer. The Li & Fung supply chain is no longer a fixed entity but rather an ephemeral structure that exists, under Li & Fung organisational management, solely for the duration of a retail order. Once that order as been completed the supply chain melts away to be regenerated again, but with different factories, in response to different requirements from the retail client. Figure 1 depicts the Li & Fung business model.

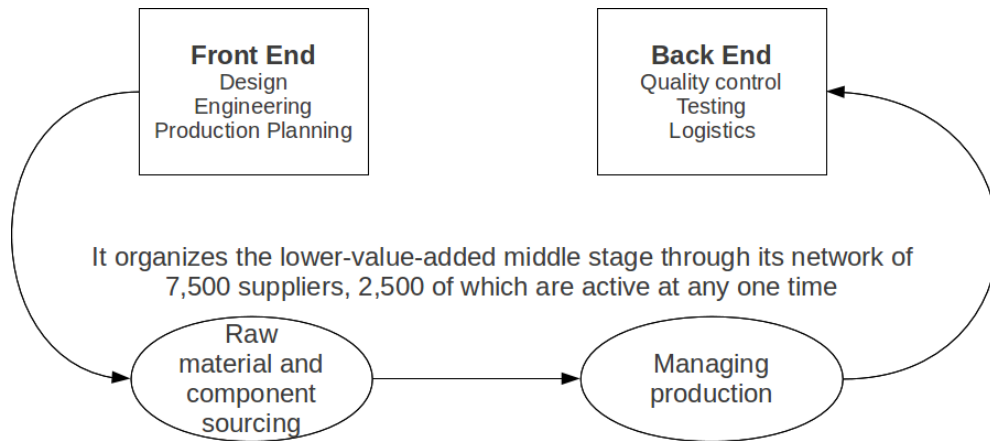


Figure 1: Li & Fung Business Model - Source: [Magretta, 2000]

The high level of integration and agility such a supply chain can achieve is imposed by the buying power asserted on behalf of the suppliers by Li & Fung. Supply chain integration is achieved through Li & Fung taking responsibility for businesses that it does not own and asserting its buying power on small factories that have no independent bargaining power with

retailers or banks (to secure letters of credit to purchase fabrics or employ staff) to satisfy sourcing contracts with retail buyers.

Li & Fung’s forced implementation of supply chain integration is in contrast to the more idealistic and olympian notion of supply chain integration described in the retail logistics literature.

3 Exploring Evidence of Integration in the Global Fashion Supply Chain

Integration and process alignment are central concepts in agile supply chain thought and practice.

Integration is a fundamental component for a network based business model [Fung et al., 2007] where ownership is dispersed among various individual companies, each providing materials, products, or services, to an integrated *value-chain*. In such systems, the "orchestration" of the network is typically governed by a dominant partner who is close to the end customer and understands their market. It is the dominant partner that asserts compliance regulations on the other, upstream, stake-holders. However, it is not clear to what extent these formal contractual arrangements have on attempts to integrate supply chain processes given the inherent market tensions that exist between *buyer* and *supplier*. Such inherent tensions typically revolve around the management of inventory. Retailers demand lean inventories and swift delivery. This is not an agenda naturally shared with manufacturers and logistics service providers. Manufacturers prefer high inventories that result from implementing economies of scale to reduce unit costs by employing long production runs, performing less re-tooling, and buying materials in bulk [Abernathy et al., 1999]. Logistics service providers are driven by opportunities to reduce costs by maximising the capacity usage of assets. Opportunities to consolidate shipments are not always in accord with the requirement for speed.

3.1 Research Instrument

A survey was devised to investigate the level of integration between different supply chain partners: *buyers*, *suppliers*, and *logistics service providers* (LSP). The responses from the survey were used to test a null hypothesis that there is no difference between the commercial interests of buyers, suppliers, and LSP when it comes to the efficient management of the global fashion supply chain. The alternative hypothesis maintained, on the other

hand, that tensions exist between buyers, suppliers, and LSP that impact on management practices and commercial interests.

The survey statements in table 1 were contrived to test each stake-holder's commitment to integration and to ascertain to what degree the notion of integration fits into the business processes of the companies.

The statements were structured to invoke a response that could be mapped onto a 5 point *Likert scale* [Bryman and Bell, 2007]. The survey respondents could *Strongly Agree*, *Agree*, *Don't Care*, *Disagree*, or *Strongly Disagree* with each statement. For analysis these categories were associated with numerical values: 1, 2, 3, 4, and 5 respectively.

The *mean* scores returned by the respondents are given and associated with each statement with a *standard deviation*. The statements are grouped into sections that query specific aspects of the respondent's connection with the agility model and the power relationship within the value-chain.

Statements 1 to 3 determine what role the respondent plays in the fashion supply chain. Statements 4 to 7 seeks to understand the market sector experienced by the respondent. The remaining statements relate to the level of integration experienced by the respondent in respect to inventory management (statements 11, 12, 13, 19, 20, and 22), demand forecasting and shared information (statements 8, 12, and 16), and strategy and perception of shared agendas (statements 9, 10, 14, 15, 17, 18, 21, 23, 24, and 25). Statement 25 postulates if the experience of the respondent is that retailers dominate the fashion supply chain.

The survey was delivered directly by email to 42 individual business contacts from fashion buying, sourcing, and logistics. Of these, 24% (10) responded with a completed survey; 2 refused to participate. The survey was also delivered, via an online survey service, to a number of fashion industry professional groups using the *LinkedIn*TM network⁶. The online survey secured a further 14 responses.

3.2 Survey Analysis

It was hoped that the 24 respondents represented a cross section of roles within the industry. Analysis was undertaken to test whether this was indeed

⁶*www.linkedin.com*. The Groups approached: Apparel Sourcing Network; China Trade Group; Fashion Retailers; Freight and Logistics Professionals; IT for Fashion; Retail Global Sourcing and Buying; Retailers Industry Management Group; Scandinavia Supply Chain and Logistics; Source the Globe; Sourcing Europe; Strategic Sourcing and Procurement; Textile, Apparel, Footwear and Fashion; The Chartered Institute of Logistics and Transport; The Logistics and Supply Chain Networking Group.

Statement #	Survey Statement	Mean	SD
1	Your company sources garments from off-shore to sell in its Western European or North American retail stores.	2.9	1.8
2	Your company supplies garments to fashion retailers in Western Europe or North America.	3.6	1.6
3	Your company is a logistics service provider for fashion garments sourced off-shore and distributed in Western Europe or North America.	3.3	1.6
4	Your company deals in high volume, low value, basic fashion garments.	2.6	1.6
5	Your company deals in high quality, high value, fashion garments.	2.6	1.3
6	Your company deals in fashion garments that are highly sensitive to volatile markets.	2.4	1.1
7	Your company deals in basic fashion garments that have buoyant consumer demand.	2.5	1.2
8	Your company frequently contacts customers to get information about market demand.	2.2	1.2
9	Your company has the ability to respond to frequent changes in Western fashion with respect to colour, textiles, and style.	2.0	1.3
10	Your company has the ability to respond to frequent changes in demand quantity.	1.9	1.1
11	Your company frequently faces the problem of overstocking or under-stocking because of demand volatility.	2.3	1.3
12	Your company conducts demand planning with its supply chain partners.	2.5	1.2
13	Your company is responsible for the management of its downstream supply chain partner's inventory and stock replenishment schedules.	3.1	1.5
14	Your company considers its suppliers as partners with whom it shares information, costs, and risks.	2.5	0.9
15	In response to falling demand and raising costs your company would seek to renegotiate prices with its suppliers.	2.0	0.8
16	Your company employs a Product Life Cycle Management System to support communication between buyer and supplier.	3.2	1.3
17	Your company uses the services of a Buying (or sourcing) Office (that employs local staff) to facilitate communication between suppliers and buyer.	3.0	1.3
18	Your company considers quality control to be the responsibility of the supplier.	2.6	1.3
19	Your company is prepared to transfer responsibility for managing inventory to its suppliers to reduce distribution costs and delivery times.	3.0	1.2
20	Your company is not prepared to transfer responsibility for managing inventory to its suppliers for fear of losing control of its response to changing market conditions and product quality.	3.0	1.1
21	Other stake-holders in the fashion supply chain are simply companies that your company buy a product or service from, or sell a product or service to, not integrated partners with whom your company share the risks and rewards of serving end-use consumers with.	2.9	1.2
22	Your company's supply chain partners have full visibility of your company's inventory levels which they use to inform their stocking decisions.	3.3	1.3
23	Your company has integrated business processes with supply chain partners to reduce operation costs, improve speed of response, and increase levels of customer satisfaction.	2.4	1.1
24	Your company considers speed of response to customer demand to be more important than cost.	2.4	1.3
25	Your company's experience is that buyers dominate the fashion supply chain and impose unreasonable compliance conditions on manufacturing and logistics service providers.	2.5	1.3

Table 1: Integration Survey Questions

the case. The analytical problem is that in the fashion industry a buyer can also have operation responsibilities that impact on logistics management, and a supplier to one customer can also be a buyer for another. In fact, 32% of the respondents in the survey had multiple roles within their organisation. This rendered the use of correlation measures, to determine degrees of consensus between members of groups representing supply chain roles, problematic. For statistical correlation to be significant there must be *variance* between the responses of buyers, suppliers, and logistics service providers [Frey, 2006]. The statistic also demands that the variable values are randomly sampled and independent. This is clearly not the case with the survey respondents.

