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The growing scale and scope of the supply chain: A reflection on supply chain graduate skills

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Abstract

Purpose - The growing scale and scope of the supply chain requires a greater understanding of the broader supply chain skills picture. This study assesses the supply chain skills needs within the context of a UK based higher education institution involving graduates, academics and employers in order to appreciate the graduate skills demands of supply chains.

Design/Methodology/Approach – A mixed methods study entailing in-depth interviews with academics followed by a questionnaire distributed to graduates and employers has been designed and utilised.

Findings – The findings indicate that the changing supply chain scope encourages the requisition and development of different supply chain skills with varied levels of emphasis in relation to twenty five skills identified in the literature. Key graduate skills needs are highlighted, including time management, collaborative learning, teamwork and problem solving, with the addition of two supply chain skill areas, namely specialist training and the understanding and application of regulations. The findings of the current study presents a limited emphasis on information technology skills, despite the significant information technology advancements and changes in supply chains.

Research implications – The study has been carried out in a UK university delivering undergraduate supply chain management courses. It would be beneficial to test whether the findings are exemplary across other supply chain undergraduate courses, and to investigate the integration of these skills within the supply chain syllabus, and how employers, graduates and academic parties could actively engage in developing the agenda for future supply chain skills needs.

Practical implications –This research paper highlights the gaps in supply chain skills, which inevitably puts considerable pressure on operatives and managers whose responsibility it is to ensure compliance with professional bodies as well as regulations.

Originality/value –This paper contributes to the supply chain skills discussion and reports subject relevant challenges for supply chain educators by engaging three key stakeholders; graduate employers, graduates and academics. The findings have generated additional supply chain skills to the academic literature as well as providing an understanding of the weighting of skills in terms of their importance and application to industry needs.

Keywords – Supply Chain Management, Supply Chain Skills, Higher Education, UK

Article Classification – Research paper

Introduction

Supply chain education research in the last fifteen years has focused on the gap between industry needs and the existing talent pool, focusing mainly on the interaction between educators and employers and tools used to bring industry and education closer (Ankers and Brennan, 2002; Bak and Boloucher-Passet, 2013; Brennan and Turnbull, 2002; Paralleda and Sanroma, 2000; Valentin, 2000). In 2012, the Wilson report highlighted the need for close collaboration and partnership, especially between industry and universities. Similarly, the Chartered Institute of Logistics and Transport (CILT) highlighted the importance of the supply chain talent pool and industry needs for UK's long-term ambition for developing skills in the logistics and supply chain industry (CILT, 2015). This is not unexpected, as research carried out in 1991 by Murphy and Poist indicated a shift in emphasis on the types of skills demanded from logistics and supply chain education, whereby supply chain managers have typically followed more traditional functional routes of finance or general management (Murphy and Poist, 1998) prior to progressing into senior roles within logistics and supply chain, with training usually undertaken on the job rather than through the academic route.

Leitch's report in 2006 indicated the lack of skills across diverse industries, particularly in the supply chain and logistics industry, evidenced through the expansion of university courses in logistics and supply chain management in recent years. "There is a direct correlation between skills, productivity and employment. Unless the UK can build on reforms to schools, colleges and universities and make its skills base one of its strengths, UK businesses will find it increasingly difficult to compete" (Leitch, 2006, p. 3). The growing complexity of the logistics and supply chain arena has also reflected in the educational scene, in which "young graduates have to un-learn and re-learn.... from lecture room to management office" (van Hoek; 2001, p. 507). Van Hoek (2001) recognised the challenges faced by academics in supply chain education to upgrade the content and level of teaching to enable improvements in academic rigor.

In 2001, Lancioni et al. indicated the lack of contribution from industry, especially in the undergraduate curriculum. Inevitably, the developments in the industry since 2001 have significant implications for the provision of undergraduate courses. It is imperative that educational establishments and industry work together to produce the right range, depth and balance of graduate skills and knowledge to enable a real contribution to business success. As

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a result, supply chain recruitment demands not only well trained supply chain graduates, but also those with a broad range of skills. These skills are no longer restricted to an operational understanding of how a warehouse functions or how to reduce transportation costs, but graduates are also expected to be equipped to set up and coordinate supply chains, manage change and enable flexibility (Ankers and Brennan, 2002; Bak and Boloucher-Passet, 2013; Sheffi and Klaus, 1997). This change in role has inevitable implications for the range and level of skills developed through supply chain education and hence a need for universities to continually reflect on their course offering (Mangan et al., 2001). Industry relevance has been incorporated in curriculum design through the use of consultancy projects (Bak and Boloucher-Passet, 2013), collaborative curriculum design (van Hoek et al., 2011) and early involvement of industry (Gravier and Farris, 2008), mostly focusing on technical skills (Mangan and Christopher, 2005; van Hoek et al., 2002) or on postgraduate education studies with the emphasis on operational aspects (Bak and Boloucher-Passet, 2013; Goffin, 1998; van Hoek et al., 2011). This study will provide an assessment of industry needs for supply chain skills. Hence, the current research is driven by the following objectives;

1. Assessment of the UK supply chain and logistics industry needs for undergraduate skills.
2. Evaluation of the supply chain skills importance to academics, graduate employers and graduates.

Supply Chain Skills Set in Higher Education

The supply chain industry demands graduates with a broad range of skills no longer restricted to operational understanding (Ankers and Brennan, 2002; Bak and Boloucher-Passet, 2013; Sheffi and Klaus, 1997). Hence, the drive for a deeper understanding of the supply chain within higher education has risen in line with the increasing recognition of supply chain skill needs (Bak and Boloucher-Passet, 2013; Hoffman, 2005). However, Stank et al. (2011, p. 944) pointed out that "[a]cademic research in [supply chain management] only rarely focused on the crucial process of developing …[supply chain] managers". Purcell et al. (1999), when reviewing early career experiences of graduates, found that academic skills were the least used by recent graduates entering the workplace, highlighting a need for universities to focus more on industry-specific skills. "From [an] industry's perspective, educational institutions must also produce an adequate supply of college graduates to fulfil workforce needs"

(Gravier and Farris, 2008, p. 234). Such an amplified role and status requires a range of substantially different and enhanced skills, education and training (Mangan et al., 2001). These differences in supply chain environment lead to the demand for increasing undergraduate capabilities which are more "applied" to the workplace than "traditional" skills which refer to more general and context-independent knowledge (Gammelgaard and Larson, 2001). Ballou (2007) highlighted the need for greater understanding of the boundary spanning characteristic of the supply chain and its incorporation into the curriculum. Hence, undergraduate programmes should focus on the production of graduates who are analytical, critical, reflective, transformative and capable of fulfilling the role of changing the supply chain landscape (Bak and Boloucher-Passet, 2013; Harvey et al., 1997).

In response to changing business needs and a globally competitive environment, supply chains must offer greater flexibility. Management of a broad set of processes across various business boundaries is a complex task. Mangan et al. (2005) viewed the supply chain boundaries and its structure as being significant in the changing skills requirement. Van Hoek (2001) raised the need for educators to remain up-to-date with current developments in such a fast-paced industry. Textbook teaching becomes quickly outdated, where graduates are encouraged to apply principles to the workplace, generally under-represented in the textbooks (ibid). Supply chain literature highlights skill changes based on; information technology (IT) (Bowersox, 2002; Lorenz et al., 2013), globalisation of business (Basnet, 2000; Bowersox, 2002; Lorenz et al., 2013), and the transition of business towards integrative management (Bowersox, 2002). Kirby (2003) recognised information technology (IT), new concepts, and their role in advancing the supply chain, but commented also on the crucial role of supply chain talent, leading to supply chain success.

