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RESEARCH ARTICLE

The Relative Emphasis on Supply Chain / Logistics Topics by UK Industry in Hiring Postgraduates and by UK Universities in Teaching and Research

Abstract

We examine how UK universities view different topics within supply chain management as seen in their research output and their post-graduate curricula and whether this view matches the relative emphasis on these aspects by UK-based employers when hiring. Using content analysis, we analysed: (1) UK-based supply-chain/logistics job ads, (2) abstracts of research articles by UK academics in supply-chain/logistics journals, and (3) the description of the postgraduate level supply-chain/logistics degrees in UK universities. Our findings show that the overall research output of UK universities is broadly in line with employers' needs with regards to the relative emphasis on different supply-chain topics. However, their relative emphasis on these topics in their teaching programmes is quite different. We suggest that universities need to look into their provision of academic programmes in relation to employers' needs and need to look into how to leverage their research output better for this purpose.

Keywords: Postgraduate programmes, Supply Chain / Logistics, Employer needs, Job advertisements, UK.

1   Introduction

In general, postgraduate (Masters) programmes in logistics and / or supply chain management (SCM) programmes are expected to supply the knowledge and skills demanded by industry. Many empirical studies have explored the actual skill sets needed by industry regarding SCM and logistics professionals. Some of these studies have suggested that existing SCM education does not meet adequately the needs of the industry (cf. Mangan *et al.*, 2001). However, questions persist about evidence being only from one side (mostly employers) and about the granularity in the empirical evidence needed for universities to make practical changes.

Focusing on the UK, we consider both employers and universities, taking into account that universities have research output in addition to their teaching provision. We seek to understand what employers in the UK seek from graduates of postgraduate taught SCM/logistics programmes in relation to different supply chain topics. This being the 'demand' side for skills, next, we seek to understand the 'supply' side, i.e. the provision of research output and teaching for SCM by UK universities.

We consider different supply-chain topics (Johnson and Pyke, 2000) and seek to understand this 'demand' and 'supply' in terms of the relative emphasis on different supply chain topics by analysing the text of: (1) employer needs as described in their job advertisements (ads), (2) research output as captured in articles written by UK-based academics in leading logistics and supply-chain-focused journals, and (3) the descriptions of university programmes. Thus we seek to examine the triangle of practice, research and teaching of supply chain topics in the UK context.

Our approach employs content analysis following Sodhi and Son (2010), who focus on the text of job ads, and we analysed the text of 821 supply chain and logistics job

ads in the UK: this is the 'demand' side. On the 'supply' side by way of the teaching output of UK universities, we looked at the descriptions of university postgraduate taught programmes in the manner of Sodhi *et al.* (2008) and analysed 25 UK university SCM and logistics-related postgraduate programmes. The other output of universities is research and we analysed the text of the abstracts of 221 articles from six major and well-established logistics and SCM journals. These analyses provided the relative emphasis on the different supply-chain topics for employer needs, research output and teaching programmes, which we then compare with each other.

Our contribution to the literature is that we compare the relative emphasis on supply chain and logistics topics in practice, research and teaching. To our knowledge, this is the first research effort where an examination of all three is attempted together in relation to logistics and SCM issues, and possibly in the broader management field.

Our results indicate that research by UK academics is broadly in line with employers' needs in regards to the relative emphasis on supply chain topics. On the other hand, the taught postgraduate programmes, seem to emphasize topics different from those reflected by current industry-hiring needs insofar as we can infer from detailed course descriptions.

2   Literature Review

As supply chains grow in scope and complexity (Melnyk et al., 2009), there is a growing need for highly skilled logistics and supply chain professionals (Thai *et al*., 2011). Christopher (2012) notes that complexity has created the need to develop professionals equipped with a broad skills-profile and, likewise, Carter and Carter (2007) stress that attracting such professionals is key for the success of a company facing this complexity and uncertainty. This in turn requires a rethinking of how supply-chain and logistics

education is provided (Murphy and Poist, 1994; Closs, 2000).

There are a number of empirical studies exploring the skill sets needed by industry with regards to SCM and logistics professionals. Gammelgaard and Larson (2001) suggest a three-factor skill model for a supply chain manager derived from the results of the surveys and case interviews: (1) quantitative, (2) technological, and (3) SCM core. Mangan and Christopher (2005) explored the key knowledge requirements for supply chain managers by looking into the industry as a buyer but also as a supplier (to students). They identified three broad knowledge groups for supply chain managers: (1) general (e.g. IT and finance), (2) logistics and SCM specific and (3) competencies/skills (e.g. analytic and interpersonal). Sodhi *et al*. (2008) analysed the contents of 704 job advertisements to identify the industry needs for the skills and knowledge of US MBA graduate. They use a list of topics developed initially by Johnson and Pyke (2000) and found out that sourcing, inventory and communication skills are highly sought after by the industry.

There are a number of studies looking into the skill requirements for the sub-set groups of SCM. Murphy and Poist (1991) propose the key skill sets for logistics professionals: (1) business (e.g. strategy, ethics), (2) logistics (e.g. material handling, forecasting), and (3) management skills (e.g. communication, negotiation). Aiming to provide a longitudinal perspective, these authors revisit the 1991 study few years later (Murphy and Poist, 2007). The 2007 study confirms the 1991 study in relation to the key skill sets required for logistics professionals and a key finding was that modern logistics managers seem to have nowadays a stronger supply chain orientation (Murphy and Poist, 2007). Equally, Thai *et al*., (2011) and Thai (2012) conclude that these skill sets are also highly sought after by the industry in Australia. Finally, Giunipero and Pearcy (2001) identify the key skill sets for purchasing professionals namely strategy, process management, teaming, decision making, behavioural and negotiation and quantitative

skills. Kovacs *et al.* (2012) share a similar objective and their work focus on humanitarian logisticians. They stress the broader set of functional skills these professionals require and highlight that humanitarian logisticians need to encompass contextual skills which relate to their specific type of employment (e.g. security management etc).

