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Technological knowledge and skills provide a basis for developing national competitiveness. However, there is an emerging clash of interests in the UK labour market between employers and policy makers. The former requests highly skilled workers who often jealously train in house for their specific operations while the latter aims to reduce unemployment through the expansion of vocational training to lower skilled workers. Universities need to find their strategic position in the knowledge economy characterised by radical technological change and shifting occupational structure by meeting the future skills demand while balancing between the clashing institutional interests. This study analyses 510 job advertisements in the supply chain management area, using a combination of OMDS and HCA techniques. The advertisements are categorised by means of six dimensions according to the skills, duties and job type. This study analyses not only employers' needs in skill types according to job roles but also emerging institutional clashes in the job market and their implications for skills training policy and curriculum development.

Keywords: Skills Demand, Technical Skills, Soft Skills, Education Policy, Innovation Policy, Technological Knowledge, Multidimensional Scaling.

Introduction

Technological trajectories determine the division of labour and occupational structure within the national economic system as the new technological specialisation expedites the shift in its industrial structure (Antonelli & Fassio, 2014). The increasing globalisation of product and capital markets triggered by technological changes reshapes the distribution of labour, pushing towards upskilling and re-skilling of the workforce (Berman et al., 1994). Governmental agendas for science and technology policy invariably stress both short and long term needs of scientific knowledge and technical skills. Examples include China's focus on the diffusion of the internet and scientific knowledge in the population as by the 12th 5-year-plan for development (National People's Congress, 2011), the EU Innovation Policy (European Commission, 2013) and the SciSIP policy of the USA (National Science Foundation, 2014).

Although fostering technological knowledge does not necessary correspond to the creation of innovation (Archibugi & Pietrobelli, 2003), advanced industrialised countries (AICs) have shifted from capital intensive to knowledge based economies. Given the pressure for specialisation in the tertiary sector, AICs saw an increase in technological knowledge that pushes up the demand for upskilled labour while pushing down the demand for both capital and unskilled labour, therefore jobs require an increasingly higher level of technological knowledge at all levels (Khayyat & Lee, 2014). As structural change in the labour demand pattern has occurred in AICs, as part of the globalisation process (Cagnin et al., 2013; Haegeman et al., 2013), some speculation has been made about the projection of future skills needs and demand (Gallouj et al., 2014). However, AICs have also experienced ongoing economic and political stagnation since the 2008 economic crisis (Antonelli & Fassio, 2014) accompanied by increasing unemployment. Such conditions of austerity and instability have constrained the government's capacity to invest in technological development and upskilling

of labour force. This view is echoed by a recent EU report: "The certain risk of jobs polarisation is still signalled, as new job growth is concentrated in jobs requiring high-level qualifications and those which have, traditionally, required low-level ones. This trend is underpinned by technology replacing people carrying out routine tasks at all qualification levels" (CEDEFOP, 2012, p. 48).

As the private sector calls for more specialised knowledge and higher technical skills, (Jensen et al., 2007), the UK government and higher educational institutions are concerned about the provision of technological knowledge and learning (UK Government, 2014; Walker, 2014). With the increasing unemployment generated by the economic downturn, it is paramount for jobseekers to be as competitive as possible to find a job. This is particularly true in fast moving industries where the skill base has to change quickly to adapt to the rapid technological change (Kamprath & Mietzner, 2015). Despite the pressure for the upskilling of the future workforce, paradoxically, the government's urge for vocational training programmes to develop basic skills in the unemployed population (CEDEFOP, 2008, 2012) has pushed universities to expand specialised vocational training for soft skills to enhance employability of graduates (Onar et al., 2013; Sohal, 2013).

However, it is often difficult for universities to identify exactly what kind of skills they have to instil into the future workforce (Laurillard, 2013). Recently, university courses specialising in operations management, supply chain management and logistics have proliferated, because they are at the base of all industries and sectors involving production, manufacturing, wholesaling, or retailing (Dreher & Ryan, 2004; Sohal, 2013). Universities are also introducing more technical modules in their programmes, such as business analytics, quantitative analysis and statistical modelling. Since the job market became increasingly demanding (Wilton, 2011; Salomonson et al., 2012), universities need to answer several important questions in designing relevant courses to prospective employers: what kind of

skills are employers looking for?; what level of salaries are employers prepared to pay?; what are the implications of technological change for curriculum development?; and what is the policy direction of responding to UK's future skills demand?

Intensifying globalisation and the pressure for industrial competition (Brown et al., 2001; Eltantawy & al., 2009) have shifted AICs' policy focus from capital and infrastructure investment to high-tech research and development. Consequently, governments in AICs need to meet the increasing demand for multi-skilled and specialised workers (Hayward & James, 2004) while tackling the challenge of continuous workforce up-skilling (Crouch et al., 1999; Wolf, 2002). In industrial markets in general – where firms strive to generate innovation for commercial exploitation – and in the area of supply chain and logistics management in particular – by which firms seek efficiency in procurement, production and distribution processes – the recent changes in the institutional and technological environments have created a conflicting demands between technical/hard and human/soft skills as well as the professional roles and job associated with them (Fuller & Unwin, 2003; Öberg, 2013).

Although the governments of AICs recognise the strategic importance of technological knowledge creation and diffusion, changing economic conditions under the global crisis have altered the perceived need for skills (Giunipero et al., 2005; Wu et al., 2013), sometimes reflecting a gap or mismatch between what is demanded by employers and what policy makers push forward to tackle unemployment (Wachner et al., 2009) in the areas of vocational training, further and higher education and workforce skilling. For instance, 'government policy in England over the last 25 years has been successful in increasing the supply of qualifications but this has led to over qualification of the workforce at intermediate skills levels' (Hayward & James, 2004, p. 7). Likewise, higher education policy in the EU and the Bologna process – in an attempt to harmonise institutional differences among member countries – (Bernon & Mena, 2013) have created agendas closely tied to industrial

requirements, which made higher education itself 'a commodity that needs to be sold in a global marketplace' (Hayward & James, 2004, p. 9).