Another response to changing business needs and a globally competitive environment is reflected in the increasing importance of human behavourial aspects (van Hoek at al., 2002) and softer skills, including communication and negotiation, which play a key role in managing today's supply chains. Van Hoek et al. (2002) noted the supply chain manager's role as the 'critical dimension', with greater emphasis placed on process management as opposed to functional management as the basis of organisational design, again highlighting the shift in future supply chain manager skills (Mangan et al., 2005). Social skills, decision-making, problem-solving and time management skills are identified by Myers et al. (2004) as essential for managing contemporary supply chains. Closs (2000) recognised that "substantial

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change in logistics and supply chain education" was necessary in order to meet the growing challenges of the industry. However, Gravier and Farris's (2008) research indicated that there was a high reliance on the curriculum rather than assessment of the changing skill needs indicating the gap in supply chain skills teaching and practice. There has been a shift from teaching of concepts to an educational experience that is much more "hands on" including the use of case studies, simulations and computer-aided teaching (Bowersox, 2002). Similarly, Basnet (2000) considered that teaching should take a more cross-functional approach rather than a narrow functional perspective. Bowersox (2002) recognised that graduates who hold a supply chain related degree approach the industry with an excellent understanding but are still likely to require more hands-on training.

Over recent years the changes experienced within the supply chain industry have resulted in the development of several frameworks and models designed to assess supply chain management skills needs. Murphy and Poist (1991) suggested that managers must possess a blend of business, logistics and management skills. Their research revealed that management skills were perceived as the most important, incorporating the ability to motivate, plan, organize and communicate effectively, in addition to abilities in analytical reasoning and problem solving. Another model developed by Gammelgaard and Larson (2001) highlighted the importance of supply chain management skills based on interpersonal/ managerial basic skills, quantitative/technological skills, and supply chain management core skills. Mangan et al. (2001) determined which skills would be more important in the future, with the five most important identified as; communications/negotiations; computers/information technology; general experience; logistics/supply chain management; and people management. Mangan and Christopher (2005) identified similar functional knowledge areas (finance, IT, management and operations/SCM) and skill areas (analytical, interpersonal, leadership and change management).

Handfield (2004) noted that education providers should ensure the delivery of fully integrated supply chain management programmes that take account of integration-oriented skills required. Hence, the integration between supply chain topic areas is necessary to ensure students understand the linkages and its relation to the workplace (Bak and Boloucher-Passet, 2013). As supply chains have moved towards increasing integration and coordination between members, managerial talent in the coordination of these services and enhanced communication skills are seen as being more essential than the ability and understanding of

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basic operational activities (Sheffi and Klaus, 1997; Mangan et al., 2001; Lutz and Birou, 2013). Communication skills are of key importance driven by mobile technology such as video conferencing and other media technology to formulate process models and exchange ideas. As change features heavily within the industry, managers should also be skilled in project management, leadership and team building (Hoffman, 2005; Kovács et al., 2012; Lutz and Birou, 2013). Whilst academic research in this field has been developing, industrial and professional organizations have also recognised the need to enhance skills of new managers entering the profession. APICS has developed the Operations Management Body of Knowledge (OMBOK) framework drawing on the broad-ranging knowledge requirements of professionals in supply chain management, which offers trainers and educators the opportunity to capture a list of knowledge topics on which to base their curricula (Castle et al., 2011). However, the framework is knowledge-centered rather than skill-centered, where academic research has suggested that more focus is needed to improve the skill set that graduates emerge from their university education with, in addition to knowledge.

The following Table 1 provides a summary of supply chain skills in higher education compiled from the existing academic literature. This provides an overall umbrella of the research undertaken from 1994 to 2015 indicating the variety of supply chain skills requirements of graduates from higher education.

Supply Chain Skill	Business Ethics	Communication	Collaborative learning	Project management	Boundary spanning management	Work experience / partnering with industry	Market understanding & customer service	Management of complexity and change	Information Technology skills	Finance and numeracy	Analytical and statistical skills	Leadership skills	Teamwork	Time management	Problem solving	People management	Organisational skills	Motivation/enthusiasm	Flexibility	Initiative	Planning skills	Stress management	Negotiation
Bak and Boloucher-Passet (2013)						X																	
Ballou (2007)					X																		
Christopher (2004)					X		X	X	X							X							
Dubey and Gunasekaren (2015)	X																						
Gammelgaard and Larson (2001)									X		X	X	X	X				X					
Gravier and Farris (2008)						X																	
Handfield (2004)					X																		
Hoffman (2005)		X		X								X											
Kopzcak and Fransoo (2000)					X																		
Kovács et al. (2012)		X		X			X		X	X						X	X					X	X
Knemeyer and Murphy (2001)					X																		
Knemeyer and Murphy (2002)					X																		
Lutz and Birou (2013)		X		X									X			X	X		X	X	X		
Mangan and Christopher (2005)			X				X	X	X		X	X				X							
Mangan et al. (2001)		X									X												
Murphy and Poist (1994)																X		X					
Murphy and Poist (2007)									X		X												
Myers et al. (2004)		X											X	X	X	X		X				X	
Nicholsan et al. (2015)				X	X										X								
van Hoek, (2001)		X																					
Sheffi and Klaus, (1997)		X																					
Sohal (2013)	X	X		X					X				X			X							
Thomchick (1997)			X										X										
Yew Wong et al. (2014)						X					X				X								

Table 1: Supply Chain Skills in Higher Education Context

Methodology

Mixed methods were utilised in a two stage approach. The research involved a UK based higher education institution which has substantial expertise in supply chain management providing undergraduate programmes for 20 years. During this time, the courses have been developed in line with industrial advances. It should be noted that logistics is included within the realms of this study as it is a function of supply chain management in accordance with the views of Mangan and Christopher (2005); Johnson and Pyke (2000); Stock and Lambert (2001); and Yen-Chun Jim Wu (2007); by using supply chain as a generic term to include logistics. Previous research in this area has focused on the use of case studies (Murphy and Poist, 2007; Heriot et al., 2008; Ferrin et al., 2001) and surveys (Gammelgaard and Larson, 2001; van Hoek, 2001; Murphy and Poist, 2007). This paper aims to contribute to the supply chain skills discussion on challenges for supply chain educators by engaging three key stakeholders; graduate employers, graduates and academics through the contextual setting of a UK based higher education institution.

The research follows a sequential exploratory design, with the priority given to qualitative inquiry, including qualitative data collection and analysis followed by quantitative inquiry, data collection and analysis. The rich, descriptive, in-depth interviews (stage 1) take account of the academic staff perspective; the resultant findings from the questionnaire (stage 2) give an insight into whether the findings from the first stage of the research are relevant to graduate employers and graduates. Drawbacks with the use of mixed methods for researchers include the long time required for data collection, analysis and interpretation, and integration of the findings. However, the mixed methods study allows the inclusion of diverse viewpoints within the selected population, underpinned by a good sampling frame which is recognised to be relevant, complete, precise and up-to-date (Bak, 2011; Denscombe, 2005). The combination of qualitative and quantitative approaches allows research triangulation enabling the researcher to understand the convergence or divergence of findings; each method complements and clarifies findings; and finally permits the expansion of the breadth of the research (Bak, 2011; Greene et al., 1989). Table 2 sets out the quality criteria and steps followed, adapted from Onwuegbuzie and Teddlie (2003).