These studies have significantly improved our understanding on the skill requirements of supply chain managers. Identifying such skills is critical for practitioners and academics for two reasons: (1) the level of such logistics and supply chain skills is a significant predictor for the employee performance (Myers *et al.*, 2004), and (2) supply chain course design requires clear understanding of the industry needs on the student skill set (Sodhi *et al.*, 2008).

Some of these studies have suggested that existing SCM education does not meet adequately the needs of the industry (cf. Mangan *et al.*, 2001). However, questions remain about evidence being only from one side (mostly employers) and about the granularity in the empirical evidence needed for universities to make practical changes. The latter is of utmost importance for logistics and supply chain management postgraduate programmes in general and for relevant UK postgraduate programmes in particular especially when specific areas for improvement have been proposed for the latter programmes in past studies (see work by Pyne *et al.*, 2007; Dinwoodie, 2001 in relation to intercultural competence and motivational profiling respectively).

3   Methodology

In order to achieve our research objectives, we content analysed textual data from: (1) UK supply chain/logistics job ads, (2) abstracts of research articles by UK academics in supply chain/logistics journals, and (3) descriptions of the postgraduate level supply chain/logistics degrees in UK universities.

3.1   *Data Collection of Job Ads*

Job ads for the demand side analysis were collected online from www.monster.co.uk, the largest online job search engine in the world (Dube, 2009) and from jobs.supplymanagement.com, the online career site of the Chartered Institute of Purchasing and Supply (CIPS) in the UK. The latter contains one of the largest SCM and logistics jobs among a number of the UK specialised SCM/logistics job sites. Online ads are quite detailed since the cost is rarely limited by the number of words (Sodhi and Son, 2010), while job ads in printed publications are short by their very nature (Mar Molinero and Xie, 2007).

From the online career section of CIPS, we initially screened all job ads available at the time of data collection (1st quarter of 2012) under the main categories, "purchasing and supply" and "supply chain" to remove ads for non-degree holders. Then we deleted irrelevant and duplicated ads, ending up with 360 ads.

From the monster.co.uk site, we used the search terms: (1) "supply chain management", (2) "supply chain", (3) "SCM" or (4) "logistics" for the ads posted mainly in the first quarter of 2012. To specify our research further, we added the following conditions for the search such as: (1) full-time, permanent, (2) Career level (student, entry level, experienced, and manager), and (3) years of experience (<1 year, 1+ years, 2+ years, or 5+ years). Once the results were collected, we screened the ads in order to delete ads that were not relevant or were duplicated, ending up with 461 ads, or a total of 821 job ads from both sources.

For each ad, we introduced categorical variables: (1) industry sector (modified based on the industry classification of monster and CIPS job database), (2) level of minimum experience, (3) salary and (4) requirements for professional qualification such as CIPS and IT related to characterize our data on jobs. In Table 1, we provide relevant

examples of entries for typical job ads from our database including our manually coded variables which analysed the text of these job ads.

"Insert Table 1 here"

From our data, it is obvious that no particular sector dominates although 14% (115) of the ads were mainly from recruiting agencies. In addition, we could not determine the employer's industry sector (Figure 1).[1]

"Insert Figure 1 here"

Overall, 95% (780) of the ads require an applicant to have prior industry experience. Most job ads posted in CIPS online career section have preference for prior experience but without specifying the extent. Therefore, we could not obtain industry experience needs for 48% (395) of the ads. For the remaining 52% of the ads, the average number of years of minimum experience required was 2.7. For 291 job ads, 0 to 2 years of industry experience was required and this was reduced to 131 jobs ads for 3 to 5 years industry experience required (Figure 2).

"Insert Figure 2 here"

While only 4% of the ads (33 in total) specifically required the post-graduate level degree qualifications such as MSc and MBA, nearly 26% of the ads (213 in total) required a specific industry qualification such as CIPS and CILT equivalent or IT related certificates. While this underscores the importance of professional qualifications in the UK context, we note that approximately half of our job ads are from the CIPS website. Comparing with the analysis of US-based job ads, we shall see this does not bias the data towards "purchasing" at least and may be representative of the UK market overall.

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[1] These sectors were quite different from those in the US-based job ads analysed by Sodhi *et al.* (2008). Despite that, the relative emphasis on supply-chain skills was quite similar.

3.2   Data Collection of Academic Research Output

We collected abstracts of 221 academic papers published from 1998 to 2012 in supply chain-focused journals. These papers were written by at least one author with a UK university affiliation covering various aspects of logistics and SCM research and were published in the six well-established logistics and SCM journals (Menachof *et al.*, 2009): (1) *International Journal of Logistics Management*, (2) *International Journal of Logistics: Research and Applications*, (3) *International Journal of Physical Distribution and Logistics Management*, (4) *Journal of Business Logistics*, (5) *Journal of Supply Chain Management* and (6) *Supply Chain Management: An International Journal*. Thus, the majority of abstracts collected, turned out to be from journals (1), (2), (3), (6) and only a few from journals (4) and (5). Overall, we obtained 221 abstracts.

3.3   Data Collection of Postgraduate Courses

We identified postgraduate SCM and logistics-related programmes delivered by UK universities by looking at various websites (e.g. http://www.findamasters.com) and we focused on Masters programmes that contained the word/s "Logistics" and / or "Supply Chain Management" in their title. In general, the terms logistics and SCM have been used interchangeably in the UK (and global) education system and relevant postgraduate taught programmes will contain, normally, one or both terms in their title. At the end, 41 programmes were identified delivered by 35 U.K. universities.

We then requested from academic colleagues based in these universities to send us relevant information (e.g. degree course handbooks, module outlines) for these programmes, mentioning the objectives of our research and that any results would be

reported only at aggregate level. Nineteen academic colleagues sent us course handbooks and module outlines or directed us to relevant university websites that contained detailed information. Overall, we got detailed data for 25 postgraduate programmes delivered from 19 universities, representing 60% of the 41 postgraduate SCM and Logistics-related programmes offered by UK universities (see Table A1 in Appendix).