Knowledge-based economies need to develop skills for enhancing technological innovation through an educational system which promotes not only scientific and technological knowledge but also critical thinking and problem solving (Khayyat & Lee, 2014). While the European Community forecasts an increase in the demand for technical skills as part of the natural future skills demand of knowledge-based economies (CEDEFOP, 2012), the UK offers a depressing prospect for technological knowledge and skills development, with only 21.8% of the country's population showing numeracy competency at Level 2 or above (BIS, 2012, p. 3). In such a scenario, political, social and economic pressures create clashes of institutional interests due to unbalanced power distribution among different actors (Crouch et al., 1999). While economic policies are shaped by the increasing power of the industry, the satisfaction of social (e.g., inclusion) and macro-economic (e.g., unemployment) needs often conflict with industrial requirements for skills (Handel, 2003), hampering the long-term technological development.

Universities need to find their strategic position in the knowledge economy characterised by radical technological change and shifting occupational structure by responding to the challenges of meeting the future skills demand while balancing between the clashing institutional interests. This study analyses 510 job advertisements in the supply chain management area, using a combination of OMDS and HCA techniques. By examining the content of the advertisements, we found that they can be categorised by means of six dimensions according to the skills, duties and job type. This paper addresses this problem by proposing a framework based on institutional clashes that contributes to innovation theory with an institutional dimension affecting the generation of those skills that generate innovation. This framework also offers a tool for policy makers to reflect current educational

setup and focus on the potential relaxation of the tention created in the national innovation system by this institutional clash.This study analyses not only employers' needs in skill types according to job roles but also emerging institutional clashes in the job market and their implications for skills training policy and curriculum development.

Analytical Framework: Salient Challenges in Upskilling and the Employability Dilemma

Under the pressure of global competition requiring governments to prioritise technological development and prompting employers to demand skills that are complementary to firms' strategic needs, AICs' economic policies aim at (i) increasing employment in the wider adult population; and at (ii) increasing the skills amongst the youth through education policies (Crouch et al., 1999). Unfortunately, and quite counter-intuitively, effective employment policies does not depend just on education policies (Crouch et al., 1999, pp. vii-ix) because: (i) highly technical skills can be applied to niches of a high-tech field, (ii) individual firms have diverse needs for skills that often do not match the public demand for mass-provision of skills. Furthermore, (iii) firms already engage in a variety of vocational training. If governments carry on deferring skills provision and training to the private sector, policy making will be limited to providing skills to the unemployed. Policy makers concentrating only on residual care of the unemployed cannot push the innovation and regional development agendas effectively.

Weak collaboration between governments and firms also undermine the provision of advanced skills policies aligned with the industry's needs. Collaboration between private and public sector for the development of higher skills in prospective employees should be stronger and better coordinated. Nevertheless, as many firms tend to protect their business practices and processes, it hampers the provision of public training, limiting it to basic or low

skills (Crouch et al., 1999, pp. 72-73). Paradoxically 'the pace of change is now so fast partly because firms increasingly want skills defined in terms of their individual company culture or technology, when they are reluctant to allow even representative business associations to be involved in their affairs' (Crouch et al., 1999, p. viii).

Technical skills, upskilling and the risk of educational failure

In recent years the UK job market saw an increase of supply of Business and Management graduates (Wilton, 2011; Lutz & Birou, 2013). Policy makers in the UK promoted higher education (Wilton, 2011) and encouraged 'training the workforce (Edwards & Miller, 1998) to enhance social cohesion by lowering the socio-economic divide in the population (Deer, 2004; Hagan et al., 2011). However, broadening access to higher education also enlarged the availability of 'highly-skilled' workforce on the job market (Deer, 2004) and caused higher competition for jobs. As a consequence, the job market continuously pushes up the quality demand for higher education and higher skills (Wilson, 2001; Felstead et al., 2007).

The creation of right skills is paramount to the livelihood of AICs' economies. Different types of skills dominate different types of markets and changing patterns in employees' skills correspond to changing patterns in trade (Crouch et al., 1999). A country's composition of the skills setup (i.e. the proportion of low, intermediate, upper-middle and high skills) and the improvement of skills have a considerable impact on the socio-economic performance of the country. For instance, educational policies might fail by providing the obsolete skills to the industry: '[t]he modern industrial economy is calling out for skilled, educated workers. The right way […] is to promote the education of sophisticated workers. That means massive new commitments to training high school dropouts and welfare mothers' (Lafer, 2002, p. 2). Thus, schools and universities should modify their curricula to develop creativity and spontaneity of

students to foster an open-minded future workforce with right skills and to assist technological and economic development. This perspective becomes particularly relevant to our discourse if we look at the current institutional clash between the public and private sectors' aims. Increasing demand for highly skilled workforce created a tension between the supply of skilled workforce and further demand for increasingly highly skilled workers (Wilton, 2011). This tension degenerated in the clash between the 'absolute' and 'relative' dimensions of employability (Brown & Hesketh, 2004; Kalleberg, 2012) that caused highly employable skills being unemployed (Wilton, 2011). Therefore, there is a call for further research into what skills are truly needed in the job market to inform higher education institutions in fostering the future workforce with those skills (Wilton, 2011). In this paper, we propose a conceptual framework to explain this institutional clash in tailoring employability skills (see Figure 1).

Previous research (Wilton, 2011) showed an important link between the production of skills and the innovative competitiveness of regions (Ramirez & Rainbird, 2010). The positive relationship between firms' capabilities and regional innovation capabilities is even more evident within a global supply chains context (Ramirez & Rainbird, 2010), as supply chains compete 'globally' while contributing to the creation of regional capabilities. However, 'capable' regions require a reciprocal understanding between the private and public sectors (Henderson et al., 2002), with educational establishments playing an important bridging role between future employees and prospective employers.