Since the declared roles of the respondents cannot be used, a priori, to define analytical variables; *buyer*, *supplier*, and *logistics*; upon which specific supply chain *attitudes* can be attached, an *exploratory data analysis* technique must be employed [Tukey, 1980] to infer associations between supply chain roles and attitudes to the supply chain.

Tukey argued that too much emphasis in statistics is placed on statistical hypothesis testing (or *confirmatory data analysis*) and not enough on *exploring data analysis* which gives insights into what hypotheses to test. Exploratory data analysis is central to inferential disciplines such as data mining [Tan et al., 2005] and machine learning [Alpydin, 2010]. These disciplines have pioneered *cluster analysis* as a tool for categorising groups within data that share the same *attributes*.

3.3 Cluster Analysis

Cluster analysis collects similar *observations* into groups by measuring the *distance* between them and placing those *observations* that are, in some sense, *close* into the same cluster.

The assumption is that the survey data contains three distinct sets of responses to the survey statements that correlate with the three primary roles within the supply chain. To verify this assumption a *distance matrix* was generated that depicted the *distances* between all of the responses to the survey statements. It is assumed that those respondents who are involved primarily in logistics will be grouped together in the same cluster, while those respondents involved primarily in buying and supplying will build their own clusters. Furthermore, there will be some *distance* between each cluster indicating the tension between the different roles in the global fashion supply chain.

3.4 Measures of distance

The typical measure of distance employed in cluster analysis is Euclidean (or straight line) distance [Aldenderfer and Blashfield, 1984]. This is defined for two-dimensional space as:

$$distance = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2} \quad (1)$$

This distance measure is clearly based on the Pythagorean Theorem $a^2 + b^2 = c^2$.

The Euclidean distance equation 1 can be extended to handle n dimensional space by adding other dimensions to the x and y coordinates. As the survey consists of 25 statements the distance between respondents is measured in a *survey space* of 25 dimensions. The distances between respondents will range from 0, indicating that respondents are sharing the same location in the survey space, to $20 = \sqrt{(1 - 5)^2 \times 25}$, indicating the maximum distance that a respondent can be from another given a Likert scale of 1 (strongly agree) to 5 (strongly disagree).

The distance matrix is summarised in figure 2 which plots the distribution of distances between respondents.

The diagonal straight line in the quantile-quantile (Q-Q) plot indicates that there is a normal distribution of distances between respondents. The histogram confirms this showing a mean distance of 9.23 (median: 9.19; standard deviation: 1.63) with extreme distances of 3.4 (minimum) and 13 (maximum).

The interesting question is: can we associate these distances with specific roles in the supply chain? To answer this question we need to cluster responses according to distance.

3.5 Hierarchical Clustering

Hierarchical clustering algorithms [Aldenderfer and Blashfield, 1984] generate a hierarchical data structure called a *dendrogram* by recursively splitting clusters into smaller clusters using distance criteria. A *dendrogram* has some useful mathematical qualities that are derived from its tree-like structure: one of which is it easily supports visualization.

Figure 3 shows a *dendrogram* depicting the similarities of answers between respondents as clusters organised into sub-branches on an inverted tree. At level 10 in the hierarchy there are three clear sub-branches that define response clusters. We will name these clusters A, B, and C (see table 2).

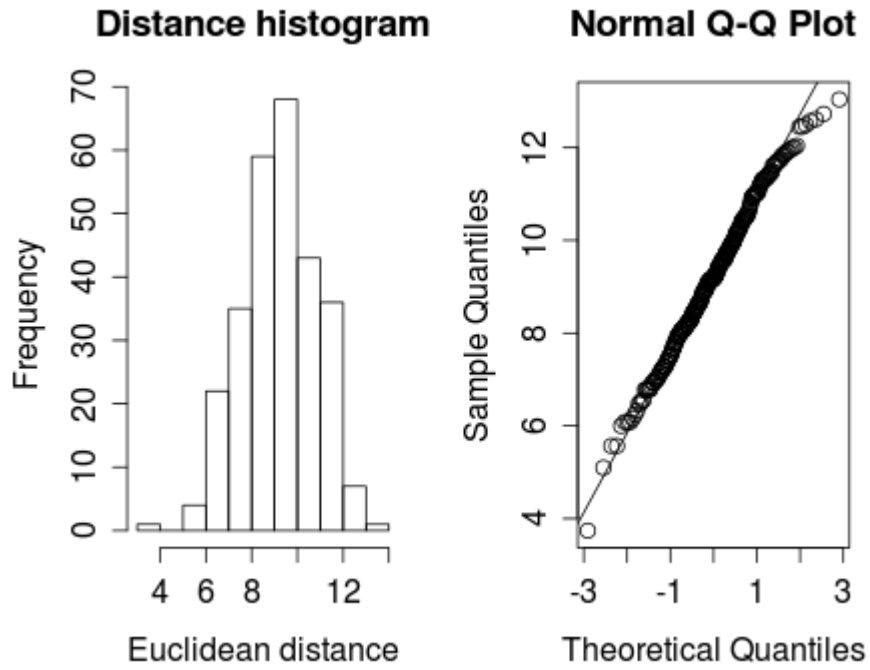


Figure 2: Distance matrix summary

Cluster	Members
A	22, 23, 4, 5
B	6,8,12,15, 1, 2, 13, 19, 3, 20
C	10, 24, 16, 21, 7, 18, 9, 17, 11, 14

Table 2:

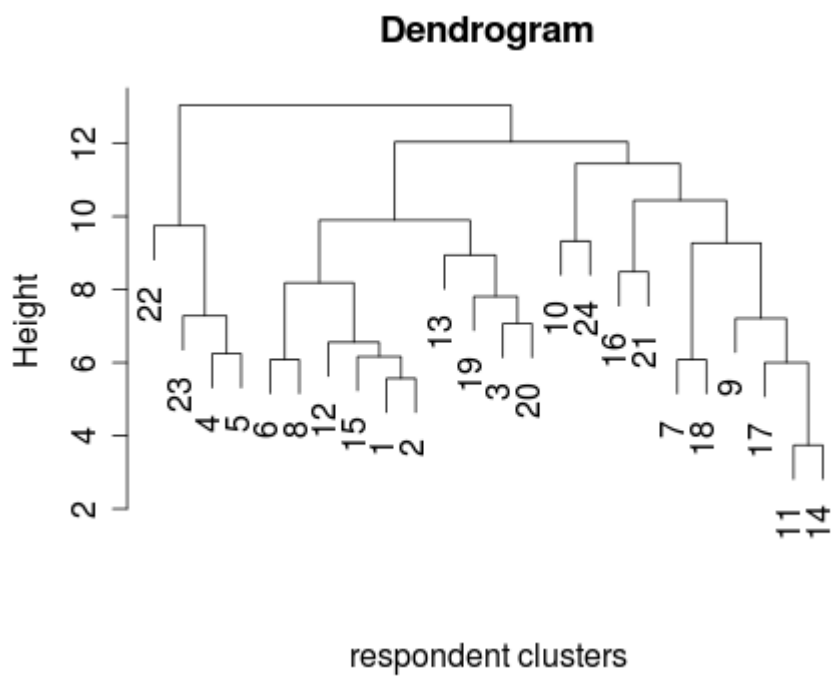


Figure 3: Dendrogram depicting respondent clusters

Declared role	Respondent ID
Buyer	1,2,3,4,5,6,8,12, 13, 15, 19, 20, 23
Supplier	3,5,6,13,19,20,22,23,24
LSP	9,10,11,13,14,16,17,18,19,21

Table 3:

	Buyer	Supplier	Logistics Service Provider
A	3(8%)	3 (33%)	0 (0%)
B	10 (77%)	5 (56%)	2 (20%)
C	0 (0%)	1 (11%)	8 (80%)

Table 4:

To confirm that these clusters are indicative of specific activities within the fashion supply chain, the cluster members must be associated with specific roles. A comparison was therefore made between the cluster members and the declared roles of the respondents. Table 3 shows the declared role of the respondents in the supply chain.