4   Analysis and Results

Following the content analysis approach for inferring skill requirements from job advertisements by Sodhi and Son (2010), we analysed: 1) 821 online UK job ads, 2) 221 abstracts from academic articles dated from 1998 to 2012, and 3) detailed information of 25 SCM and logistics-related postgraduate degrees in the UK.

Content analysis entails analysing the occurrence of relevant words and phrases including cross tabulation in text data (Duriau *et al.*, 2007). Analysis of the frequency of keywords in the texts has been widely used in many studies to infer industry skill requirements from the text of job ads (e.g. Todd *et al*., 1995; North and Worth, 1996; Redman and Matthews, 1997; Lee and Lee, 2006; Mar Molinero and Xie, 2007; Den Hartog *et al*., 2007).

Central to such content analysis is developing the "dictionary"—the specification of words and phrases, i.e. "keywords" under various named categories to create counts under each topic or skill when a word or phrase under that category is found in a record (Krippendorff, 2003). For our work, we used the dictionary developed by Sodhi *et al*. (2008) that, building on the categories proposed by Johnson and Pyke (2000), analysed the text of 704 US-based supply chain postgraduate level job advertisements. This dictionary was built by listing 13,080 words and phrases, up to six words long, by placing appropriate words and phrases as "keywords" in these categories and sub-categories

(Sodhi *et al.* 2008, see Table 2 and Table 3). For example, we placed phrases such as *Material usage forecasts* and *Forecasting and replenishment*, which occur in the ads, into category C (Inventory and forecasting) and, following that, in sub-category C2 (Forecasting) (see Table 3).

"Insert Table 2 here"

"Insert Table 3 here"

We refer the reader to Sodhi *et al.* (2008) for details on the specific keywords while we provide the categories and sub-categories in Table 2 for convenience. Our dictionary follows a strict hierarchy so there is no overlap of keywords across categories or sub-categories. We also carried out content analysis in two ways depending on the nature of the dataset: computer-based for job ads and article abstracts, and manual for the description of post-graduate programmes. Given the large amount of text, we used computer-aided content analysis (Lissack, 1998; Osborne *et al.,* 2001; and Duriau *et al.*, 2007) using WordStat software by Provalis Research[2] to analyse the text of job ads and of article abstracts.

However, for analysing the descriptive text of postgraduate degree programmes, we analysed manually the occurrence of keywords and phrases in these degrees, following Mar Molinero and Xie (2007), but using the same dictionary as we used for job ads and article abstracts. Following the framework by Tangpong (2011), we read through the programme-related information such as actual course handbooks and/or course descriptions on the web for 25 postgraduate degrees in SCM and logistics from 19 UK universities. If a topic in our dictionary was covered by one or multiple modules from the

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[2] See http://www.provalisresearch.com/wordstat/Wordstat.html

programme, we coded as 1 otherwise 0. Each column total then indicated the proportion of courses or cases covering the particular topic. Essentially this is what the computer software did with job ads and abstracts.

4.1 Industry "Demand" for Supply Chain Skills

We assume that the frequency of appearance of a set of skill (and related keywords and phrases) indicate the relative demand for these skills. Based on this, UK companies' top needs are E: *sourcing and supplier management* (54% of the ads) and B: *transportation and logistics* (33%) (see Table 4). This means that matters related to sourcing and procurement are represented in a majority of job ads, and are therefore of great importance to employers. It could be argued that this could be because CIPS is the source of nearly half the job ads. However, the results from a similar study using US jobs (none of which came from CIPS or similar website) also suggested that the percentage of job ads requiring this skill was more than 57% (Sodhi *et al.*, 2008). Keywords related to the emerging category I: *reverse logistics and green issues* appeared in less than 3% of the job ads, which contrasts with their importance (cf. Walker and Jones, 2012).

<u>"Insert Table 4 here"</u>

We did a separate content analysis at sub-category level in order to provide more detailed views for industry demand for a particular set of skills (see Table 5). For example, as mentioned above, the most sought-after skill is in category E: *sourcing and supplier management* and this is mainly because of the highest appearance of keywords and phrases under sub-category E3: *procurement* (46% of the ads). Indeed, most of the important sub-categories are consistent with findings at category level shown in Table 5. One point which requires attention is that there is no single ad containing any keywords or phrases for F1: *e-commerce* and F3: *e-procurement*. This might suggest that e-commerce has become an integral part of industrial supply chains and, therefore, it is a 'given'.

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4.2 UK-based Academic Research regarding Supply Chain Skills

Starting with the abstracts of 221 articles, we first conducted frequency analysis at category level (Table 4). The results of our analysis suggest that topics related to B: *transportation and logistics* (40% of the abstracts), E: *sourcing and supplier management* (28%), C: *inventory and forecasting* (27%) and L: *global issues* (24%) appear to be most frequently researched by academics in UK universities. Although we provide a detailed comparison in Section 6, it is easy to note that the emphasis by researchers on different supply-chain topics is broadly in line with employer needs. At the more granular sub-category level, sub-categories B3: *logistics*, C1: *inventory and materials management*, H1: *customer service*, E3: *procurement*, D5: *marketing* and J3: *alliances*, (Table 5) are the most frequently researched topics by UK academics. These sub-categories shed more light on category-level analysis. For instance, a big part of the importance of category C: *inventory and forecasting* is due to the child sub-category C1: *inventory and material management*.

4.3 UK Postgraduate Programmes: The "Supply" of Supply Chain Skills

Analysis of 25 postgraduate degree programmes provided by 19 UK universities showed that, on average, 9.4 core and elective modules are offered; however, contact hours may not be uniform across these modules. Our analysis of the coverage of category level supply-chain topics in these core and elective modules shows that category B: *transportation and logistics* was mentioned in all degree handbooks and descriptions. Also, C: *inventory and forecasting* (96%) and E: *sourcing and supplier management* (96%) were

covered by nearly all UK degrees. Then, follows J: *outsourcing* (88%) and F: *information and electronic mediated environments* (84%). At this level, it is easy to see that the rankings of different topics are different from those of employers (see Table 4).