Upskilling per se is positive, but in the current European socio-economic context it might not improve the skills settings of countries, but rather hamper progress by increasing intermediate-skilled as opposed to highly skilled workforce (Farkas, 2003), of which the so called '1,000 Euros Generation' is an example (Sotiris, 2010). Therefore, more effective public-private collaboration is called for devising better educational policies benefiting the

industry while securing more votes at the political level through policy success and unemployment control (Crouch et al., 1999, pp. 111-132).

The conflicting demand between technical and soft skills: The employability dilemma

With the increase of global competition on one hand and the increase of the demand for higher skills in the workforce on the other, the focus of firms shifted overtime from hard or technical skills towards 'soft skills' (Hillage et al., 2002; Grugulis & Vincent, 2009). With soft skills refer to characteristics that are related to communication abilities. However, soft skills are not just about communication abilities, but they are also about personal attributes that enhance an individual's interactions as well as job performance and career prospects. Today's employees need to possess not only technical skills specific to the duties to be performed in the company, but also soft skills to communicate with their stakeholders (Oliver & Turnton, 1982; Steiger, 1993) while showing a sound understanding of business processes.

A balanced mix of both technical and social skills appears being important (Thompson et al., 1995; Shibata, 2001) in a knowledge-based economy (Grugulis, 2007) that capitalises on workers' specialisation and requires duty-specific technical skills. Nevertheless, a shift from manufacturing towards a 'service' economy has generated increasing demand for a soft-skilled workforce (Lloyd & Payne, 2009). Soft skills are critical in 'service interactions' (Bolton, 2004). Although skills evaluations differ from a firm to another, it is dependent upon the industrial context of the firm (Abbott, 1993; Findlay et al., 2009). Previous studies also found that soft skills are often boosted by the presence of technical skills (Grugulis & Vincent, 2009).

A graduate with predominantly soft skills might be perceived as a worse employee than someone with a mix of technical and soft skills (Grugulis & Vincent, 2009; Madrick, 2012). Soft skills are not a substitution for technical skills (McDowell, 1997). Although a mix of

skills is preferred, many educational establishments focus on the development of soft skills because these skills are valued in customer service (Grugulis & Vincent, 2009). Soft skills are associated more closely with 'emotional workers', i.e. those employees who interact with clients or customers, especially in the service sector (Korczynski, 2005).

Furthermore, soft skills might not be as advantageous to employees as it might seem (Cohen, 2003; Lafer, 2004). From an employee's perspective, soft skills are often associated with lower salaries (Steinberg, 1990, 1999). Despite the abolition of gender based pay inequalities thirty years ago in the UK (Grimshaw & Rubery, 2007) soft skills are often associated with 'female' workers and undervalued (Steinberg, 1999). Sometimes employees with soft skills might be victims of discrimination for the perceived lower status of these skills in comparison to technical skills (Grugulis & Vincent, 2009). On the other hand, soft skills might be convenient to employers in the sense of increasing the flexibility of employees whose work might be adapted to a diverse portfolio of tasks (Grugulis & Vincent, 2009).

Some studies report UK firms' lack of trust in graduate employees' educational preparation (Woods & Dennis, 2009; Shokri & Nabhani, 2015). This suggests that a great deal of UK universities failed to provide the right skills to the prospective workforce (Martin et al., 2008). Perhaps this is due to the lack of understanding of what 'skills' are per se (Lloyd & Payne, 2009) and what the real needs of employers are. Overall, this trend indicates that there is a need for systemic collaboration between universities and the industry to realign their skilling aims.

The lack of alignment of students' training in universities with the skills needed by firms in the industry has both social and managerial implications. From the social point of view, workforce employed in 'bad jobs' is often a skills related problem (Lloyd & Payne, 2009) and low skilled workers are reported being stressed and constantly under pressure (Lafer, 2004). They need better training to perform better. From the managerial point of view, the

presence of the wrong skills' mix contributes to low firm performance (Grugulis & Vincent, 2009; Lorentz et al., 2013). However, as organisations are complex political entities, determining the right mix of skills for a firm is not an easy task (Abbott, 1993). Nevertheless, among policy makers in the UK there is a general debate that focuses on the overall need for the 'up skilling' of the workforce. In what follows we analyse which characteristics employers search for among their recruits, in terms of both technical and soft skills.

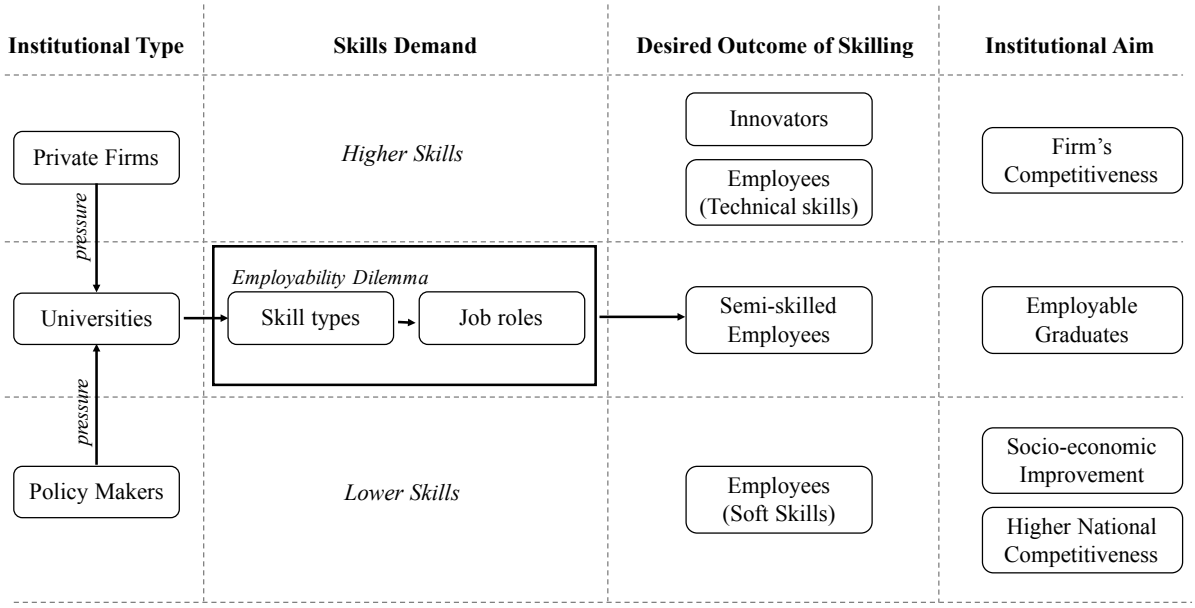

Figure 1: A framework of institutional clash in terms of workforce skilling and institutional aims.
Source: Authors' own.