Clearly there is duplication in table 3 reflecting the multiple roles that a respondent could have in their organisation. For example, respondent 3 is both a buyer and a supplier; respondent 13 is a supplier and a logistics service provider. Such blurring of business functions is not unusual in the fashion industry with its combination of small and large enterprises. Table 4 shows the results of intersecting each declared role in the supply chain with the discovered clusters.

Table 4 is very revealing: 77% of those respondents that declared a buying role in the supply chain have been captured by cluster B, while 80% of those respondents who declared a logistics role in the supply chain have been captured by cluster C.

Furthermore, the survey responses of those who declared a supplier role in the fashion supply chain are close (in the Euclidean sense) to the responses of those who declared a buyer role. This can be explained by the prominent role of the Buying (or Production) Office [Jackson and Shaw, 2001] in the global fashion supply chain. It seems likely that cluster A has captured a unique position: the attitudes of buying office workers, the facilitators who work closely with retail fashion buyers to source products from overseas manufacturers. This may also explain, given the sample source, the 56% of 'suppliers' within cluster B. Nonetheless, hierarchical cluster analysis has identified a significant measurable distance between the position of buyers and logistics service providers with the international fashion supply chain.

3.6 Principal Component Analysis

The detected distance between buyers and logistics service providers suggests the existence of *variance* within the responses that can be mapped onto specific survey statements to expose the principal components that distance the two groups from each other.

Principal Component Analysis (PCA) is an appropriate tool for dimensionality reduction in multivariate problems [Venables and Ripley, 2002]. The idea is to reduce the set of 25 statements in the survey to a smaller set of *principal components* that summarise the tensions; which were discovered by cluster analysis; between buyers and logistics service providers. PCA reduces the complexity of a multivariate problem by iteratively applying the *spectral decomposition theorem*, from linear algebra [Jolliffe, 2002] to matrix representation of the data to discover degrees of variance in the responses.

High variance will occur when buyers and logistics service providers have the same spread of agreement or disagreement on a survey statement (which will support tensions), or when their responses strong diverge. In contrast, variance will be weak when buyers and logistics service providers strongly agree, or disagree, with each other with respect to a survey statement.

Responses to statements 13, 16, and 15 in Figure 4 respectively illustrate each of these cases of variance in the responses. The measure of variance will help us identify where buyers and logistics service providers diverge from the principle of supply chain integration, or when buyers and logistics service providers both disagree with equal disdain on an issue critical to good integration practice.

PCA was applied to the buyers' and logistics service providers' responses to survey statements 4 to 25, thereby removing the response to the statements about supply chain role. Principal component analysis showed no one principal component dominating the results; only 34% of the proportion of variance is explained by the largest two principal components. A Biplot [Gabriel, 1971] visualises the results of the PCA analysis and provides insights into which survey statements framed the principal components.

The relevant information in figure 5 is the length and direction of the arrows that represent the original variables (survey statements). The biplot allows us to see how the original variables relate to the first two principal components and to each other: if any of the survey questions are approximately aligned with the horizontal (or vertical) axis, then they are approximately aligned with the first (or second) largest principal component. This allows us to see which of the survey statements contribute to the largest principal components: PC1 and PC2. This provides insights into the nature of the component, which might in turn provide insight into those key survey state-

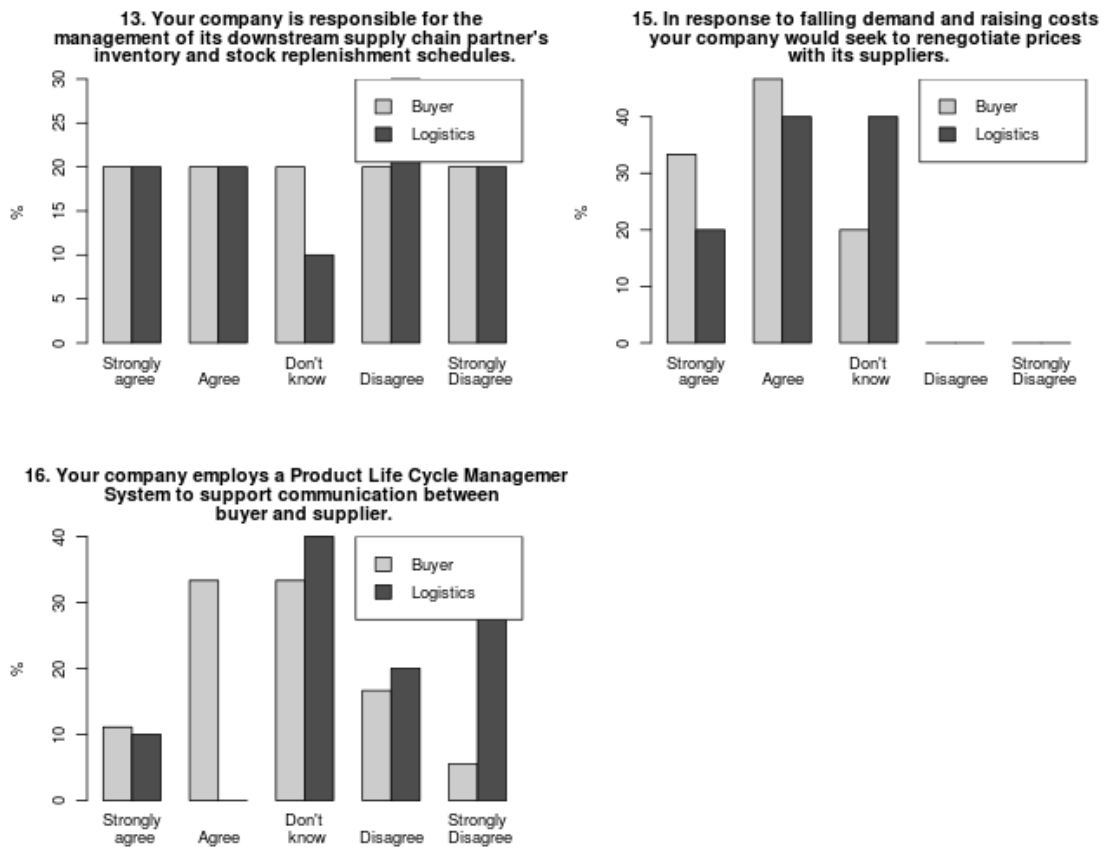


Figure 4: Examples of agreement and disagreement between buyers and logistics service providers

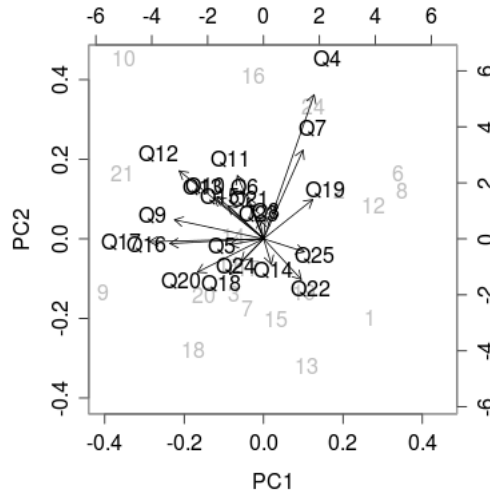


Figure 5: Biplot of PCA results. The numbers correspond to the respondents ID projected onto the plane spanned by the two largest principal components. Also shown are the original variables (survey statements) projected into the same plane.

ments that provoked the response from buyers and logistics service providers. Furthermore, any of the survey statements that are roughly redundant will show up, more or less, parallel to each other in the biplot. The length of the arrow is an indicator of proportion of variance.