We conducted an analysis at sub-category level as well (see Table 5). C1: inventory and material management, B3: logistics, J1: outsourcing, E4: supplier and vendor management, and F5: emerging IT/ managing information are the top 5, most widely provided topics at sub-category level as part of regular core and elective modules. While the percentages are largely in comparison with those from analysis at the same level of job ads and of research output, what matters is the relative emphasis as obtained from ranking or from rescaling these percentages for comparison as we also do in the following sections.

4.4 Ranking and Importance of Supply Chain Topics in relation to Research Output and Postgraduate Programmes

For a more granular comparison (recall our goal to be able to provide granular comparisons to allow universities to make practical changes), we carried out a (ranked-order) tau-correlation at sub-category level of granularity to see how well the emphasis on different supply-chain topics in hiring needs correlates with the relative emphasis on supply chain topics in UK universities' research output and in their provision of post-graduate programmes (see Table 6).

"Insert Table 6 here"

The results confirm our findings as indicated at category level earlier, i.e. there is a better correlation between the relative emphasis on supply chain topic in research and in employer requirements (correlation 0.547) than there is between programme descriptions

and employer requirements (correlation 0.363). Moreover, there is a low correlation between research and teaching programme (0.294) even though both are outputs of UK universities (Table 6). The correlation numbers give an overall view but they do not show which specific sub-topics are *over*- or *under*-emphasised by universities in their research or teaching output vis-á-vis industry needs for hiring. To illustrate this, we created scatter plots of research output (Figure 3) and academic programmes (Figure 4) against industry skill requirements using a rescaled number of frequency count to reflect relative importance: the sub-topics above the diagonal represent over-emphasis and the sub-topics below the diagonal represent under-emphasis in relation to industry's view.

From this scatter-plot analysis, it appears that for most part, most sub-topics are close to the diagonal, indicating that the relative emphasis on these in relation to research output and job ads is the same (Figure 3). However, some topics are over-represented in research output: B2: *transportation*; I1: *environmental issues*; J3: *alliances*; and L2: *government*, and some are under-represented such as E3: *procurement*; E4: *supplier and vendor management*; E5: *contracts and negotiations*; and F2: *ERP systems*.

"Insert Figure 3 here"

"Insert Figure 4 here"

The analysis for the coverage of topics in postgraduate programmes, at least as could be inferred from the module descriptions, shows many sub-topics being far away from the diagonal, thus indicating many areas of over- and under-emphasis. This illustrates why the rankings at top level in Table 4 are so different or why the τ-correlation is so low in Table 6 between post-graduate programme descriptions and job ads. For instance, there is an over-emphasis by programmes on such topics as F1: *e-commerce*; F5: *emerging topics in IT*; J1: *outsourcing*; and J3: *alliances*. At the same time, relative to industry emphasis, programmes under-emphasise such topics as B3: *logistics*; E3: *procurement*; E4: *supplier*

and vendor management; and H1: *customer service* (Figure 4).

5   Discussion and Non-SCM Skills

Our work does not want to claim that the two sides in Figures 3 and 4 *should* be perfectly matched. Indeed, it can be argued that universities focus more on emerging topics to prepare students for the future job market rather than the present one.

As such, we also investigated the coverage of other relevant topics not reflected in our dictionary. Indeed, most degrees in our sample have modules (or major topics in modules) covering either strategic issues in general and / or strategic issues in the supply chain specifically (96%) as well as having modules covering operations management (80%). For example, we found modules entitled "International Business Strategy" and "Strategic Analysis and Management" examining strategic issues in general whilst we found modules focusing on strategic issues within supply chains such as "Strategic Supply Chain Management" and "Logistics and Supply Chain Strategy". Also, the programmes have modules (or major topics in modules) providing simulation and modelling skills (64%) and finance and accounting skills in business, SCM and logistics contexts (44%). For example, there are modules entitled "Accounting and Finance", "Finance and Accounting", "Strategic Finance" and "Supply Chain Finance" all focusing on developing relevant skills. Four programmes provide modules covering a humanitarian logistics topic, which is an emerging theme in research as well. For example, the "Evolving Issues in Supply Chain Management" module has a strong focus on the humanitarian supply chain whilst a "Green Logistics" module covers aspects of humanitarian logistics too.

To complete the picture on employers' hiring needs, we augment the previous analyses with skills not specifically related to SCM by doing content analysis on our sample of UK-based jobs using another dictionary created by Sodhi and Son (2008). This

dictionary was used by Sodhi *et al.* (2008) on US-based supply-chain jobs as well to compare SCM and non-SCM (operational research) jobs. This dictionary contains ten non-SCM skills and underlying keywords in a three-level hierarchy similar to the supply-chain topics dictionary, and covers 'hard' or technical skills such as IT as well as 'soft' skills such as communication skills and leadership (see Table A2 in the Appendix).

We found that the top non-SCM skills sought by employers are all 'soft' skills: (1) T: *leadership skills* (30% of the ads), the ability to run an organization, to bring about change, or to lead a team, (2) O: *communication skills* (28% of the ads), which includes written and verbal communication and presentation skills, and (3) R: *team-related skills* (the ability to work in a team, 20% of the ads), and (4) Q: *project management skills* (the ability to manage complex projects, and lead projects, 17% of the ads) (see Table A3 in the Appendix).

Our results from the analysis of postgraduate programmes suggest that all programmes appear to have modules or key topics to cover soft skills such as communication and working in a team in their curriculum, usually by way of team projects and presenting them. We found some modules entitled "Developing Self", "Personal Development" and "Professional Skills" that include soft skills (e.g. presentation skills, problem solving, etc.) as well as working in a team. Finally, despite the importance of leadership (Murphy and Poist, 2006), few programmes appear to cover related skills although related topics were found in "Human Resource Management", "Managing People" and "Managing People and Organisations" modules.

6   Conclusions

Motivated by the question of how well UK universities meet UK industry's needs for supply-chain skills, and looking for multi-faceted evidence from both sides that is granular enough to offer practical advice, we first conducted content analysis on: (1) UK job ads for post-graduates, (2) abstracts of research papers, and (3) descriptions of post-graduate programmes in supply chain and logistics. Our content analysis of UK jobs ads is similar to that of US data by Sodhi *et al.* (2008) whose hierarchical categorization of supply chain topics we used.