Dimensions	The use of mixed methods in the current study
1. Purpose	The first stage is exploratory and second stage is confirmatory in nature
2. Root	First stage includes in-depth interviews with academics highlighting the variables set out in Table 1, followed by testing the findings with graduates and employers
3. Data analysis techniques	Use of analytical techniques in each phase • Stage 1: Exploratory • Stage 2: Confirmatory

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4.	Data types	Stage 1: Qualitative
		Stage 2: Quantitative and Qualitative
5.	Relationship	The relationship between the data collection phases; first stage includes in-depth interviews with academics highlighting the variables set out in Table 1 followed by testing the findings with graduates and employers
6.	Nomination	The research categories were initially based on the literature and evolved through the analysis in Table 1
7.	Verification	The justification of the current research involves (Stage 1) academic staff members, (Stage 2) external employers and graduates
8.	Designation	The categories have been created a priori before the data was collected, and enhanced through stage 1 findings
9.	Analysis tools	The first stage was analysed via content analysis and the second via statistical analysis
10.	Legitimisation	Following data interpretation, integration of findings allows for inferences and final conclusions

Table 2: Quality considerations of current study in using mixed methods

The interviews provided the best method for collecting data on the views and perceptions of academics since they were readily accessible and relatively few in number (5 academics) allowing sufficient time for the researchers to gather meaningful information. Any issues relating to validity could be checked during the interview to ensure accuracy and relevancy. The sample selection criteria were based on academics with over 5 years supply chain industry experience, and 5 years experience of supply chain teaching in higher education. For the purposes of the questionnaire, selecting a representative sample from the whole of the population of undergraduates and graduate employers, a stratified sampling approach was taken. This was selected in order to allow every member of the population an equal chance of being chosen, whilst being set within the boundaries of year of graduation. Their input was invaluable to the research due to the dual benefit of having experienced the undergraduate education and the workplace role and their ability to judge the relevance and applicability of their studies to the actual workplace. A questionnaire was devised and distributed by e-mail to a sample of alumni from the last 10 years who are currently working in the industry. The developmental stage of formulating the questionnaire involved a review of the literature and a conceptual analysis of the key skills, to incorporate those which have risen in importance over time. The questionnaire was thus devised based on these key skills and took the form of both open and closed questions. The areas of coverage included;

- Skills developed during the graduates' studies which have helped to prepare them for working life.
- Skills required in their work which they were not prepared for.
- Suggestions for future curriculum development.

In addition, a sample was derived from a set of nationally recognised graduate employers who have recruited supply chain graduates over the last five years, including manufacturers, retailers, logistics service providers, consultancies, etc. A random sample was selected from

the graduate employers known to the university. This allowed for a representative cross-section to be sourced.

Findings

The sample selected consisted of a total of 120 respondents, the response rate achieved 20% with respondents employed in supply chain roles ranging from director to management trainee. Of the respondents, 49.2% were employed within logistics industries, 13% within each food and beverage industry and public transport, and 4.3% from each of freight forwarding, oil and gas, consultancy and defence. The remaining respondents hailed from other related areas such as shipping, rail infrastructure and vehicle management systems. Of the respondents, 70% had worked with their current employer for over 24 months and hence are likely to have a deeper understanding of the demands for supply chain graduate skills. In order to determine the skills requirements, the questionnaire was designed using a seven-point Likert scale. Respondents were asked to rate each of the skills listed. The table below, adapted from Giunipero and Pearcy (2000), shows the derived skill sets from the literature findings;

Strategic Skills	Process Management Skills	People Management Skills	Decision making Skills
• Boundary spanning management • Work experience partnering with industry • Market understanding and customer service • Business ethics	• Project management • Training* • Regulations*	• People management • Teamwork • Leadership skills • Collaborative Learning	• Problem solving • Organisational skills • Planning skills • Flexibility • Initiative
Behavioural Skills	**Quantitative Skills**	**Negotiation Skills**	
• Communication • Time management • Motivation and enthusiasm • Stress management	• Finance and numeracy • Information technology • Analytical and statistic skills	• Management of complexity and change • Negotiation	

Table 3: Supply Chain Skills (*supply chain skills which have been added as part of the research findings)

In addition, open questions were added to understand and explore the supply chain skills needed. The graduates highlighted the industry applicable skills recognised as key to their career development. Industry specific skills included analytical skills, modelling and simulation, transport and logistics management, supply chain management, quantitative methods, statistics, strategic management and transport economics (Mangan and Christopher, 2005).

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Data Analysis

The survey instrument was developed based on a comparison of the skills listed by previous supply chain researchers in Table 1. The survey was pilot tested within the higher education institution to test for clarity of questions and concepts used. Additions, modifications and alterations were undertaken based on the feedback. The survey instrument was tested for reliability (Table 4). When analysing the elements, codes were assigned to the following constructs in Table 4.

Code		Cronbachs alpha
BSM	Boundary spanning management	.951
WEP	Work experience partnering with industry	.556
PMS	Project management skills	.841
OSM	Organisational skills	.875
TRN	Training	.639
REG	Regulations	.853
COM	Communication skills	.878
TIM	Time management	.797
MAE	Motivation and enthusiasm	.732
SSM	Stress management	.952
INI	Initiative	.793
FIN	Finance and numeracy	.823
INT	Information technology	.598
ASS	Analytical and statistical skills	.637
COL	Collaborative learning	.691
TEW	Teamwork	.637
LES	Leadership skills	.879
PRO	Problem solving	.903
PLN	Planning skills	.813
FLX	Flexibility	.756
MUC	Market understanding and customer service	.886
MCC	Management of complexity and change	.865
NEG	Negotiation	.772
PEM	People management	.825
BET	Business ethics	.868

Table 4: Factors and their scale items

The initial analysis for reliability indicated that all measures were acceptable at a minimum for Cronbach's coefficient alpha of 0.60 (Hair et al., 2011), implying that they were internally consistent. However, a few measures were below 0.60. According to Churchill (1979), if the study is exploratory in nature, the Cronbach's coefficient alpha levels between 0.50 and 0.60 are acceptable. For this study the Cronbachs coefficient alpha ranges from 0.56 to 0.95. The factors and their respective scales and the Cronbachs coefficient alpha levels are shown in Table 4. Based on the feedback received, the questionnaire instrument was refined. In an effort to increase the response rate, a modified version of Dillman's (2000) methodology was followed, sending a reminder to follow up the questionnaire. Based on the supply chain skills,

the top ten skills rankings were identified (Table 5) as time management; communication; collaborative learning; teamwork; problem solving; motivation and enthusiasm; people management; organisational skills; initiative; and stress management. The ten top skills are hence mainly located under the umbrella of behavioural skills, decision-making skills and people management skills.
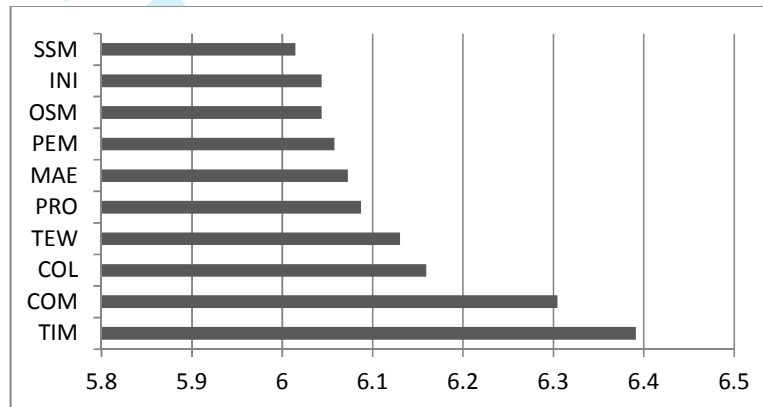

Table 5: Top ten supply chain skills and their ranking

After having assessed and ranked the top ten skills, the following Table 6 introduces the individual constructs and their respective descriptive statistics to enable a broader understanding of the constructs used. The next section introduces the findings of the twenty five skills observed within this study, and their relevance to current supply chain skills research.