Statements 9, 16, 17, and 25 are, more or less, aligned with PC1. Interestingly, these statements are related to strategy and operations management. However, we should be careful in our interpretation: the scattering of original variables in Figure 5 suggests that non principal component dominates the results. What is indicative of poor supply chain integration is when both buyers and logistics service providers give high scores to processes that are in conflict with good integration practice. The response to statement 15, for example, (see Figure 4) showed that both buyers and logistics service providers would be prepared to renegotiate prices (i.e. push costs up, or down, stream) in response to falling demand or raising costs.

Nonetheless, it should be acknowledged that the survey identified operational practices indicative of strong alignment between supply chain partners. See the responses to statements 8 and 10 (Figure 6) for example.

The extend by which the agility agenda has been adopted by the fashion industry was further ascertained by analysing the frequency of agility and supply chain integration discussions in fashion business periodicals and web

sites.

3.7 Text Mining

3.7.1 Research design

Analysis of fashion business news reports was undertaken to ascertain the extent to which the agile supply chain research agenda has penetrated business practice. A hundred fashion business news articles were randomly sampled from the *just-style.com* web-site and analysed, using text mining techniques ??, to extract reports that describe the implementation of agile supply chain practices. *Just-style* is the fashion industry's leading online business intelligence resource. The organisation employs a network of international analysts to provide insights and business intelligence for senior executive within the fashion industry. Since 1999, just-style has established a reputation for delivering independent, authoritative and timely business information. Just-style reports and interprets the apparel and textile industry's key events and trends publishing up to 20 major stories, comment and analysis articles and interviews each working day ⁷.

A lexicon of 111 supply chain management words and phrases was devised and mapped against the 100 *just-style* articles to extract any text that discussed agile supply chain practices. The lexicon consisted of words and phrases that would capture discussions relating to agility (*integration, alignment, market sensitivity, quick response, network orchestration, virtual manufacturing, ...*), sourcing (*sourcing territories, buying office, lead-time, trade regulations, ethics, labour costs,..*), logistics (*inventory, transport, shipping routes, distribution networks, environmental impact, sustainability,..*), and retailing (*markets, brands, consumer behaviour, promotions, economy, products, merchandise,..*).

A regular expression parser was implemented (see APPENDIX B) in the open source Python programming language ⁸ to generate a frequency matrix that summarised the occurrence of the business themes that dominate the just-style articles.

3.7.2 Text analysis

Interestingly, the terms associated with supply chain agility and integration were not used in any of the articles; no mention is made of concepts such as

⁷just-style.com

⁸www.python.org

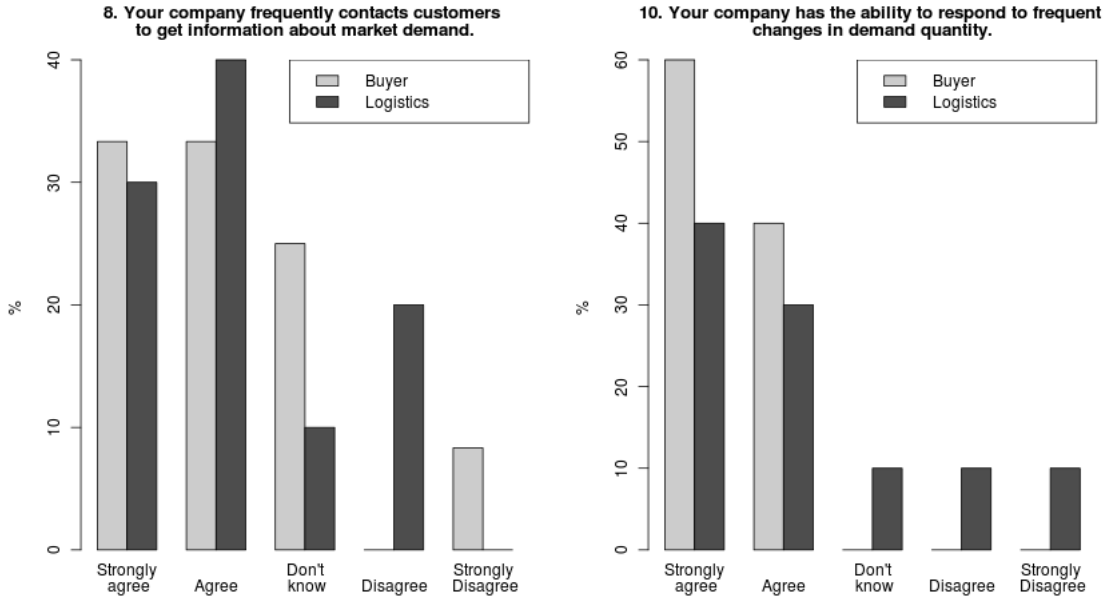


Figure 6: Examples of supply chain alignment

process alignment, supply chain integration or lead-time reduction strategies. The dominating themes of the *just-style articles* is depicted in table 5.

The *just-style* articles are dominated by Asian territories, either in the context of sourcing regions or emerging markets. These articles are typically addressing concerns about costs or financial performance of individual companies. From the *just-style* reports, costs, commodity prices, and product design are a major concern of the industry. The industry is also clearly driven by preferential trade agreements between regions and currency exchange rates. The deployment of IT systems, such as Project Life Cy-

Theme	Coverage
Asian sourcing countries and emerging markets	18.65%
Technology	9.35%
Cost and commodity prices	8.71%
Product (design, merchandising)	7.88%
Trade initiatives	5.53%
Strategy	1.07%

Table 5: The dominating themes of *just-style* articles

cle Management (**PLM**) software, is of particular interest to the industry. Strategy is rarely discussed. Interestingly, the word "logistics" and the phrase "supply chain managements" are explicitly used 68 times in 28 articles, but typically in the context of technology deployment and costs. The concerns of operations managers; inventory, vendor management issues, distribution, etc.; are rarely discussed, and then only in the context of retail concerns.

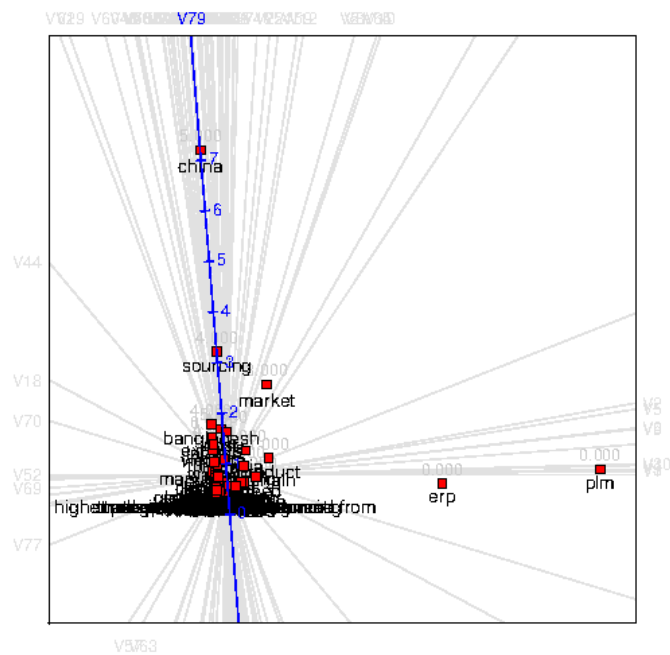


Figure 7: Biplot depicting principal components of *just-style* text

Furthermore, principal component analysis [Gabriel, 1971] (see biplot 7), applied to the frequency matrix, indicates that 80% of the *variance* in the extracted *just-style* articles (represented by the two largest components) is explained by the Asian and technology themes that dominate the articles.

If the *just-style* articles reflect the concerns of the industry, then it seems that the industry is driven by sourcing costs and the opportunities afforded by emerging markets. It would seem from the articles that the responsiveness of the supply chain is best addressed by investment in product life cycle technology not "good practice".