Next, we compared the results to indicate under- or over-emphasis of supply-chain topics in research or teaching output relative to the employers' needs as expressed in the job ads. We found that academic programmes under-emphasise supplier-facing topics like purchasing, or service and after-sales while over-emphasise other topics such as outsourcing.

Surprising to us at least, SCM topics and sub-topics are much more matched in terms of relative emphasis between the research output of UK universities as a whole and employer needs. This suggests that UK-based researchers (and supply-chain journal editors) are in tune with industry needs and tend to examine applied logistics and SCM issues.

Nevertheless, the knowledge illustrated in their research output is not transferred to postgraduate programmes in logistics and SCM. This can be due to delays in updating programmes or relevant material owing to university bureaucracy. Equally, logistics and SCM academics can be specialised in their research (e.g. Automotive or Health Supply Chain Management) and have to design and deliver more generic modules. However, these speculations need to be validated by further research with the logistics and SCM academic community.

Overall, a major implication for universities is that they must check their coverage of supply-chain topics, and indeed non-SCM topics, relative to employer needs. Our dictionary as well as the results provided here are quite granular with the possible 'problem areas' showing up at topic as well as sub-topic level. Moreover, universities must ensure that their logistics and SCM postgraduate programmes (and teaching delivery) are research-led as this would serve employers' needs better. This may mean universities encouraging academics to deliver further topics on their research specialism while remaining within the module and programme learning outcomes. Another area for universities to look into is the provisioning of 'soft' skills, such as those pertaining to leadership or communication. In addition, they need to augment 'hard' technical skills already on offer in these programmes. Other ways to strengthen the link between academic programmes and industry could be via the use of student visits to industry, guest lectures, student projects, etc as also pointed out by van Hoek *et al.* (2011). Overall, our data indicates few independent modules emphasizing these 'soft' skills. It may be that some programmes are providing these skills via coursework or even outside the curriculum. It is also likely that the students may have already acquired such skills outside of the conventional education system, for example through work experience before their postgraduate study. Even so, UK degree programmes need to look into how to improve the soft skills of students as a part of their curriculum, as these skills matter to employers.

To conclude, further work is needed to address limitations as well as avail other opportunities. For example, we have analysed many job ads taken from CIPS and therefore our sample needs to be broadened. The number of ads as well as the number of articles could be expanded. As already noted, we need to better understand the 'gap' between industry needs and the teaching provision in post-graduate programmes from supply-chain academics themselves, who at the same time show a close understanding of

industry needs via their research output. Extending this work to related fields like operations management by analysing the triangle of practice, research and teaching is certainly an opportunity. Moreover, expanding the dictionary with related topics and running content analysis on major operations and SCM journals (or major conferences) can be used periodically to show major trends in these research topics. Lastly, this work could form the basis for an international study where postgraduate programmes, research output and job ads can be compared between various countries and regions and with key similarities and differences being exposed (see Wu, 2007).

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Figure 1: Number of ads for top 10 sectors, (number of ads, %).
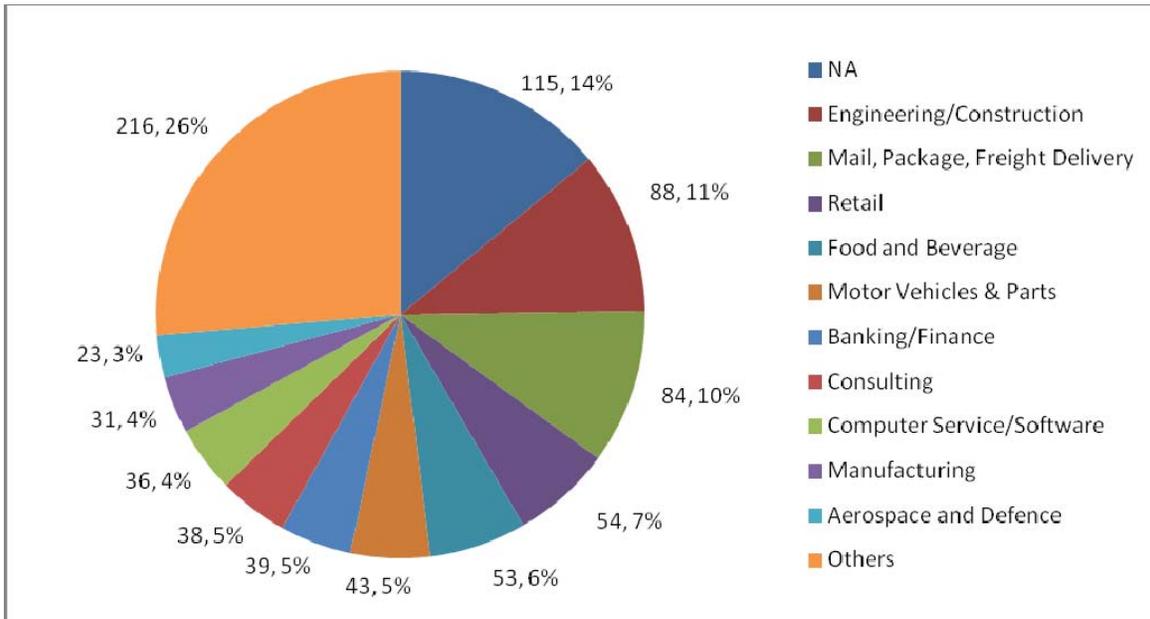
Note: NA indicates "not available".