Research Design and Method

Researchers generally investigate employers' job requirements through surveys with recruiters (Howard & Kerin, 2006). However, self-reported data, such as information obtained from surveys, are considered to be less reliable than observational data (Llieva et al., 2002; Podsakoff et al., 2003). Whenever possible, it is better to collect observational or secondary data as the information they carry could be more reliable. An obvious source of such information is job adverts, as employers list in them what they require and the characteristics of the job, as well as the salary offered and the location of the job. All adverts

present differences in the job requirements, but there are also common characteristics as employers search for well-rounded students in terms of skill sets (Rynes et al., 2003).

A basic assumption in this study is that job adverts reflect the industry's real situation. We assume that whenever a recruiter describes in a job advertisement the skills required and the duties to be undertaken, both the required skills and requested duties are effectively the ones advertised. We assume that the prospective employee will not find surprises, such as requests to fulfil either different duties from the ones advertised by the employers or extra non-advertised skills requirements. The analytical method of this research is 'content analysis' (2004). In performing a content analysis, there are three main approaches to analyse qualitative information, i.e. conventional, directed or summative (Hsieh & Shannon, 2005). Given the various approaches to content analysis, in this study we use the methodology developed by Mar Molinero and Xie (2007), based on the application of multivariate data analysis.

Data collection and coding

The data collected in this study consists of all the job adverts displayed on a supply chain management jobs website[1] between the 1st of May 2011 and the 30th of June 2011. No particular reason was behind the choice of the collection period dates. However, each job would be advertised for about 2-to-4 weeks and we believe two months was enough a good time window to make sure the jobs advertised were shown in full. Overall, information about 510 job adverts was collected and no advertisement showed duplications or incomplete information. The domain of supply chain management contains several professional roles which are often employed within the following functional areas: Marketing and Sales, Operations or Production, Warehousing, Logistics and Distribution and Purchasing or

[1] www.jobs4supplychain.com

Procurement, as well as Management. Table 1 shows the professional roles we mentioned above, divided by organisational function.

Sales[2]	Operations/ Production	Warehousing	Logistics and Distribution	Purchasing/ Procurement	General Management
Customer Service Assistant Customer Service Manager	Operations Manager Manufacturing Manager Production Manager	Expeditor Inventory Planner Inventory Manager Shift Manager Warehouse Supervisor Warehouse Manager Distribution Centre Manager	Logistics Analyst Logistics Coordinator Logistics Engineer Logistics Manager Logistics Specialist (consulting role) Transport Coordinator Transport Planner Scheduler Transport Supervisor Transport Manager	Assistant Buyer Purchasing Assistant Buyer Senior Buyer Category Manager Commodity Manager Purchasing Manager Procurement Manager Purchasing Consultant. Procurement Consultant Purchasing/ Procurement Director	Supply Chain Analyst[3] Supply Chain Coordinator Supply Chain Manager Supply Chain Consultant Supply Chain Director Business Development Manager

Table 1: Supply chain management job positions categorised by organisational function

The variables were defined after a detailed examination of the text of the advertisements. Keywords associated with the variables were manually identified in the job advert. Four sets of variables were identified: those related to the duties the person would be required to undertake once formally hired (duties); those related to the skills required to match the job criteria (skills); those related to the prospective employee's personal characteristics; and finally, other information such as salary, location, job and industry types and level of experience required (extras). Sometimes, the same keyword was used for both duties and skills. For example, some firms required inventory management skills to manage the firm's inventory. In such instances, the keyword 'inventory management' would appear both as a skill and as a duty in the dataset. It should be noted that two ads might have used different words in order to describe the same skill or activity. This required careful rereading of the ads contents to generate uniform variables that were employed to designate similar skills or duties. All variables were then zero/one encoded.

[2] We included customer service assistants in this category because they are the sales force who sells and then deals with the post-sale service of the products for many firms. These positions are considered important elements of demand management in current supply chain and marketing literatures. For further information please see Mentzer (2004).

[3] This position is very similar to the one of the logistics analyst. However, while the logistic analyst deals with logistics only, the supply chain analyst also operates value chain analysis on different aspects of supply chain management rather than logistics only, e.g. buyer-suppliers relationship strengths and weaknesses.

Dataset composition

Job roles requirements: Modern duties and technical skills

The list of keywords collected, with the number of times it appeared in the advertisement (in brackets) is reported in appendix A.1. The five most frequently advertised duties within a management context are: driving efficiencies, planning, lower production/distribution costs, analyse the market/supply chain, take decisions promptly and take accountability/responsibility for own actions. This suggests that management related positions tend to focus towards production/manufacturing planning and costs reduction rather than consumer-based value creation. All these positions required highly-skilled personnel and the development of technical skills is essential to aspire to work in these roles. A look at the skills required sheds light on this issue. The keywords associated with the technical skills required were identified in the advertisements as follows (full detail in appendix A.2).