The opportunities to push costs upstream is also a recurring theme in the *just-style* articles. An article published on the 22nd November 2011 by Petah Marian reported a row between *Marks and Spencer* and its major suppliers. M&S had asked its major suppliers to pay 1.25% of their annual sales with the retailer towards its store revamp programme. The article reports that one of M&S's major suppliers has refused to contribute towards the M&S revamp of stores [Marian, 2011]. Issues of sustainability and cost have also highlighted tensions between retailers and suppliers that have put the *integration research agenda* into doubt:

Using the platform of Sri Lanka's annual design festival, which was held for the third time last week and aims to showcase the country's emerging potential as a design centre, one of Sri Lanka's biggest apparel exporters, Brandix Lanka, called on international buyers to "walk the talk" on sustainable production. Brandix noted that while international apparel brands talk of ethical garment production, orders are still placed on the basis of lowest cost. "Retailers have been pushing the concept of sustainability and ethical manufacturing but when it comes to buying, they only look through the lens of price," said Ashroff Omar, chairman of Brandix Lanka. Speaking at the South Asian Leadership Forum, a discussion forum with international apparel industry participation, held on Friday (18 November) as part of the Sri Lanka Design Festival, he added: "I am not saying retailers should pay higher prices for green products, but retailers should differentiate green and non-green products and reward green manufacturers through other, non-price based, methods." Over the last few years many Sri Lankan apparel manufacturers have made their factories more environmentally friendly. The sector has also tried to turn Sri Lanka's strong labour laws to its advantage by presenting Sri Lanka as an ethical apparel manufacturing destination. Its 'Garments Without Guilt' positioning revolves around these qualities of ethical and environmentally sustainable production. In an industry that is noted for being exploitative because of its preference for poor countries with low wages, Sri Lanka's Garments Without Guilt concept was expected to give an advantage for made-in-Sri Lanka clothing. Now however, with western markets running into economic difficulties and the pressure growing for lower costs, the sustainability of this strategy is being questioned. The higher costs of going green and offering better working conditions are being seen as an unaffordable luxury

for a small developing country emerging from nearly 30 years of war. The industry is also struggling with labour shortages as Sri Lanka's educated young women look for better paid work with higher social standing than 'garment girl' jobs. But Mr Omar, who says Brandix is converting two more of factories into green facilities, says the idea is still commercially viable, despite the costs involved. "We are not hung up on a do-gooder mentality. Any venture must be commercially viable. Although it's more expensive to go green, in the longer term a green factory is much cheaper than a non-green one," he says. Competitive advantage challenge The difficulty though, is how to turn sustainability into a competitive advantage in a cost focused market, where a few cents' difference can push away or pull in an order. Omar, one of Sri Lanka's leading industrialists, maintains that international buyers should see ethical, or green garments, as a value addition that meets increasing consumer demand for sustainable manufacturing. "If a green factory can supply at the same price as a non-green one, then place the orders with the green factories. So the green factories will benefit from higher volumes but the retailer will not pay more for green products that are more sustainable environmentally," he says. How buyers react to this pitch remains to be seen. This year, despite difficult economic conditions in Western markets, Sri Lankan apparel exports have risen 45% in 2012. But with business likely to get worse before it gets better, the industry is looking at ways of communicating directly with end consumers - to strengthen its bargaining position with buyers. As industry representatives point out, if more consumers are educated to ask specifically for green goods from Sri Lanka, retailers would be forced to place orders with eco-friendly Sri Lankan factories, instead of moving to other supply destinations that only offer a low cost advantage. Sri Lanka makers urge retailers to back green garments. [Samaraweera, 2011]

Further examples indicating tensions between retail and manufacturing interests from *just-style* reporters can be given; however, these tensions are clearly indicated in the textural analysis of the articles given above.

4 Conclusion

The research project attempted to understand the relevance of the agility research agenda in post 2008 fashion logistics. The literature relating to agility and supply chain integration is heavily biased towards the interests of retailers, it deemed appropriate to ask if that research agenda was still applicable in an era that exhibits increasing supply costs [Dalziel, 2010]. While the agility model, advocated by Christopher et al. [Christopher et al., 2009], is a theoretical model that describes "best practice", the language of agility has been adopted by suppliers and logistics service providers as a marketing tool to attract orders from buyers from powerful fashion retail brands. Logistics service providers typically cite *integration* and *quick response* in their promotional material to gain an edge over rivals in a highly competitive logistics market (see citepduffy2011). The use of conceptual models as marketing tools confound the academic pursuit of discovering knowledge. To circumvent the commercial obstacles and understand actual operational practices a field trip was undertaken to Istanbul in Turkey to interview key suppliers to UK fashion retailers. On this field trip an interview was held with Bulent Alkanli, Vice President Li & Fung, Turkey, to understand the role of integration in Li & Fung's supply chain model. The information from that interview was used to structure a sourcing and distribution survey that was delivered, via an online survey service, to key retail, supply and logistics service provider decision makers in the global fashion supply chain (responses to that survey are given in APPENDIX A).

The response to the survey was disappointing; only 24 replies, this no doubt was because the survey was only delivered in English and not in the languages of many supplying nations. It would, in retrospect, have been beneficial to have the survey translated into the languages of Turkey and South-East Asia. Nonetheless, the data from the survey allowed exploratory data analysis techniques to be employed that identified tensions in the relationships between supply chain stake-holders. These tensions were also confirmed by textual analysis of articles from the trade journal *just-style*.

4.1 Future Research

Hopefully, the research has illustrated that *agility* and *integration* are not particularly interesting academic research agendas for contemporary fashion retail logistics. A more relevant research agenda should focus on the distribution of profit, cost and risks between different stake-holders in the global fashion supply chain. To initiate this agenda a conference is planned for Easter 2012 on emerging supply chain models and strategies in fashion lo-

gistics. That conference will be the foundation of a new textbook (currently being planned with Berg Publishing⁹) on fashion logistics in the post 2008 era. Jon Spragg has also secured further funding from MIRIAD¹⁰ to construct simulation models of fashion supply chains to investigate the feasibility of *vendor managed inventories* for the delivery of fast fashion garments.

5 Acknowledgement

This research project has been carried out on behalf of, and with funding from, the Chartered Institute of Logistics and Transport (UK), as part of its Academic Seed Corn funding programme.

⁹www.bergpublishers.com/

¹⁰www.miriad.mmu.ac.uk

Bibliography

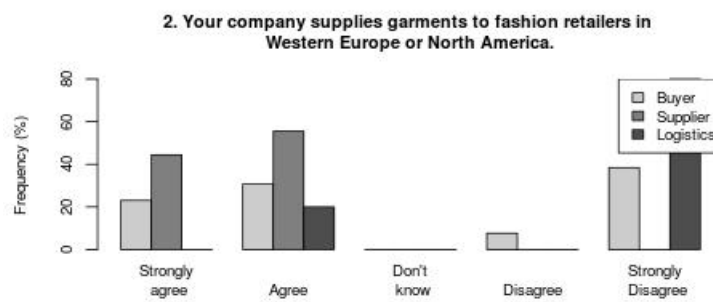
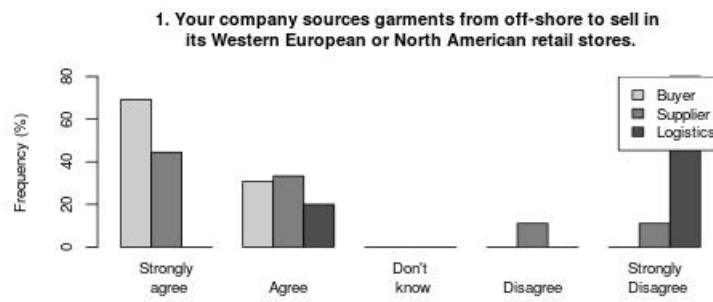
- F. Abernathy, J. Dunlop, J. Hammond, and D. Weil. *A Stitch in Time, Lean retailing and the transformation of manufacturing - Lessons from the apparel and textile industries*. Oxford University Press, 1999.
- M. Aldenderfer and R. Blashfield. *Cluster Analysis*. Sage University Press, 1984.
- E. Alpydin. *Introduction to Machine Learning*. MIT Press, 2010.
- M. Bruce and L. Daly. Buyer behaviour for fast fashion. *Journal of Fashion Marketing and Management*, 10(10):329–344, 2006.
- A. Bryman and E. Bell. *Business Research Methods*. Oxford Press, 2007.
- M. Christopher. *Logistics and Supply Chain Management: Creating value-adding networks*. Prentice Hall, 2005.
- M. Christopher and H. Peck. *Marketing Logistics*. Elsevier, second edition edition, 2004.
- M. Christopher, R. Lowson, and H. Peck. Creating agile supply chains in the fashion industry. www.martin-christopher.info/downloads/.
- M. Christopher, B. Lowson, and H. Peck. *Fashion logistics and Quick Response*, chapter 5, pages 102–120. Kogan Page Limited, 3rd edition, 2009.
- A. Dalziel. Evolving business models in the textile and apparel industry. *Textile Outlook International*, 2010.
- P. Doeringer and S. Crean. Can fast fashion save the us apparel industry? *Socio-Economic Review*, 2006.
- K. Ferdows and M. Lewis. Rapid-fire fulfillment. *Harvard Business Review*, 2004.