Figure 2: Number and percentages of SCM job ads at different experience levels.
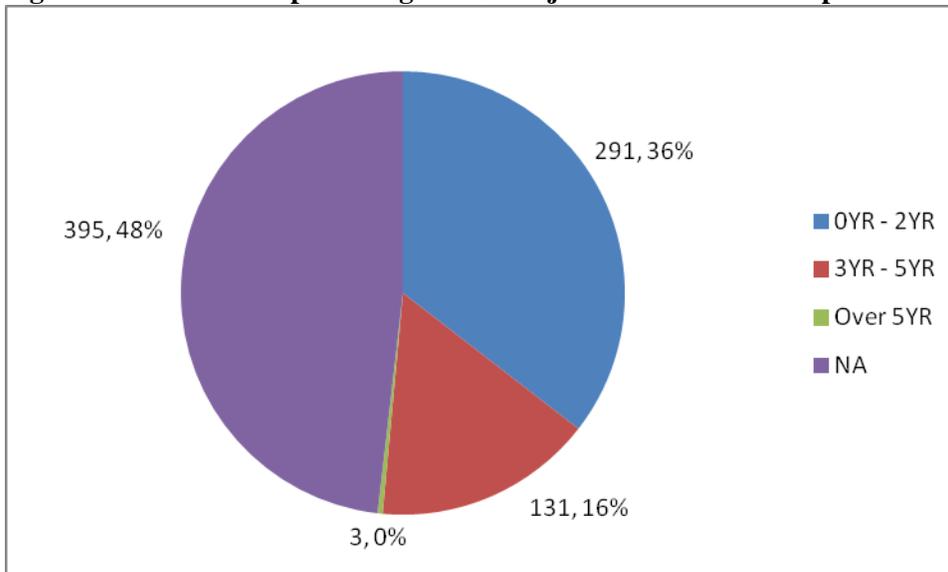
Note: NA indicates "not available".

Figure 3: Relative proportion of papers vs. relative proportion of ads (sub-category level)
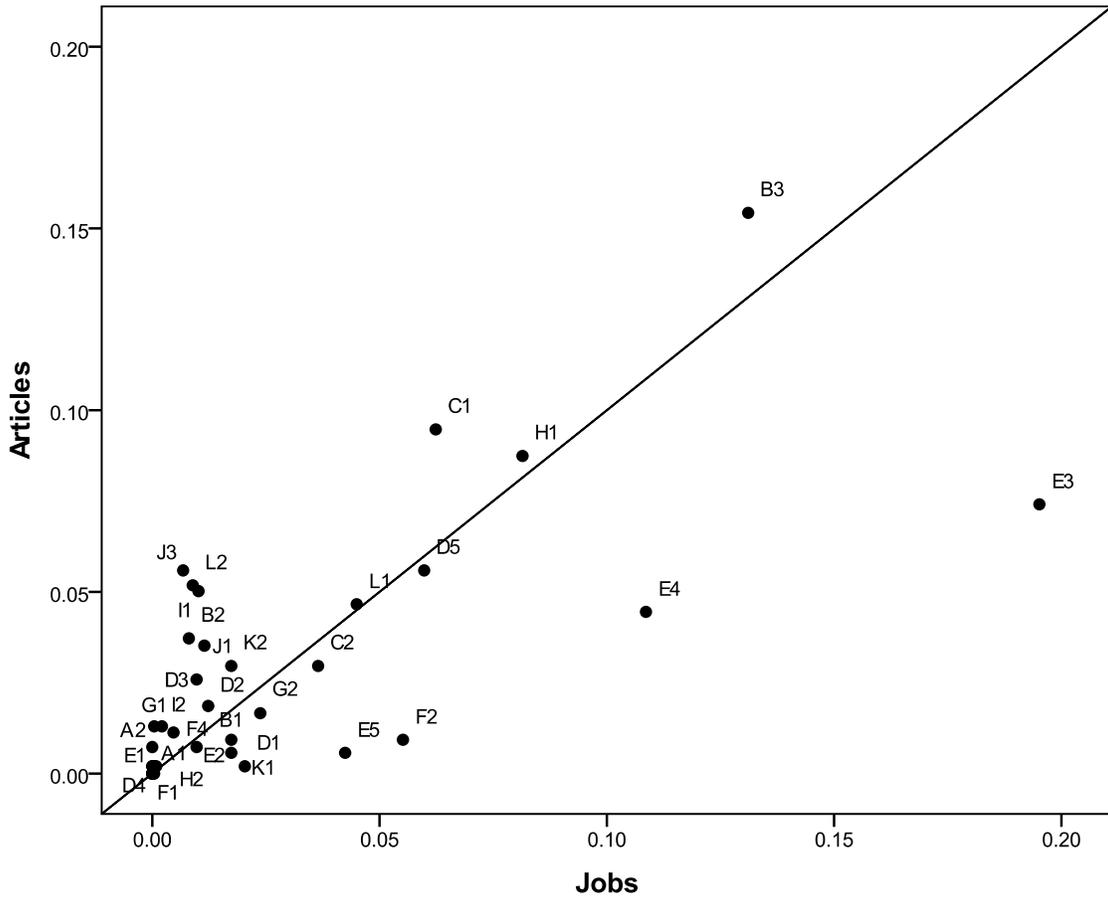
Note: Relative proportions were calculated by scaling all percentages by the column total.