Strategic Skills

- *Boundary spanning management.* Graduates in the study noted the importance of an in-depth understanding of the "bigger picture" in managing the supply chain, incorporating knowledge of strategic management, transport management, demand forecasting, warehousing and inventory control, and the relationship between these functions. Equally, employers viewed the combination of customer service, transport management, inventory control, production planning, demand forecasting and logistics IT systems, also identifying that it is the overall understanding of how these supply chain elements impact on each other were viewed as important. This finding resonates with Gammelgaard and Larson (2001) who found that the ability to see the "big picture" was a priority for supply chain practitioners. However, our findings indicated that boundary spanning management was not included within the top ten most important skills. This may also be due to the developments in supply chain education since Gammelgaard and Larson's work in 2001

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Strategic Skills	Process Management Skills	People Management Skills	Decision making Skills
Boundary spanning management (BSM)	**Project management skills (PMS)**	**People management (PEM)**	**Problem solving (PRO)**
VAR1 Min.2 ; Max.7; Mean 5.83; Std 1.30	VAR1 Min.4 ; Max.7; Mean 5.78; Std 1.30	VAR1 Min.3 ; Max.7; Mean 5.87; Std 1.06	VAR1 Min.4 ; Max.7; Mean 6.22; Std 0.85
VAR2 Min.3 ;Max.7; Mean 6.00; Std 1.24	VAR2 Min.2 ;Max.7; Mean 5.43; Std 1.41	VAR2 Min.5 ;Max.7; Mean 6.30; Std 0.88	VAR2 Min.4 ;Max.7; Mean 6.09; Std 0.79
VAR3 Min.3; Max.7; Mean 5.70; Std 1.29	VAR3 Min.3; Max.7; Mean 5.91; Std 1.12	VAR3 Min.5; Max.7; Mean 6.00; Std 0.80	VAR3 Min.4; Max.7; Mean 5.96; Std 1.02
Work experience partnering with industry (WEP)	**Training (TRN)**	**Teamwork (TEW)**	**Organisational skills (OSM)**
VAR1 Min.4 ; Max.7; Mean 6.09; Std 1.00	VAR1 Min.1 ; Max.7; Mean 4.74; Std 1.96	VAR1 Min.3 ; Max.7; Mean 6.26; Std 1.05	VAR1 Min.5 ; Max.7; Mean 6.09; Std 0.85
VAR2 Min.4 ;Max.7; Mean 5.52; Std 0.95	VAR2 Min.2 ; Max.7; Mean 4.91; Std 1.70	VAR2 Min.3 ;Max.7; Mean 5.78; Std 1.20	VAR2 Min.4 ;Max.7; Mean 6.17; Std 0.86
VAR3 Min.5; Max.7; Mean 6.13; Std 0.87	VAR3 Min.2; Max.7; Mean 5.57; Std 1.16	VAR3 Min.5; Max.7; Mean 6.35; Std 0.71	VAR3 Min.3; Max.7; Mean 5.87; Std 1.06
Market understanding and customer service (MUC)	**Regulations (REG)**	**Leadership skills (LES)**	**Planning skills (PLN)**
VAR1 Min.3 ; Max.7; Mean 5.83; Std 1.07	VAR1 Min.4 ; Max.7; Mean 5.78; Std 1.09	VAR1 Min.3 ; Max.7; Mean 6.13; Std 1.01	VAR1 Min.4 ; Max.7; Mean 5.91; Std 0.85
VAR2 Min.4 ;Max.7; Mean 5.96; Std 0.93	VAR2 Min.3 ; Max.7; Mean 5.13; Std 1.36	VAR2 Min.3 ;Max.7; Mean 5.87; Std 1.10	VAR2 Min.4 ;Max.7; Mean 6.04; Std 0.88
VAR3 Min.3; Max.7; Mean 5.65; Std 1.15	VAR3 Min.4; Max.7; Mean 5.78; Std 1.00	VAR3 Min.2; Max.7; Mean 6.04; Std 1.15	VAR3 Min.4; Max.7; Mean 5.91; Std 1.16
Business ethics (BET)		**Collaborative learning (COL)**	**Flexibility (FLX)**
VAR1 Min.5; Max.7; Mean 5.67; Std 1.15		VAR1 Min.2; Max.7; Mean 6.17; Std 1.30	VAR1 Min.4 ; Max.7; Mean 5.91; Std 0.95
VAR2 Min.6 ;Max.7; Mean 6.67; Std 0.58		VAR2 Min.3; Max.7; Mean 6.09; Std 1.08	VAR2 Min.3 ;Max.7; Mean 5.57; Std 1.04
VAR3 Min.5; Max.7; Mean 6.00; Std 1.00		VAR3 Min.3; Max.7; Mean 6.22; Std 1.00	VAR3 Min.4; Max.7; Mean 6.09; Std 1.00
			Initiative (INI)
			VAR1 Min.4 ; Max.7; Mean 5.91; Std 0.90
			VAR2 Min.5 ;Max.7; Mean 6.26; Std 0.75
			VAR3 Min.4; Max.7; Mean 5.96; Std 0.98

Behavioural Skills	Quantitative Skills	Negotiation	
Communication (COM)	**Finance and numeracy (FIN)**	**Management of complexity and change (MCC)**	
VAR1 Min.3 ; Max.7; Mean 6.22; Std 1.09	VAR1 Min.2; Max.7; Mean 5.43; Std 1.24	VAR1 Min.3; Max.7; Mean 5.87; Std 1.03	
VAR2 Min.4 ;Max.7; Mean 6.26; Std 0.86	VAR2 Min.3 ;Max.7; Mean 5.70; Std 1.11	VAR2 Min.5 ;Max.7; Mean 5.96; Std 0.87	
VAR3 Min.4; Max.7; Mean 6.43; Std 0.84	VAR3 Min.2; Max.7; Mean 5.43; Std 1.16	VAR3 Min.4; Max.7; Mean 6.22; Std 0.94	
Time management (TIM)	**Information Technology (INT)**	**Negotiation (NEG)**	
VAR1 Min.5 ; Max.7; Mean 6.48; Std 0.73	VAR1 Min.3; Max.7; Mean 5.52; Std 1.31	VAR1 Min.4; Max.7; Mean 5.43; Std 0.97	
VAR2 Min.5 ;Max.7; Mean 6.43; Std 0.79	VAR2 Min.2 ;Max.7; Mean 5.43; Std 1.47	VAR2 Min.3 ;Max.7; Mean 5.70; Std 1.19	
VAR3 Min.5; Max.7; Mean 6.26; Std 0.86	VAR3 Min.3; Max.7; Mean 6.26; Std 0.96	VAR3 Min.5; Max.7; Mean 5.43; Std 0.80	
Motivation and enthusiasm (MAE)	**Analytical and statistical skills (ASS)**		
VAR1 Min.5; Max.7; Mean 6.22; Std 0.85	VAR1 Min.5; Max.7; Mean 6.17; Std 0.78		
VAR2 Min.1 ;Max.7; Mean 5.83; Std 1.34	VAR2 Min.1 ;Max.7; Mean 5.35; Std 1.43		
VAR3 Min.5; Max.7; Mean 6.17; Std 0.78	VAR3 Min.3; Max.7; Mean 5.83; Std 1.11		
Stress management (SSM)			
VAR1 Min.2; Max.7; Mean 5.78; Std 1.17			
VAR2 Min.3 ;Max.7; Mean 6.09; Std 1.00			
VAR3 Min.3; Max.7; Mean 6.17; Std 1.07			

Table 6: Descriptive data summary of the skill set findings

indicating that the supply chain is already seen holistically.