The five most frequently required skills are: previous experience in a similar position; an understanding of the job/industry processes; ability in critical thinking; good interpersonal communication skills; and determination. It is interesting to see how the skills requested are as a matter of fact important to the main duties requested. Previous experience may be very important, along with the ability to think critically, to plan production and distribution and to drive efficiencies. Previous experience is also functional to a better understanding of production/manufacturing or distribution processes. Good interpersonal skills may also be important when employees that have to justify the employees' actions are requested to be accountable for their actions. Good communicators are able to extricate themselves from difficult situations. Good communicators are also able to make clear statements about their prompt decision-making.

Personal characteristics, salary and level of expertise

The five most frequent keywords associated with personal characteristics (appendix A.3) were: personal initiative, ambitious, business acumen, confident personality and analytical/mathematically minded. These personal characteristics somehow reflect the skills that are requested in order to undertake different duties. This suggests employers are searching not only for skills, but also for attitudes toward life and work. Salary was split into very narrow categorical intervals of about £2,000 each in order to reflect the variety of salaries offered in different job adverts (appendix A.4). Sometimes the salary was defined as 'competitive' and in these cases the salary was re-coded as a 'comp' variable without assigning any value. Furthermore, some ads specified benefit packages that might have included final year bonus on performance, private pension scheme, and flexible hours' schemes and so on. These benefits were in this case encoded in a 'benefit' variable. From the salary frequencies we can observe most of the job ads are aimed at the lower end of the salary scale, the mode being between £28,000 and £35,000 per annum. However, different levels of experience correspond to different salaries the employer is willing to pay for. Hence, two binary experience-related variables were created:

- *c_early*: first job, early career or 1 to 3 years of experience (n=301)
- *c_expert*: more than 3-4 years of experience (n=209)

Jobs that require little or no experience are in the majority and most common. If we compare this observation with the salary ranges offered we can understand that most of these job ads were aimed at relatively young prospective employees. Young people may also be more inclined to move long distances to find a job.

Work location, job type and industry sector

Job location generated seven zero/one variables (appendix A.5): a very small number of jobs were advertised for Scotland and Ireland and these jobs were included in 'North'. The South of England shows the highest number of jobs in management related positions. These

are followed up by the North and the Midlands, where most of the heavy English industry is based. We now discuss the actual type of job that was offered (appendix A.6). Despite the variety of positions available in management, the most common positions advertised are: buyer, supply chain manager, supply chain analyst, demand planner, and supply chain coordinator. These job types are quite operational in nature and generally at a fairly junior level. This strengthens the idea that most job adverts published within that specific time period are mainly aimed at younger, early career individuals with fairly little working experience.

The most represented industries (appendix A.7) were: engineering, food and drink and retailing. All these industries are moving quite fast, as these industries are characterised by quick innovations; hence we can assume most of the jobs being offered are in fast paced (somehow stressful) industries. This section reported descriptive results. One can expect that the variables discussed under the various categories are related. In the next section we will model the associations between variables using multivariate analysis.

Data analysis

The data collection and coding phase that has just been described resulted in a matrix of 510 advertisements (rows) and 132 zero/one variables (columns). This table will be analysed with multivariate data analysis techniques. Collected data were fed into the statistical package SPSS with variables as columns and cases as rows. The data collected were analysed with multivariate statistical tools, specifically OMDS (Ordinary Multi-Dimensional Scaling) and HCA (Hierarchical Cluster Analysis) following Mar-Molinero and Xie's (2007).

The objective of the analysis is to establish in what way duties, skills, personal characteristics and extras are related. Furthermore, it is important to establish whether any variables subsets appear together in the advertisements. OMDS is a data modelling tool based

on proximities (Kruskal & Wish, 1978). The OMDS algorithm starts from a table of similarities between points. Such similarities indicate how close any two points are to each other, but not their relative location in the map. The first step in the application of the algorithm is to define a measure of proximity (similarity) between any two objects, in this case variables. Many measures of similarity exist, but it should be remembered that the variables are all encoded zero/one. It is possible to calculate several measures of proximity between binary data (Yin & Yasuda, 2005). The difference between the various measures of proximity reflects the way in which zero values are treated. In our case, we took the view that two variables are "similar" if they both appear together in the same advertisement. For example, if supply consultants (ty_4) require the ability to conduct statistical analysis (Sk_stat), we will find that both variables will take the value one together.

The measure of proximity between two variables was obtained by counting how many times they simultaneously assume value 1 in the same advertisement over all the 510 advertisements. Because of the 132 variables we have in the table, we end up with a 132x132 matrix that measures proximity. This matrix is used as an input dataset to the PROXSCAL routine in the SPSS software. We had to work with the syntax facility in this programme, as some of our choices were not contemplated in standard menus. It is important to assess the dimensionality of data set. Following established practice in this area, we represented the data in one, two, three, four, five, six, seven, and eight dimensions and took note of the measure of goodness of fit $Stress_1$ (Kruskal & Wish, 1978).

$Stress_1$ is equivalent to a residual sum of squares in regression, and declines as the number of dimensions increases. At the beginning, when the map has been constructed in few dimensions, the addition of an extra dimension tends to have a large impact on the value of $Stress_1$, but there is a moment when the addition of extra dimensions does not affect the goodness of fit, and we have found a parsimonious representation of the similarity matrix.

Table 2 shows the values of $Stress_1$ for the different dimensional representations, and Figure 2 shows this in information in graphical form.