- B. Frey. *Statistics Hacks, Tips and Tools for Measuring the World and Beating the Odds*. O'Reilly Press, 2006.
- V. Fung, W. Fung, and Y. J. Wind. *Competing in a Flat World. Building Enterprises for a Borderless World*. Wharton School Publishing, 2007.
- K. Gabriel. The biplot graphical display of matrixes with application to principal component analysis. *Biometrika*, 58:453–467, 1971.
- P. Ghemawat and J. L. Nueno. Zara: Fast fashion. Technical report, Harvard Business School, 2006.
- T. Hines. *Supply Chain Strategies: Customer-driven and customer-focused*. Elsevier, Butterworth Heinmann, 2004.
- T. Jackson and D. Shaw. *Mastering Fashion Buying & Merchandising Management*. Palgrave Master Series, 2001.
- I. Jolliffe. *Principle Component Analysis*. Springer, second edition, 2002.
- S. Linguri. Zara, responsive, high speed, affordable fashion. Technical report, London Business School, 2006.
- J. Magretta. *Fast, Global, and Entrepreneurial: Supply Chain Management, Hong Kong Style. An Interview with Victor Fung*, chapter 2, pages 29–59. Harvard Business School Press, 2000.
- P. Marian. Uk: Suppliers refuse to pay for m&s store revamp - reports. Just-Style.com, November 2011.
- D. Samaraweera. Sri lanka makers urge retailers to back green garments. Just-Style.com, November 2011.
- J. Spragg and G. Kelleher. A discipline for reactive scheduling. In D. Drabble, editor, *Proceedings 3rd International Conference on Artificial Intelligence Planning Systems*, pages 199–204. AAAI Press, 1996.
- P. Tan, M. Steinbach, and V. Kumar. *Introduction to Data Mining*. Pearson Education, 2005.
- N. Tokatli. Global sourcing: insights from the global clothing industry – the case of zara, a fast fashion retailer. *Journal of Economic Geography*, 8: 21–38, 2008.

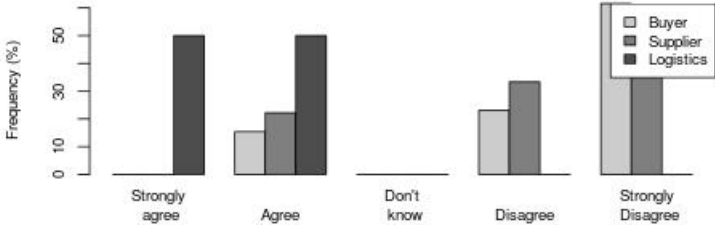
- N. Towers and J. Bergvall-Forsberg. *Agile merchandizing in the European textile fashion industry*, chapter 6, page 121140. Kogan Page Limited, 3rd edition, 2009.
- J. Tukey. We need both exploratory and confirmatory. *The American Statistician*, 1980.
- N. Venables and B. Ripley. *Modern Applied Statistics with S*. Springer-Verlag, 2002.

6 APPENDIX A

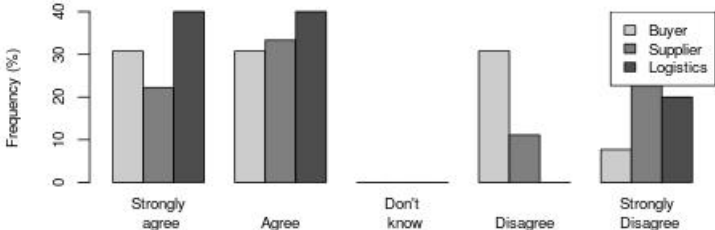
6.1 Sourcing and Distribution Survey Results



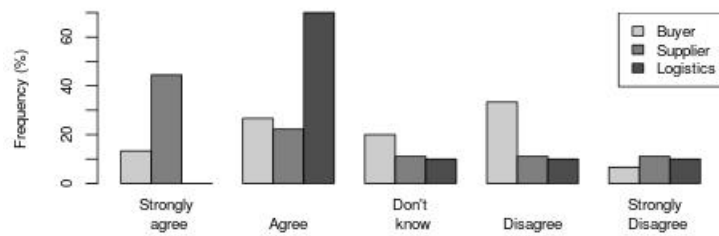
3. Your company is a logistics service provider for fashion garments sourced offshore and distributed in Western Europe or North America.



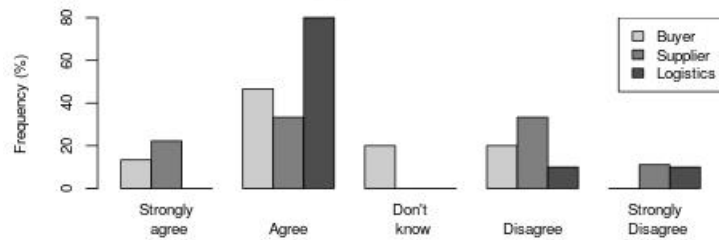
4. Your company deals in high volume, low value, basic fashion garments.



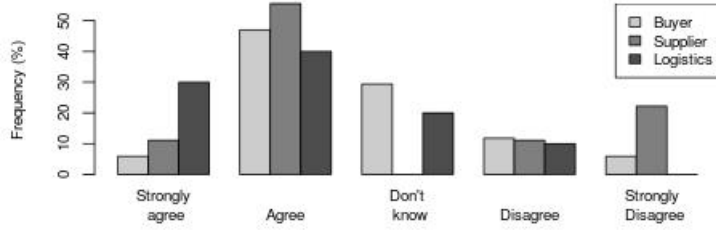
5. Your company deals in high quality, high value, fashion garments.



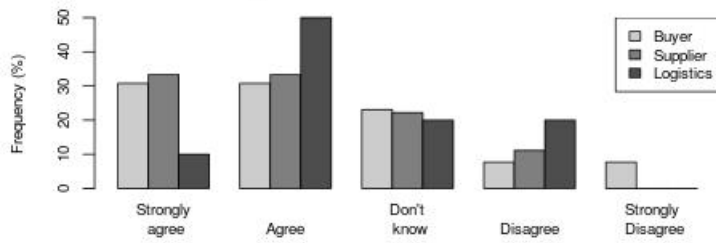
6. Your company deals in fashion garments that are highly sensitive to volatile markets.



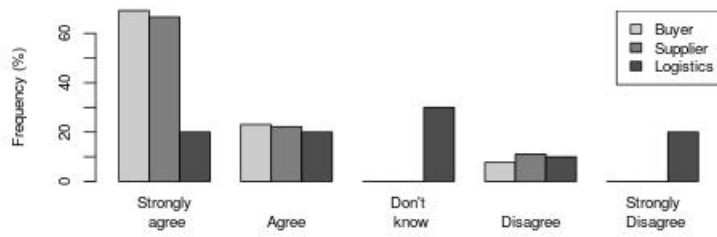
7. Your company deals in basic fashion garments that have buoyant consumer demand.



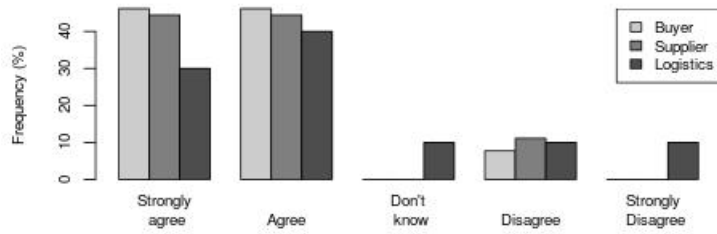
8. Your company frequently contacts customers to get information about market demand.