- *Work experience and partnering with industry*. All respondents agreed that relevant work experience is essential for the development of supply chain skills, particularly those which may not be easily developed within the lecture room. Graduates indicated that they benefited from workplace exposure during their studies, which allowed an opportunity to apply knowledge and practice new skills. Work experience and partnering with industry takes place often in the form of work placements, real-life projects and consultancy tasks (Bak and Boloucher-Passet, 2013) which equip the students with relevant supply chain skills and experience. Additionally, graduates noted that industrial experience gave them a head start in their careers. Surprisingly, although the interviews indicated a pivotal role to work experience and partnering with industry, this was not observed as one the key skills (Table 5).

- *Market understanding and customer service.* The supply chain is seen as the driver of customer service, enabling business objectives to be achieved through meeting the demands of the end users, whether they are internal or external to the supply chain (Christopher, 2004; Gammelgaard and Larson, 2001). In this study, the findings indicated that graduates recognise the importance of customer service from a theoretical stance as well as how it is applied to the working environment. The link between supply chain and customer service is familiar to all parties, and it is recognised that an understanding of customer service and markets at both operational and strategic supply chain level will enhance a supply chain manager's abilities to respond appropriately. One academic with previous experience in commercial management and directorship stressed that an understanding of the market is essential for supply chain success. However, the second stage in our research failed to classify market understanding and customer service as one of the top skills in supply chain education, despite the interest attracted in supply chain literature (Christopher, 2004; Kovacs et al., 2012).

- *Business Ethics*. An awareness of business ethics is growing in importance and is often linked to corporate social responsibility (Sohal, 2013) within the supply chain context. Recognising the responsibility towards society, social justice and the environment is seen as a high level strategic decision within companies and graduates need top level visibility to understand its impact on the business. Ethical principles also apply to daily operations and the decisions made which impact on how individuals and groups work effectively together, both nationally and internationally (Sohal, 2013). Business ethics identified as

being a highly rated skill within our findings, indicating the importance of understanding of ethical codes (eg. the Modern Slavery Act, 2015; Ethical Code of Conduct).

Process Management Skills

Process management skills have been acknowledged as being underdeveloped in former studies, including health and safety regulations and their implications in the supply chain (Bak and Boloucher-Passet, 2013).

- *Project Management.* The rate of business change in recent years has driven the need for enhanced supply chain skills in order to plan, implement and manage new projects. However, project management skills were seen as limited, reflecting upon limited opportunities to apply theoretical knowledge to real case examples with the outcome being to produce a serviceable solution. This was reliant on the company's willingness to engage. Relevant industrial experience permitted a greater practical emphasis on skills development in this area, and graduates valued project management skills highly (Bak and Boloucher-Passet, 2013). Project management has been a recognised skill requirement according to Gammelgaard and Larson (2001), Mangan and Christopher (2005), and Giunipero et al. (2006). In our study the second stage findings supported Yew Wong et al. (2014) with project management being seen to be less important, which may be relevant to specific job roles. However, it was also noted that some respondents encouraged further development of project management in the curriculum, this may also reflect the difference in graduation years, as within the last 5 years project management has gained momentum in undergraduate supply chain teaching.

- *Training.* Qualifications are becoming a requirement in business either as a result of government regulations or company policy, triggering responses to suggest that curricula should include subjects which offer additional industry-focused qualifications. For example, the Certificate of Professional Competence (CPC), an operational based qualification relating to the movement of goods, relevant for drivers and transport managers, whilst Six Sigma Green Belt training is often required in manufacturing to develop specific skills which drive process improvement within the organisation. As highly specific subjects resulting in professional qualifications, it could be argued that they narrow down the opportunities of those with these qualifications, hence it may be far more effective if they were taught on-the-job. They may produce less transferable skills than some of the skills already mentioned. The research indicated that additional qualifications would be beneficial, but an awareness of the changing nature of some qualifications'

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requirements should be considered and undergraduates should focus more on higher level thinking and application skills. Additional coverage of environmental considerations was also suggested, alongside risk assessment and quality management. The results of the findings may be also linked to the specific roles which graduates are assigned to (Table 5).

- *Regulations*. Regulations, although not mentioned as a specific skill in the literature review, the ability to comply with a range of regulations was identified as one of the necessary skills in relationship to environment, transport, quality management and health and safety. Findings in the second stage highlighted the importance of environmental legislation, such as the disposal of waste and associated regulations, with an emphasis on understanding the area of salvage and scrap disposal and the associated packaging. This may be also due to the increasing prominence of government regulations and reverse supply chain operations, which is recognised within the literature as a growth area (Rahman and Qing, 2014). Despite this assertion, the industry dependency of this skill has attracted one of the lowest ratings within the 25 skills investigated.

People Management Skills

People management includes many sub-skills such as working in a team (Gammelgaard and Larson, 2001; Lutz and Birou, 2013; Myers et al., 2004) and collaborative learning (Thomchick, 1997).

- *People management*. As a standalone category, people management skills overall evaluation attracted one of the highest rankings of the categories under investigation. People management was seen as a valuable skill for all respondents, this is in agreement with previous studies on supply chain skills (Christopher, 2004; Kovacs et al. 2012; Lutz and Birou, 2013). Our findings also indicated that the graduates should be equipped with the necessary people management skills to deal with a variety of different situations within the global scope of supply chains.
- *Teamwork*. Teamwork was rated highly and identified as having been particularly well developed during academic studies through a range of group-based activities and assessments which assisted in the preparation for the workplace. The academics viewed group-based assessments as valuable in exposing students to different scenarios and working partners, which often poses significant challenges to achieving an end result. This resonates with Sohal's (2013) findings, which suggest that effective team-working skills are essential for the successful integration of intermediaries along the supply chain, with consideration to both local and global partners. Where students are given a range of

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contexts to experience, both within academia and work experience, this adds to their learning and development of social skills that employers need (Lutz and Birou, 2013).

- *Leadership Skills.* The findings of Stage 1 did not highlight leadership skills as a key development area, whilst Stage 2 findings placed leadership skills as one of the highest ranked skills, a vital area which required further development. It could be argued that leadership can be taught from a theoretical stance and tested through group-based projects. However, it remains a skill which will inevitably develop throughout the graduate's career progression with experience. This is in line with previous research indicating the importance of industry leadership skills in supply chain management (Hoffman 2005; Lutz and Birou, 2013) as a key ingredient to lead effectively (Hoffman, 2005; Kovács et al., 2012; Lutz and Birou, 2013).