Figure 4: Relative proportion of ads (demand) vs. relative proportion of degrees (supply) at sub-category level
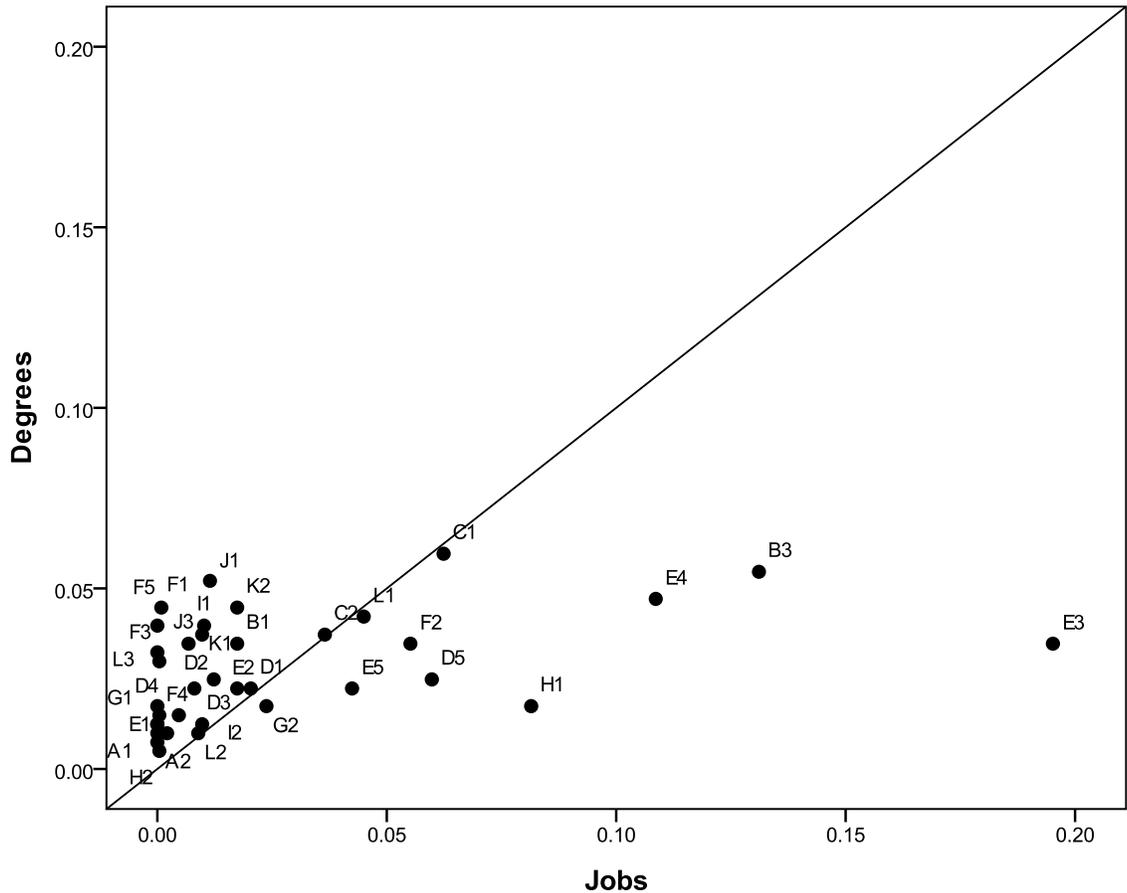
1)

Note: Relative proportions were calculated by scaling all percentages by the column total

2)

Table 1: Examples of entries for typical job ads

Job ad (text variable)	Min Experience (categorical variable)	Professional Qualifications (categorical variable)	Industry sector (categorical variable)
Supply Chain/Manufacturing & Operations Graduate ….If you have the ambition to become part of our world class operation and develop a career in Supply Chain you will need to have achieved at least a 2:1 or equivalent in mechanical, chemical or manufacturing engineering, Supply Chain or Operations Management and as of 2012, a minimum 300 UCAS points or equivalent and speak fluent English. A degree in chemistry or post qualification in supply chain or logistics will also be considered. You must also have strong interpersonal skills to work with colleagues across functions, cultures and at different levels within the business. Comfortable working in a team, you will need strong project management and analytical skills and be comfortable working on multiple projects with new groups that could be based in different locations. A second European language would be desirable but not essential…..	Not required	No	Chemical
Buyer - Global Energy Major	5	Yes (CIPS equivalent)	Energy

…Have previous procurement experience gained working as a buyer or assistant buyer within the oil, gas and energy industry. Have knowledge of the suppliers and clients within the Oil and Gas industry. Have excellent supplier management and stakeholder engagement skills. Be degree educated or equivalent and be CIPS qualified or equivalent. In this operational procurement buyer role, the successful candidate will: Work across a number of indirect and direct procurement categories, in support of the company's global operations. Be regularly involved in the full life cycle of procurement. Have significant opportunity to progress their procurement career in a successful and growing company….			

Table 2: Structure of the dictionary including twelve categories & sub-categories

Categories and sub-categories of supply-chain topics and subtopics	
A. Location and supply-chain design[*] A1. Facility location A2. Supply-chain restructuring B. Transportation and logistics B1. Material handling B2. Transportation B3. Logistics C. Inventory and forecasting C1. Inventory and materials management C2. Forecasting D. Marketing and channel restructuring D1. Customer relationship management D2. Distributor or channel management D3. Replenishment D4. Pricing D5. Marketing (general) E. Sourcing and supplier management E1. Make/buy decision E2. Supply management E3. Procurement E4. Supplier and vendor management E5. contracts and negotiation	F. Information and electronic mediated environments F1. E-commerce F2. ERP systems F3. E-procurement F4. Business-to-business F5. Emerging information technology G. Product design and new product introduction G1. Product design G2. New product introduction H. Service and after sales support H1. Customer service H2. After-sales service I. Reverse logistics and green issues I1. Environmental issues I2. Returns and reverse logistics J. Outsourcing organizational and alliances J1. Outsourcing J2. Organizational issues J3. Alliances K. Metrics and performance K1. Metrics K2. Performance-related L. Global issues L1. Global management L2. Government issues L3. Global (other)

Note: The dictionary is based on work by Sodhi *et al*. (2008)

Table 3: An example of keywords from sub-category C2 (main category C)

C: Inventory and Forecasting	
C2: Forecasting	
Demand management	Forecasting and supply chain management
Material usage forecasts	Forecasting for seasonal fluctuations and maintaining
Forecast	Forecasting process
Forecast accuracy	Forecasting/budgeting
Forecast to delivery	Forecasting/demand
Forecasting	Forecasting/production
Forecasting and replenishment	Forecasts and inventory strategies to ensure
Forecasting and reporting	Forecasts to the business units
Forecasting and supply	

Note: Based on work by Sodhi *et al.* (2008)

Table 4: Percentages and rankings of UK job ads, papers by UK-based academic(s) and UK postgraduate programmes