Dimensions	Stress I
1	0.305
2	0.210
3	0.168
4	0.140
5	0.120
6	0.106
7	0.096
8	0.088

Table 2: Dimensionalities and Stress I

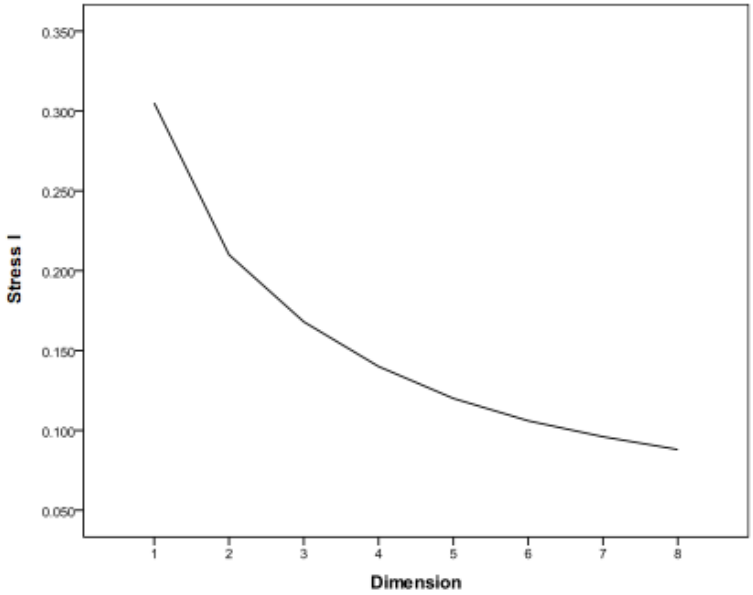

Figure 2: Stress I–Dimensionalities plot

Although there is no clear elbow in the figure, six is a reasonable value for the dimensionality of the data set. Rather than re-estimate the model in six dimensions, we have taken the first six dimensions of the eight dimensional configuration, in fact, we are treating dimensions seven and eight as "residual variation". Interpretation is based on visual inspection, but when the number of dimensions is higher than two, or perhaps three, interpretation in this way becomes problematic. A six -dimensional space can only be generated mathematically. Hence, we must work with the projections of the solution on bi-dimensional sub-spaces. The projection of variables on Dimension 1 and Dimension 2 can be

seen in Figure 3. The projection on dimensions three and four is reported in Figure 4. In this occasion also dimensions five and six were interpreted and these were plotted in figure 5. We will interpret the meaning of the dimensions further below.

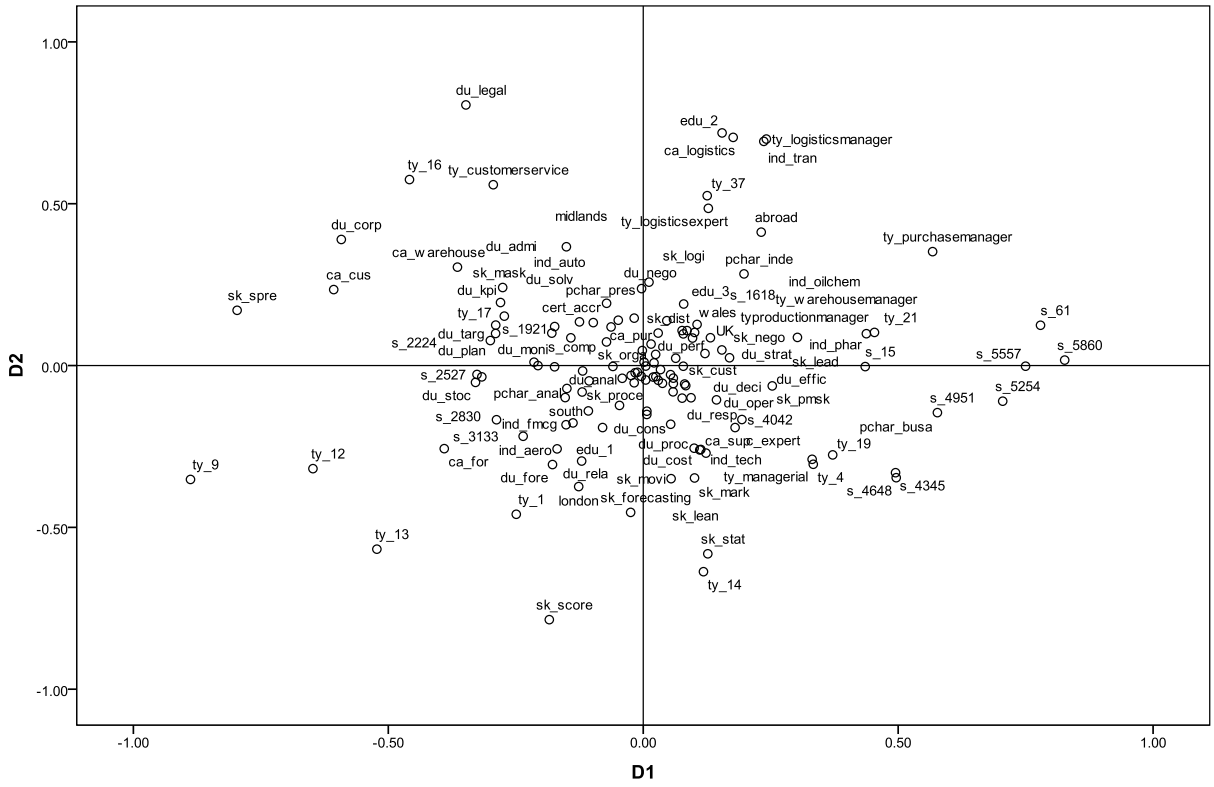

Figure 3: Multidimensional scaling configuration. Plot of dimensions 1 versus 2.