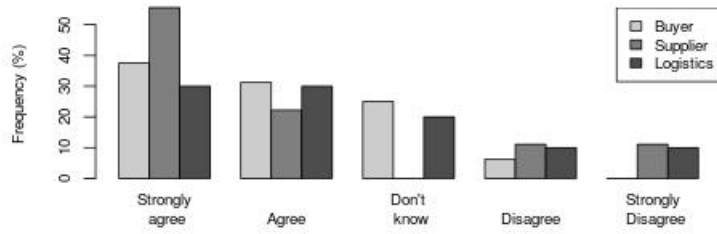
9. Your company has the ability to respond to frequent changes in Western fashion with respect to colour, textiles, and style.



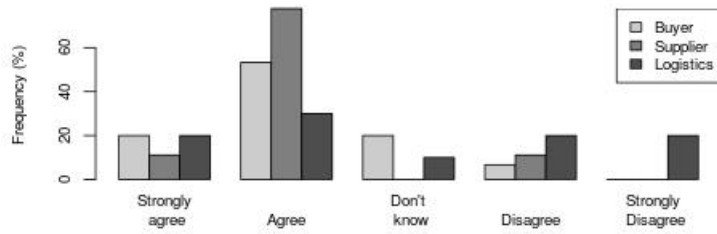
10. Your company has the ability to respond to frequent changes in demand quantity.



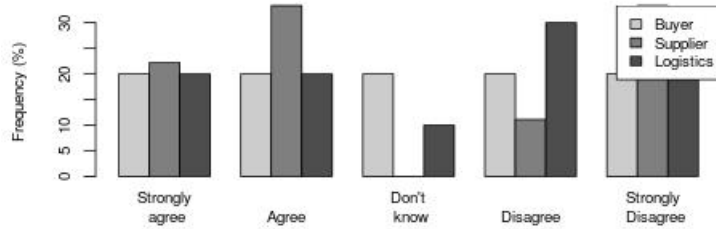
11. Your company frequently faces the problem of overstocking or under-stocking because of demand volatility.



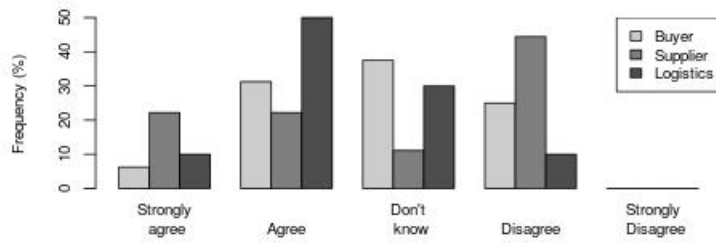
12. Your company conducts demand planning with its supply chain partners.



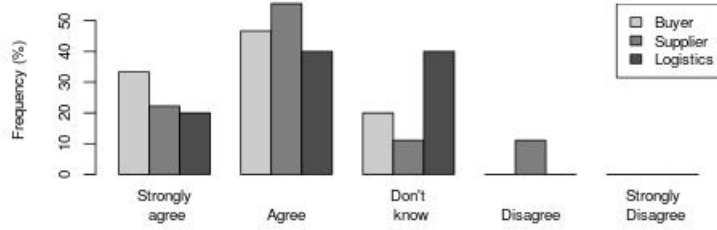
13. Your company is responsible for the management of its downstream supply chain partner's inventory and stock replenishment schedules.



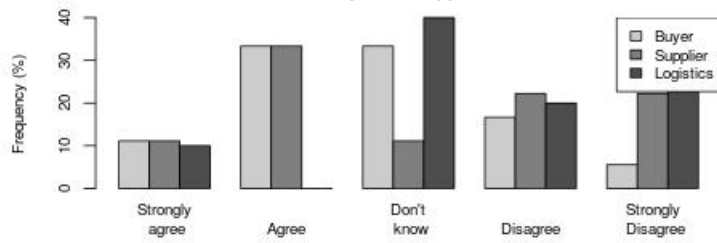
14. Your company considers its suppliers as partners with whom it shares information, costs, and risks.



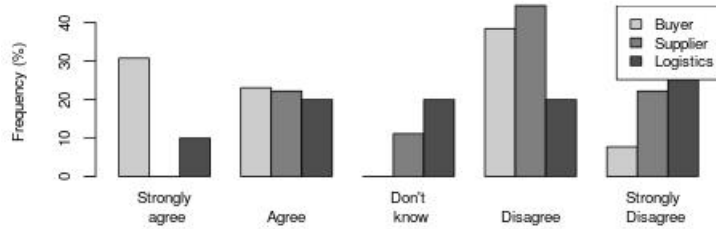
15. In response to falling demand and raising costs your company would seek to renegotiate prices with its suppliers.



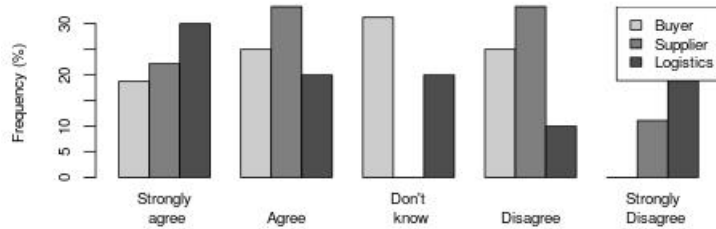
16. Your company employs a Product Life Cycle Management System to support communication between buyer and supplier.



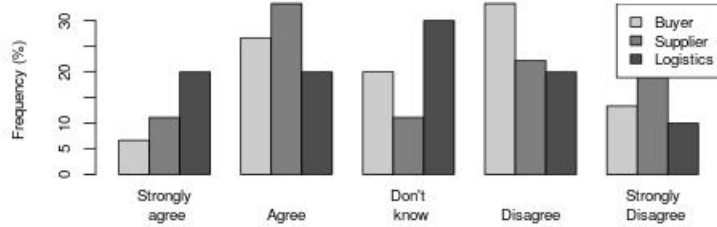
17. Your company uses the services of a Buying (or Sourcing) Office (that employs local staff) to facilitate communication between suppliers and buyer.



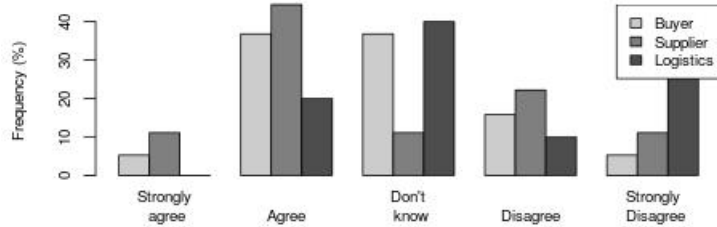
18. Your company considers quality control to be the responsibility of the supplier.



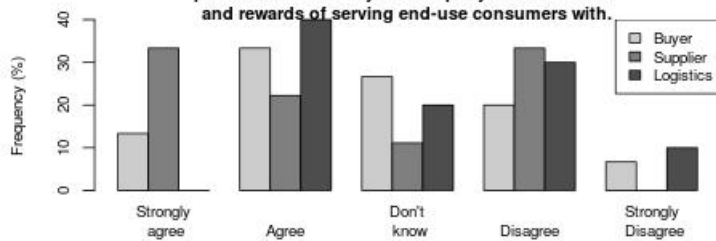
19. Your company is prepared to transfer responsibility for managing inventory to its suppliers to reduce distribution costs and delivery times.



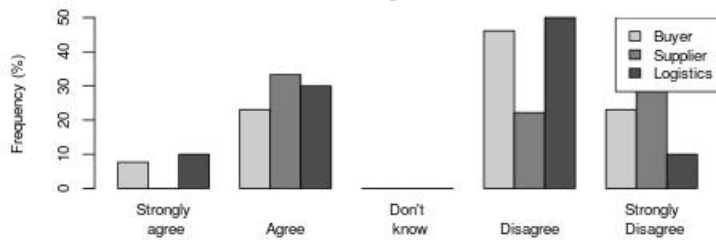
20. Your company is not prepared to transfer responsibility for managing inventory to its suppliers for fear of losing control of its response to changing market conditions and product quality.