- *Collaborative learning.* Collaborative learning is identified by Thomchick (1997) as a means by which students engage with others as part of the learning process. Within the university setting the lecturer is instrumental in guiding and keeping the focus of the learning on track, whilst this can equally be applied to the workplace whereby the graduate is responsible for his/her own learning, often termed 'lifelong learning'. The ability to actively participate in discussions and to critically assess the objects for discussion are encouraged during the academic process and this can also continue in the workplace to generate graduates who are active in their learning through listening and working with others. Collaborative learning is rated highly within the study, indicating the importance of involvement of a range of contributors in the learning process.

 Decision making Skills

Decision making skills have also been highlighted as one of the most important skills for graduates to possess, including skills such as planning, flexibility and problem solving.

- *Problem solving.* An early study of supply chain skills by Murphy and Poist (1991) underlined the importance of problem solving skills, which is also reflected in our second stage findings. Although problem solving skills might be taught at the classroom level, nevertheless experience is perhaps the most effective means of developing this skill. This finding is also in line with Bak and Boloucher-Passet (2013) whose research indicated that problem solving skills are imperative within the context of supply chain education, which can be provided via consultancy projects or in class real-life cases.

- *Organisational skills.* During the interview with one of the academics, it was noted that "organisational skills [can] "in a sense be viewed as a generic competence, which is

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developed [or acquired] throughout their degrees", and may be subject to change based on the context and industry specific (Kovács et al., 2012). Organisational skills are noted as one of the most important supply chain skills. Although not taught as a specific module, it is seen as a skill that has been developed throughout the undergraduate degree as part of several modules. Hence, our findings indicated that graduates placed a high emphasis on developing organisational skills.

- *Planning skills.* The findings are in line with Lutz and Birou (2013) who viewed planning as an important skill for supply chain management. Attributes relating to the ability to plan and organise were rated most highly by all respondents, whilst some respondents noted that junior management skills such as the ability to supervise, delegate responsibility and train employees was important. Although the first stage of research did not indicate a high emphasis on planning skills, the second stage, on the contrary, rated this as one of the higher ranked supply chain skills.

- *Flexibility.* Commitment and flexibility were seen necessary by all respondents, which could be demonstrated by undergraduates whilst working on group projects, which require a certain level of flexibility and adaptability. Flexibility and adaptability has become pivotal nowadays, as the structure of supply chains change based on; information technology (IT) (Bowersox, 2002; Lorenz et al., 2013), product proliferation and shorter product life cycle times with smaller and more frequent shipments which require quick responses (Bowersox, 2002; Lorenz et al., 2013), globalisation of business (Basnet, 2000; Bowersox, 2002; Lorenz et al., 2013), and the transition of business towards integrative management (Bowersox, 2002). Hence, in reflection of these rapidly changing trends in the supply chain, graduates require greater flexibility to respond.

- *Initiative.* Respondents gave this skill one of the highest rankings, as a result of boundary spanning supply chains which require initiative, creative thought or thinking 'outside the box'. The initiative is especially important within an industry which is challenged to find new solutions and innovations to continually drive service levels up and costs down, requiring supply chain experts to take the initiative in order to respond.

Behavioural Skills

Behavioural traits are often seen as key employability factors. Research findings indicated a high importance.

- *Communication.* Gammelgaard and Larson (2001) concluded that communication was one of the most important skills for practitioners, in both written and oral formats, and at all

levels of management. Out of 25 skills assessed, this skill was rated in the top two skills with equivalent importance to all respondents. The respondents highlighted that effective communication was instrumental at a strategic level in career development, one respondent noting the impact on career progression. The findings indicated similarities and conformance to Gammelgaard and Larson's (ibid) study, which remains valid today.

- *Time management.* Time management can be viewed as an essential skill for managing contemporary supply chains (Myers et al., 2004). A characteristic of the supply chain involves activities that are time-sensitive and interconnected to meet increasing customer demands in real time. Hence, graduates must be well prepared to respond quickly. Similarly, our findings confirmed the importance of time management, giving this the highest ranking out of all 25 skills. Although time management has not been taught as a specific skill, nevertheless it is an essential and integral part of the academic curriculum and learning process which is transferable to the workplace.

- *Motivation/enthusiasm.* An assessment of industry needs identified enthusiasm as being a significant feature, indicating similarities and conformance to Gammelgaard and Larson's (2001) study. However, Murphy and Poist (1991) found that motivation skills are particularly of importance for senior logistics executives. Our findings indicated that motivation and enthusiasm ranked within the top 10 skills not only for senior managers but also for graduates. Despite its importance, one interviewee noted that "[d]elegation and motivational skills are perhaps missing from the graduates' skills portfolios." Hence, a discussion to what extent this can be embedded in the current curriculum is needed. As Yew Wong et al. (2014, p. 539) highlighted, this may be still a relevant discussion, especially where senior executives "must be good managers first and logisticians second".

- *Stress management.* Myers et al. (2004) and Kovács et al. (2012) indicated stress management to be an essential element necessary to cope with the demands of a fast-paced, competitive environment. Our findings confirmed this need, despite this particular skill not directly taught as part of the curriculum, students do however, learn to develop coping strategies to deal with stress during various aspects of their studies, including complex projects involving diverse parties (i.e. different teams, industry projects, case studies) and with tight assessment delivery time scales.

Quantitative Skills

- *Finance and Numeracy.* Briscoe (2001, p. 247) noted "where a lack of financial skills exists, such shortcomings may pose a significant threat to the operation of a successful

supply relationship". Our findings indicated that quantitative expertise and financial skills are still generally recognised within the literature to involve statistical and quantitative tools and techniques which are imperative to equip the supply chain manager to perform at optimum levels (Mangan and Christopher, 2005; Kovács et al., 2012; Yew Wong et al., 2014). This is also reflected at higher education level through the study of best practice organisations and the techniques which they employ to manage and control business. In-depth understanding of finance and numeracy is fostered during studies and hence graduates emerge from the educational system with a perception of the high value placed on quantitative ability.

- *Information Technology Skills.* The key themes highlighted as being important to graduates include information technology skills. This reflects also upon the increasing information technology structure within supply chains and the development of new tools and techniques and a greater emphasis on efficiency and cost-effectiveness. This shift is emphasised in Murphy and Poist's (1994) and Bak's (2016) findings. Production planning and demand forecasting are both coming to the forefront of knowledge requirements as new information technologies are developed, establishing the need for appropriately trained personnel. However, our findings also indicated a lower importance attributed to IT skills, which may be a result of graduates becoming more accustomed to the use of IT in academic work and therefore these skills are well developed.

- *Analytical and statistics skills.* Industry specific supply chain skills, including analytical skills, modeling and simulation, quantitative methods, and statistics was paid high importance by Mangan and Christopher (2005). On the contrary, our findings suggest that analytical and statistical skills, including quantitative methods, modelling and simulation wasn't placed as an important skill. This finding may reflect the differences in industry needs (i.e. multinational corporations often make use of simulation tools) between firms, sectors and divisions, as well as job roles.

- *Management of complexity and change.* Although in the literature, managing change and complexity have been viewed as important *(*Bak and Boloucher-Passet, 2013; Ankers and Brennan, 2002; Sheffi and Klaus, 1997), this contradicts our findings, which indicated that the respondents viewed it as a skill of average importance. This may be due to a greater acceptance of these characteristics as part of the contemporary supply chain environment, which graduates are prepared for with a broad skills toolkit relating to the use of information technology and practical experience of simulated global projects.