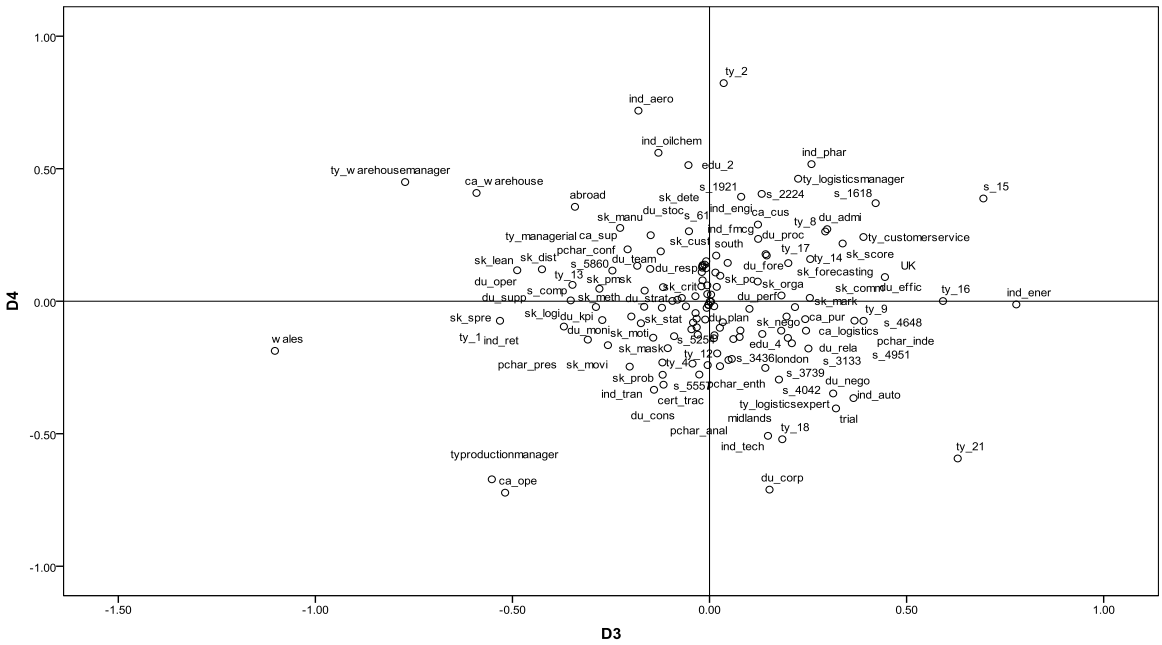

Figure 4: Multidimensional scaling configuration. Plot of dimensions 3 versus 4.

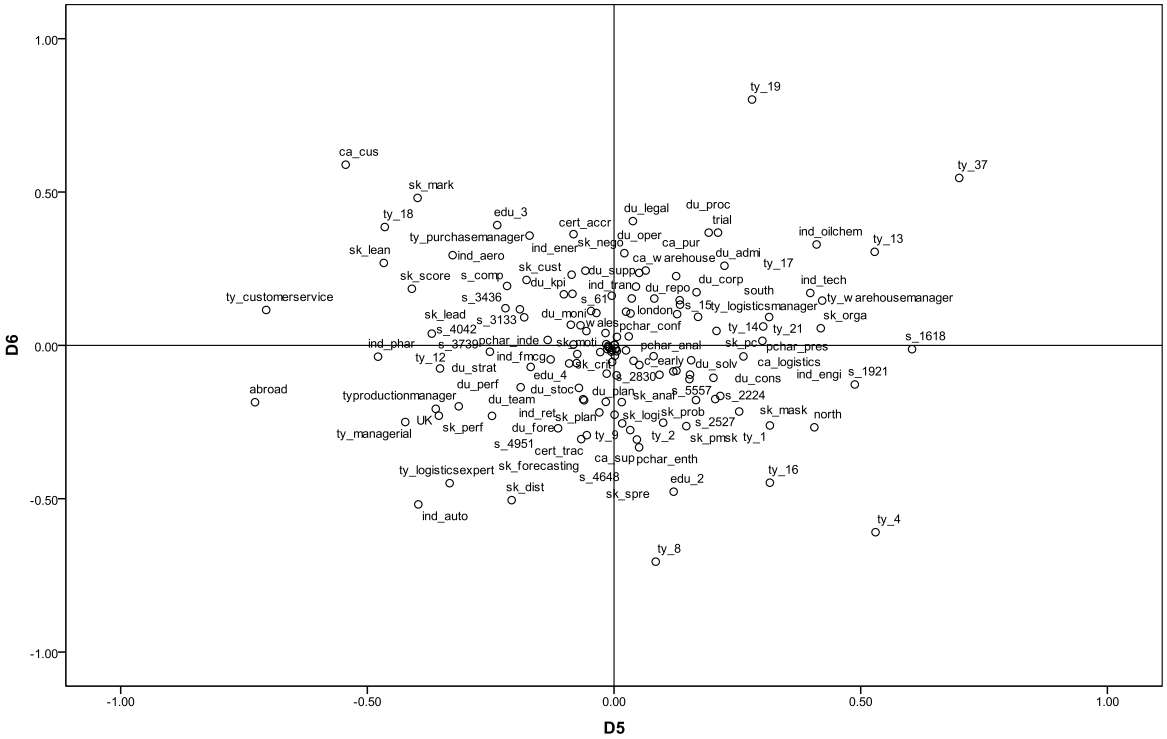

Figure 5: Multidimensional scaling configuration. Plot of dimensions 5 versus 6.

Before attaching meaning to the dimensions, it is important to note that two-dimensional maps can sometimes be tricky to interpret. Since the points are positioned on the map by means of a projection, two points that appear physically close in the two-dimensional representation may not necessarily be close to each other on the space. This can be illustrated as follows: imagine two people, one of which is standing one at the top of a very high building, and the other one is standing at the bottom of the same building. If we see them from above it looks as if they are close to each other although this is not the case. Clustering techniques can give an indication of the real distance amongst points in the six-dimensional space.

To assess the real proximity between two points in the space we have used Hierarchical Clustering Analysis (HCA). The measure of proximity between any two points was derived from the coordinates of the points in the six-dimensional space using Ward´s measure of distance (Ward, 1963). Ward´s measure maximises the homogeneity within clusters (so that points that are contained inside a cluster are as similar as possible) and the heterogeneity

between clusters (so that the different clusters are as different as possible). The dendrogram obtained with HCA can be seen in appendix A.8.

The dendrogram shows when points merge. When branches are short, then clusters are similar to each other and when branches are long, then clusters are dissimilar one from the other. The number of clusters is assessed by looking at the length of the branches. It should be noted that there is no single standard for deciding how many clusters should be identified; hence good common sense and the research context should be used in judging the optimal number of clusters.