	Supply-chain topic category (Level 1)	Ads (%)	Papers (%)	Degrees (%)	Ads (ranking)	Papers (ranking)	Degree (raking)
A	Location and supply chain design	0.0%	1.8%	32.0%	12	12	10
B	Transportation & Logistics	33.0%	39.9%	100.0%	2	1	1
C	Inventory and forecasting	19.7%	26.6%	96.0%	4	3	2
D	Marketing & channel restructuring	22.5%	21.6%	76.0%	3	5	6
E	Sourcing and supplier management	53.7%	27.5%	96.0%	1	2	2
F	Information & Electronic mediated environments	14.4%	5.5%	84.0%	6	11	5
G	Product design & new product introduction	5.7%	6.4%	24.0%	9	10	12
H	Service & After sales support	19.2%	21.6%	28.0%	5	5	11
I	Reverse logistics & green issues	2.8%	13.3%	68.0%	11	8	9
J	Outsourcing organisational & alliances	4.1%	21.6%	88.0%	10	5	4
K	Metrics & Performance	6.1%	7.8%	72.0%	8	9	8
L	Global issues	12.8%	23.9%	76.0%	7	4	6

Note: Keywords correspond to supply-chain topics at category level. Totals exceed 100% because each ad can fit into multiple categories.

Table 5: Percentage of UK job ads, papers by UK-based academic(s) and UK postgraduate programmes descriptions

		% of UK job ads				% of papers by UK academic(s)				% of UK programmes	
1	E3	Procurement	46.0%	B3	Logistics	38.1%	C1	Inventory and material management	96.0%
2	B3	Logistics	30.9%	C1	Inventory and material management	23.4%	B3	Logistics	88.0%
3	E4	Supplier and vendor management	25.6%	H1	Customer service	21.6%	J1	Outsourcing	84.0%
4	H1	Customer service	19.2%	E3	Procurement	18.3%	E4	Supplier and vendor management	76.0%
5	C1	Inventory and material management	14.7%	D5	Marketing (general)	13.8%	F5	Emerging IT / managing information	72.0%
6	D5	Marketing (general)	14.1%	J3	Alliances	13.8%	K2	Performance-related (incentives, etc.)	72.0%
7	F2	ERP systems	13.0%	L2	Government issues	12.8%	L1	Global Management	68.0%
8	L1	Global Management	10.6%	I1	Environmental issues	12.4%	F1	E-commerce	64.0%
9	E5	Contracts and negotiation	10.0%	L1	Global Management	11.5%	I1	Environmental issues	64.0%
10	C2	Forecasting	8.6%	E4	Supplier and vendor management	11.0%	C2	Forecasting	60.0%

Note: Keywords correspond to top 10 supply-chain topics at sub-category level. Totals exceed 100% because each ad can fit into multiple categories.

Table 6: Correlation for the relative ranking of supply-chain topics (subcategory level) for ads (employer ranking), research output (research ranking) and programmes (programme ranking)

	Employer ranking	Research ranking	Programme ranking
Employer ranking	1.000		
Research ranking	.547**	1.000	
Programme ranking	.363**	.294*	1.000

Note: $p < 0.01$.* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Appendix

Table A1: UK post-graduate programmes analysed in this study

No.	Name of degree programme	University
1	MSc in Operations & Supply Chain Management	Newcastle University
2	MSc in Operations, Logistics & Accounting	
3	MSc in Logistics & Operations Management	Cardiff University
4	MSc in Operations & Supply Chain Management	University of Liverpool
5	MA in E-Logistics & Supply Chain Management	University of Greenwich
6	MA Transport & Logistics Management	
7	MSc Project Management for Logistics & Supply Chain Management	
8	MSc Procurement, Logistics & Supply Chain Management	Salford University
9	MSc Global Logistics & Supply Chain Management	University of Huddersfield
10	MSc in Supply Chain Management	Aston University
11	MSc International Logistics	Plymouth University
12	MSc International Supply Chain Management	
13	MSc Logistics & Supply Chain Management	Hull University
14	MSc Logistics & Supply Chain Management	Heriot-Watt University
15	MSc Global Logistics & Supply Chain Management	Northumbria University
16	MSc Global Supply Chain Management	Brunel University
17	MSc in Supply Chain, Trade & Finance	City University
18	MA in International Supply Chain & Logistics Management	Kingston University
19	MSc in IT for Supply Chain Management	
20	MSc Logistics & Supply Chain Management	Cranfield University
21	MSc Supply Chain & Logistics Management	Warwick University
22	MSc Logistics & Supply Chain Management	Lancaster University
23	MSc SC & Operations Management	Nottingham University
24	MSc Logistics & Supply Chain Management	
25	MSc Purchasing & Supply Chain Management	London Metropolitan University

Table A2: Categories and sub-categories of non-SCM skills

Categories and sub-categories of non-SCM skills	
M. General analytical – Analysis – General abilities – Problem-solving skills **N. Basic IT** – General PC skills – MS Office – Word and PowerPoint **O. Communication** – General communication – Presentation skills – Written and verbal skills **P. Programming** – Programming languages – Database programming – Software applications – Web applications – Programming general **Q. Project** – Manage projects – Lead projects – Projects – miscellaneous	**R. Team** – Interpersonal skills – Team-related skills **S. Statistics** – Stats software – Dataset management – General data analysis – Data mining – Data modelling – Stats miscellaneous **T. Leadership** – Change management – Leadership general – Team leading **U. Modelling** – Modelling languages – Algorithm development – Optimization – Optimization applications – Decision science and analysis – Decision support – Model development – Simulation **V. Spreadsheet and DB** – MS Excel – MS Access

Source: Sodhi and Son (2008)

Table A3: Percentages of ads with keywords corresponding to each non-SCM skill (category level)

Category	Skill	Ads (%)	Rank
T	Leadership	29.8%	1
O	Communication	27.9%	2
R	Team	19.5%	3
Q	Project	17.2%	4
M	General analytical	13.0%	5
V	Spreadsheet and DB	11.6%	6
N	Basic IT	10.6%	7
U	Modelling	7.9%	8
S	Statistics	5.4%	9
P	Programming	5.2%	10

Note: Totals exceed 100% because each ad can fit into multiple categories