- *Negotiation.* Negotiation is a key activity both internally and externally to an organization and relates to the effectiveness of personal communication and expertise in interpersonal relations which both parties are in agreement with. The perception of the term "negotiation" may vary with those in more senior roles, seeing this as a high level attribute specifically relating to commercial negotiations between existing and potential business partners. However, it is equally a determinant of success at lower managerial and operational levels as it enables the individual to coordinate activities with other functional departments and instigate trade-offs to the benefit of all parties. Negotiation has been recognised only by Kovács et al. (2012) as a supply chain skill, especially in a humanitarian context. However, our findings indicated that this skill is not solely relevant to humanitarian supply chains, but also accepted across other supply chains.

Supply Chain Skill	Stage 1 Findings	Stage 2 Findings
Communication	One interviewee noted that graduates should "be able to formulate and present an effective argument and be able to deal with any associated rejection which might result". Hence, communication skills also link to these skills and can be seen as imperative if success is to be achieved in business.	• One graduate noted that "communication and organisation skills have been paramount in my career to date, giving me confidence to speak in meetings and in front of management".
Project Management	One interviewee noted that "Project management has traditionally been separated from the supply chain degree and was considered part of engineering degrees. However in the last 5 years project management seems to be more important and highly valued in the curriculum."	• Project management was seen as a valuable skill both by graduates and employers. Some undergraduates had the opportunity to select the module as an option. • One employer noted that "project management was lacking". • Project management was seen to be more important by the graduates compared to the employers.
Boundary spanning management	One interviewee noted that "An understanding of the 'bigger picture' is necessary, and this is a particular feature of logistics and supply chain management, whereby synergies are sought between functional activities." Academics view this as a growth area but from a practitioner's point of view this may appear less relevant if the job role an individual is responsible for focuses only on one part of the whole supply chain.	Respondents' comments on skills developed included; "[the] various concepts which companies are using to develop their supply chains and gain a competitive advantage."; "understanding the links in an organisation and the flows of knowledge and resource both up and downstream" was useful. And the "ability to have a global view of the supply chain" helped.
Work experience and partnering with industry	An interviewee noted that "We do have a placement scheme that is taken up by many students..... it equips the students with a broader range of practical skills, which employers demand". Also, "placements are an ideal way for students who are weaker academically to shine in the workplace. Often those students perform better on placement and gain most value from it." Hence, "[a] placement year provides the opportunity to learn all about the world of work, but the students are in the hands of the employer. Students in some cases might get more out of the placement if more structure is put in place. It is also a chance to learn transferable skills."	• The year in industry spent as work experience was seen as invaluable by one graduate.
Market understanding and customer service	One academic noted that "[a] lot of market analysis is undertaken specifically in the rail, air and retail sectors. Although we try to cover a range of markets in detail, more specific company knowledge will be gained whilst on the job." One interviewee noted that "[s]tudents are learning the concepts within commercial and business context, which in turn will enable them to gain understanding of business practices."	• Market/customer service knowledge was useful when setting out in the workplace for graduates. One graduate stated that "The economic and business environment knowledge is useful to understand and comprehend a market." • "All the theoretical knowledge gained whilst at university has prepared me for going into the business environment" noted one graduate. • "Knowledge about logistics and supply chain management has provided me with good background and understanding of the subject".
Management of complexity and change	"Although change management has been not delivered as a subject, it has been an integral part in the discussion of project management as well as information technology applications."	No further elaboration
Information Technology	"Since demand forecasting is reliant on information technology it would follow that the emphasis is also placed on IT awareness as a skill." Another interviewee agreed that "IT systems awareness and practice should feature strongly throughout an undergraduate programme".	• One graduate noted that analytical / computing skills had put them "a step ahead of most of my colleagues in the workplace".
Finance and Numeracy	All interviewees indicated that more focussed teaching in financial issues would enhance graduates' capabilities and enable them to understand the reasoning behind commercial decisions much better, with one interviewee noting that "[t]eaching finance should be closely applied to industry practice once the basic knowledge is in place."	• Employers viewed analytical skills as important if the graduate career required the use and application of finance and numeracy. • Similarly, one graduate noted that a lack of financial understanding had been a limitation within his role.
Analytical Skills	One interviewee noted that "Analytical and communication skills are essential in this industry." "Business statistics and analysis is included in the subjects and we also run simulation and modelling classes, which prepare students for the workplace. However the importance of statistics and analytical skills may vary depending on the type of job."	• A graduate felt that the "ability to handle large amounts of data and the analytical skills to interpret, understand and apply it" were essential in the workplace. Specific tools such as modelling and simulation were emphasized. • Statistical knowledge was important to one graduate.
Leadership Skills	No further elaboration	• Graduates reported that leadership skills were lacking and underdeveloped.
Time management	One interviewee stated "Students learn throughout their degrees how to manage their time as they accomplish several tasks with set deadlines every year, which allows them to manage their time, work to	• The respondents ranked time management as most important skill.

	deadlines, set objectives and evaluate their own performance."	
Problem solving	One interviewee noted that they "[n]eed to promote more logical thinking". Another interviewee agreed "students have the chance and opportunity through real life case studies solving problems while recognising alternative solutions".	• One of the graduates noted that "[d]eveloping the ability to investigate a subject, allowing the best possible decision making process to take place" was important.
People Management	One interviewee noted "People skills should be included in the syllabus to prepare graduates with dealing with conflict, handling difficult people or situations, motivating staff, or how to deal with subordinates or senior managers. This should not be taught from purely a theoretical basis, but with practical application to the workplace." One interviewee noted that "more collaboration should be encouraged and opportunities for research progressed. An industrial liaison panel is a good idea – once or twice a year." Another interviewee agreed that "[t]here needs to be a group of industry representatives and academics who meet on a regular basis to discuss industry trends and evaluate the courses and respective subjects taught."	• Good people management skills were important to employers. • One graduate noted that "Interpersonal skills are important in the workplace." • Graduates highlighted the importance of collaborative learning through capturing organizational contexts in real-life case studies. • Employers noted that the ability to work as part of a team was important in the workplace.
Organisational Skills	One interviewee noted that "organisational skills are a key competence, which is also developed throughout their degrees."	• "Organisation skills have been paramount in my career to date".
Motivation/ Enthusiasm	One interviewee noted that "[d]elegation and motivational skills are perhaps missing from the graduates' skills portfolio."	• Self-motivation was considered as important to respondents
Planning skills	No further elaboration*	• Planning skills was seen important by the respondents.
Stress Management	One interviewee noted that "Students are learning to deal with stress and complexity within the group and individual tasks as well as managing tight deadlines."	• Dealing with stress and difficult situations was a gap noted by one graduate, although it was recognised that this may be a difficult skill to learn at university.
Flexibility	One interviewee noted that "[w]e hope as the students are learning to manage diverse tasks within bigger projects, this allows them to become flexible and adaptable employees in future."	• Commitment and flexibility were seen as necessary by respondents.
Initiative	Educators are responsible not only for the transfer of knowledge but also instilling within their charges the abilities for innovative thought, or thinking 'outside the box'. The promotion of greater logical thinking was raised by the interviewee. Another interviewee claimed that "Students are expected to take the initiative when working and devising projects."	• Respondents agreed that initiative is needed and also ranked highly in the skills assessed.
Regulations	Not identified	• Additional regulation coverage was identified by respondents, particularly environmental considerations, with greater emphasis on passenger transport operations, Health and Safety, Risk Assessment, and Quality Management.
Negotiation	One interviewee noted the limited presence of negotiation skills within the context of supply chain programme. "We teach students negotiation skills particularly within the context of purchasing, however they have the potential to exercise negotiation skills during group projects..."	• Graduates noted the lack of negotiation skill development.
Specialist Training	One interviewee noted the training possibilities; "CPC – The opportunity already exists where they can take the course with the Technical college for a small fee, but few take up this offer. The course is not appropriate at this level. Graduates should know why the regulations exist not what the regulations are in detail as these change frequently." Another interviewee noted that "Green Belt – Probably could be included in the final year, but may have to be an optional module as the content is quite extensive. It would fit somewhere between strategic supply chain management and modelling and simulation."	• One employer noted that training "in [supply chain] area … [may] add to a manager's portfolio of skills… and knowledge of the tools and techniques used"