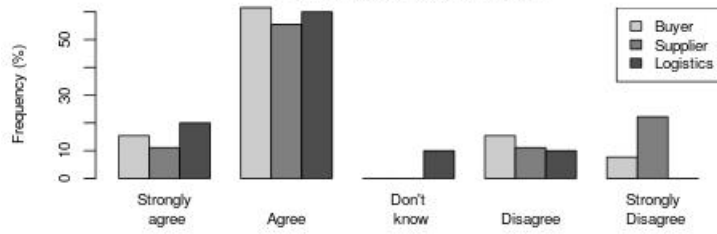
21. Other stake-holders in the fashion supply chain are simply companies that your company buy a product or service from, or sell a product or service to, not integrated partners with whom your company share the risks and rewards of serving end-use consumers with.



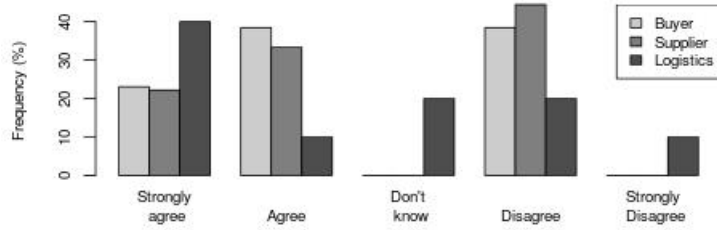
22. Your company's supply chain partners have full visibility of your company's inventory levels which they use to inform their stocking decisions.



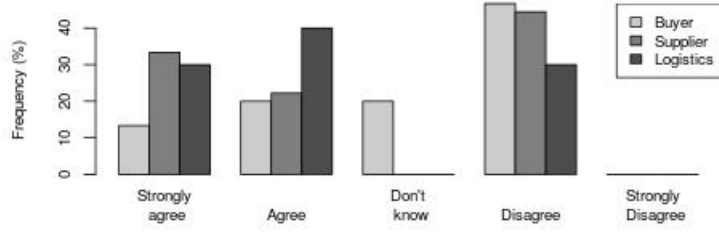
23. Your company has integrated business processes with supply chain partners to reduce operation costs, improve speed of response, and increase levels of customer satisfaction.



24. Your company considers speed of response to customer demand to be more important than cost.



25. Your company's experience is that buyers dominate the fashion supply chain and impose unreasonable compliance conditions on manufacturers and logistics service providers.



7 APPENDIX: B

7.1 Python code for extracting agility themes from *just-style* articles

```
import re
import os
import csv

def makeDict():
    return { "integration" : 0, "lean": 0, "agile" : 0,
            "agility" : 0, "inventory" : 0, "stock" : 0, "risk" : 0,
            "vendor" : 0, "forecast" :0,"retailer" : 0, "retail" : 0,
            "m&s" : 0, "h&m" : 0, "zara" : 0, "li & fung" : 0, "l&f": 0,
            "agent" : 0, "new look" : 0, "supply chain" : 0,"erp" : 0,
            "logistics" : 0, "distribution" : 0, "cost" : 0,
            "sustainable" : 0, "plm" : 0, "supplier" : 0,
            "profit" : 0, "alignment" : 0, "market" : 0,
            "supplier incentives" : 0, "speed" : 0, "fast-fashion" : 0,
            "manufacturing" : 0, "factory": 0, "quick response" : 0,
            "customer" : 0, "dhl": 0, "fast fashion" : 0,
            "postponement" : 0, "sourcing" : 0, "low cost sourcing" : 0,
            "china" : 0, "asia" : 0, "turkey" : 0, "cambodia" : 0,
            "vietnam" : 0, "east europe" : 0,
            "ups" : 0, "north america" : 0, "mexico" : 0,
            "3pl" : 0, "third party logistics" : 0,
            "primark" : 0, "emerging market" : 0,
            "strategic approach to sourcing" : 0,
            "strategic sourcing" : 0, "integration of" : 0,
            "product" : 0, "lead-times" : 0,
            "responsiveness" :0, "flexibility" : 0,
            "overseas office" : 0, "aligned" : 0,
            "global sourcing" : 0, "planning" : 0, "plan" : 0,
            "trade promotion agreement" : 0,
            "trade preference programme" : 0, "time to market" : 0,
            "bangladesh" : 0, "higher prices for products sourced from" : 0,
            "pdm" : 0,"cotton prices" : 0, "wal-mart" : 0, "egypt" : 0,
            "courtaulds" : 0, "eco-factories" : 0, "sri lanka": 0,
            "brandix" : 0, "mas holdings" : 0, "green" : 0,
            "water usage" : 0, "wages" : 0,
            "environment" : 0, "incentives" : 0, "india" : 0,
```

```

"pakistan" : 0,
"export promotion" : 0, "labour" : 0, "greenbox" : 0,
"brand" : 0, "designing" : 0,
"design" : 0, "designers" : 0, "shipping" : 0,
"exports" : 0, "imports" : 0,
"profit sharing" : 0, "demand management" : 0,
"assortment planning" : 0,
"merchandising" : 0, "merchandizing": 0,
"supplier relationship management" : 0,
"customs" : 0, "sweatshop" : 0, "sweatshops" : 0,
"africa" : 0, "petroleum" : 0,
"fuel" : 0, "gas" : 0, "network" : 0 }

```

```

pattern = r"""\b(Egypt|emerging\s+market|asia|
china|turkey|cambodia|vietnam|ups|north\s+america|primark|mexico|
east\s+europe|retailer|retail|M&S|H&M|Zara|Li\s+&\s+Fung|agent|
New\s+Look|supply\s+chain|logistics|distribution|cost|
sustainable|plm|supplier|profit|
Speed|fast[\-\s+]fashion|manufacturing|factory|
forecast|supplier\s+incentives|quick\s+response|
customer|erp|dhl|alignment|market|postponement|
sourcing|low\s+cost\s+sourcing|3pl|
third\s+party\s+logistics|strategic\s+approach\s+to\s+sourcing|
strategic\s+sourcing|
integration\s+of|product|lead[\-\s+]time[s\s+]|
responsiveness|flexibility|overseas\s+office|
aligned|global\s+sourcing|planning|plan|
Trade\s+Promotion\s+Agreement|trade\s+preference\s+programme|
time\s+to\s+market|Bangladesh|
higher\s+prices\s+for\s+products\s+sourced\s+from|
cotton\s+prices|
Wal-Mart|Courtaulds|eco-factories|Sri\s+Lanka|Brandix|
MAS\s+Holdings|shipping|incentives|India|Pakistan|Green|
Water\s+usage|wages|labour|Greenbox|brand|designing|
design|designers|environment|export\s+promotion|PDM|
exports|imports|profit\s+sharing|demand\s+management|
assortment\s+planning|merchandi[sz]ing|
supplier\s+relationship\s+management|
Customs|sweatshop[s\s+]|Africa|gas|fuel|petroleum|
network|L&F)\b""

```

```

data_dir = '/home/jspragg/Development/python/
DataMining/TextMining/data/'

def analyseDoc():
    result = []
    p = re.compile(pattern, re.IGNORECASE +
re.VERBOSE + re.LOCALE)
    for n in range(1,81):
        doc = "doc" + str(n) + ".txt"
        doc_file = os.path.join(data_dir, doc)
        text = open(doc_file).read()
        d = processResult(p.findall(text,
re.IGNORECASE + re.VERBOSE + re.LOCALE))
        result.append(d)
    writeCSV( result )

def processResult(l):
    d = makeDict()
    for i in l:
        il = i.lower()
        if (d.has_key(il)):
            d[il] += 1
    return d

def writeCSV(d):
    datafile = os.path.join(data_dir,
"matrix.csv")
    csv_file = csv.writer(open(datafile, 'w'),
delimiter=',')

    ks = sorted(d[0].keys())
    row = []
    for k in ks:
        row.append(k)
    csv_file.writerow(row)
    for c in d:
        row = []
        for k in ks:
            v = c[k]
            row.append(v)
        csv_file.writerow(row)

```

```
print("Done!\n")

if __name__ == '__main__':
    analyseDoc()
```