Table 7: Response snapshot from Stage 1 and Stage 2 data analysis, (* indicates where no further comments were added by the respondents)

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Discussion

The academic debate on supply chain skills started by Murphy and Poist (1991), and van Hoek (2001) is still ongoing (Bak and Boloucher-Passet, 2013; Myers et al., 2011; Sohal, 2013; Dubey and Gunasekaran, 2015). An understanding of the "bigger picture" of supply chain skills is deemed to be necessary to bridge the gap between the supply chain needs and associated skills required (Bak and Boloucher-Passet, 2013). Previous research on supply chain management skills covered the USA, Australia, and the Far East (Bak and Boloucher-Passet, 2013) with few providing a general outlook on UK supply chain skills needs (van Hoek, 2001; van Hoek et al., 2011). Hence, the current study based on a UK university has provided an insight into the skills impact and changing focus on key supply chain skills in an increasingly competitive global environment.

Firstly, the changing competitive global environment indicated the inclusion of new supply chain skills requiring specialist training in areas such as lean, six sigma, CPC, and regulations. An understanding of the application of regulations has been identified as a crucial requirement as part of decision making skills, especially in relation to national and international laws and regulations (e.g., environment, exports, imports) and rules and regulations involving health and safety, and employment law, as many management decisions are bound by both external laws and internal rules and regulations.

Secondly, the findings indicated that not all skills are weighted equally and different levels of emphasis have been placed by the respondents on the identified skills. For example, although previously identified as a key enabler within the supply chain (Bowersox, 2002; Kirby 2003; Mangan and Christopher, 2005), the findings of the current study presented a limited emphasis on information technology skills, despite the significant information technology advancements and changes in supply chains (Bak, 2016). This may reflect the changes being implemented as part of the curriculum, for example, information technology is now an integral element of several modules, rather than a separate skill. However, one has to bear in mind that in some cases access to a broad range of information technology and software tools are limited in terms of cost and time available in the respective higher education institutions and also dependent on the job requirements and the industry.

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Finally, it was noteworthy within our findings that more emphasis has been placed on behavioural skills, decision making skills and people management skills. The discussion on supply chain skills mainly focused on the supply chain specific expertise in the academic literature (Bowersox, 2002; Kirby 2003; Mangan and Christopher, 2005), with standalone cases of particular skills such as time management (Gammelgaard and Larsson, 2001; Meyers et al, 2004) and people management (Christopher, 2004; Kovacs et al. 2012; Lutz and Birou, 2013). The changing supply chain skills reflect the shift in supply chains requiring responsiveness and availability of 24/7 supply chain operations, which inevitably puts considerable pressure on operatives and managers whose responsibility it is to ensure compliance and to secure operations. To some extent, the supply chain graduates are exposed to handling stress, time management and engaging in project management through having to adhere to strict time deadlines when submitting coursework, presenting projects, preparing for tutorials/group works and exams whilst at university, with some also having exposure to workplace stress through undertaking an industrial placement year. Although graduates are well equipped with supply chain technical skills, the findings supported a greater emphasis towards the behavioural, decision making and people management skills, highlighting key areas for further research. The inclusion of skills identified (behavioural, decision making and people management skills), business ethics and specialist training (i.e. six sigma, CPC) can be further developed through innovative and collaborative relationships between industry and higher education, such as mentorship schemes.

However, it should be noted that the findings are relevant to one UK based university setting and its stakeholders based on 25 skills assessed, and may not reflect other UK universities, where variances across supply chain teaching might exist (Mangan and Christopher, 2005). Indeed, a need for a wider UK based study was evident through successive calls by researchers undertaking studies on supply chain management; current education provision, practitioner viewpoints; future supply chain skills needs and collaboration between industry and teaching (van Hoek et al., 2011; Bak and Boloucer-Passet, 2013). Hence, the findings of the study need to be tested in a wider UK higher education setting.

Conclusion and research implications

This study began with a discussion of existing supply chain skills identified in the academic literature. The discussion surrounding supply chain skills needs is not new (Bowersox, 2002;

Kirby 2003; Mangan and Christopher, 2005; van Hoek et al., 2011; Bak and Boloucher-Passet, 2013) although the emphasis on specific skills areas has evolved over time. Supply chain skills are driven by professional organisations (Dubay and Gunesakaran, 2013) as well as industry needs (Bak and Boloucher-Passet, 2013). However, ongoing discussions have omitted the individual course perspective and the impact on skills development, with particular regard to engaging graduate employers, graduates and academics. Our findings indicated a variance in relative importance of supply chain skills from the viewpoints of these stakeholders. Although the literature acknowledges skill sets, there is a need to identify whether these skills differ in terms of industry, departmental level and/or seniority.

Given that some skills have become an increasingly integral part of the university curricula, it was interesting to note the lower importance attributed to some areas in our study, such as IT skills. Undergraduates have become more accustomed to the use of IT in academic work that these skills might be seen as "second nature", and therefore reasonably well developed. Findings indicate that as the supply chain scope continues to evolve, the skills needs must adapt to this change (e.g. the emphasis on problem solving skills and negotiation skills). Survey respondents identified some limitations in leadership skills developed through their studies, suggesting that that more attention could be paid to enhancing these. Currently, assessments such as projects, problem solving and group work encourage the development of leadership skills. However, these could be the focus of a more systematic, cumulative and focused programme to build on continued learning with opportunities given for relevant contextual practice.

The findings of this study encourage further discussion into supply chain skills needs and how these can be reflected in classroom innovations in order to equip the students with the necessary supply chain skill sets. One approach to embedding skills development involves a supply chain skills portfolio, maintained throughout the degree course, which encourages review and reflection upon the individual's supply chain skills set. Current innovations towards integrative teaching encourage a developmental perspective, with the inclusion of supply chain skills scenarios (real-life and fictious) such as the "blue suitcase" (Nicholson et al., 2015) involving a snapshot of 22 individual video clips supporting the development of supply chain skills. Further research should consider the production of a framework of key supply chain skills, linking them with appropriate classroom innovations as a resource tool for programme directors.

While this study provided an overall understanding of supply chain skills needs, engaging three types of respondents, and laid the groundwork for further studies, caution should be taken when attempting to generalise the findings, given the scope of our exploratory research which was based on one UK university. Although other studies have looked into the specific supply chain skills requirements, (Alvarstein and Johannesen, 2001; Chikan, 2001; Sodhi et al., 2008) it may be beneficial for researchers to investigate the integration of these skills within the supply chain syllabus, and how the employer, graduates and academic parties could actively engage in developing the agenda for future industry needs. Hence, a conceptualisation around such an idea would create an insightful takeaway for the reader and tie in well with the set research objectives.

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