Findings

Analysis of the clusters

Nine clusters of variables were identified from the dendrogram. We will now proceed to discuss cluster membership. Full details about cluster membership can be found in Appendix 0. Cluster 1 groups variables related to the demand for supply chain consultants or analysts. The requirements include analytical skills, problem solving and an understanding of the supply chain. The jobs advertised are for early career positions as they require less than four years of experience, lots of enthusiasm and ability to work under pressure. Cluster 2 groups variables related to top management. The person to be hired has to take high responsibility and needs a sound understanding of the supply chain processes (production, distribution, inventory management and so on) as well as more than four years of experience. They need to be good communicators, ambitious and team players. They need to motivate the staff and be independent critical thinkers showing prompt decision making. They need to have a University degree or postgraduate studies as well as being accredited with relevant professional bodies. They need business acumen to drive performance and be able to lower costs.

Cluster 3 groups variables associated with senior buyers' positions. These people need to be familiar with procurement related processes and need to know how to use scorecards, spreadsheets as well as being able to plan demand. Cluster 4 groups variables related to planning, as most of the skills required are analytical skills in order to forecast production. Cluster 5 groups production/operations managers' variables. The prospective employee must undertake the duties of a production manager and be familiar with operations in general. Cluster 6 groups variables associated with junior managerial positions such as junior operations managers or operations clerks. Salaries are fairly low, ranging from a minimum of £16k to a maximum of £22k per annum. A must for this type of positions are the knowledge of pc, organisation skills, knowledge of statistical packages and be ready to undertake administration work.

Cluster 7 groups variables relating to logistics/procurement coordinators. These positions require a fairly low educational level (A level) and they require the future employee to work on logistics or purchasing areas. The ability to guarantee compliance with legal and corporate standards is important. Cluster 8 groups variables related to assistant positions in procurement or customer service. These positions have low pay (£15k per annum, as in *s_15*) and involve assistance related work to buyers and customer service managers. These positions correspond to what in the past was called 'secretarial job'. Cluster 9 groups senior managerial roles with relatively high salaries. We represented the clusters in the configuration by substituting the name of the variable for its cluster membership and projecting the points on to pairs of dimensions.

Figure 6 shows the projection of the points on the subspace formed by Dimension 1 and Dimension 2. The names of the variables in figures 4 and 5 were also replaced by their cluster membership, but they are not reproduced here.

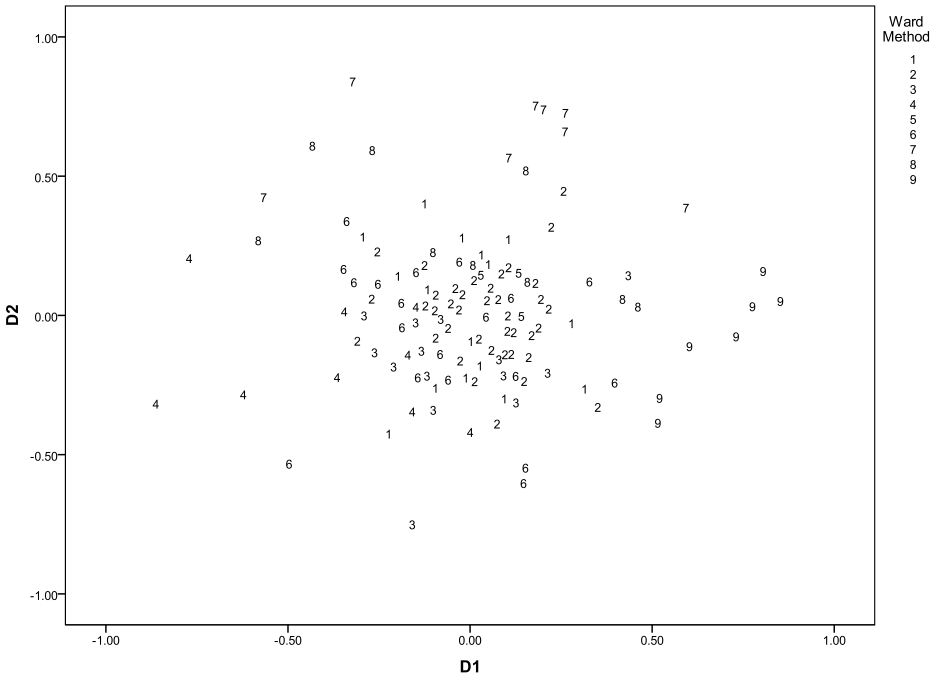

Figure 6: Projections of the multidimensional configuration on dimensions 1 and 2 labelled by cluster membership.

Dimensionality interpretation: Dimensions 1 to 6

Having discussed the clusters, we can look at figures 3, 4 and 5 and attempt to attach meaning to the dimensions. In order to label the dimensions we will concentrate on the variables that are plotted at the extreme of the axes, and we will take into account their cluster membership. By observing figure 3, we can see that most planning jobs— involving production and demand planning as well as skills such as forecasting, and scorecard knowledge— are to be found on the left hand side. On the right hand side most of the variables are related to management (e.g., logistics, purchase, warehouse managers). We suggest that Dimension 1 captures a planning *versus* managerial orientation. We now turn our attention to Dimension 2.

On the positive side of this dimension we find jobs such as assistant buyer, customer service assistant, warehouse assistant, as well as administrative skills like spreadsheet use, compliance to legal and corporate standards along with low salaries (e.g., £22k per annum). On the negative side, there are jobs like manager, supply chain consultant, as well as skills like knowledge of lean management, statistical packages and marketing along with high

salaries (around £46k per annum). It is reasonable to conclude that Dimension 2 is associated with the level of seniority required by the job advert. Dimension 3, the horizontal axis in Figures 3 and 6, groups on the left hand side, skills such as understanding of logistics and spreadsheet modelling, ability in motivating the staff, and in working under pressure. The job types involved are: supply chain analyst, or production manager. On the right hand side of Dimension 3, required skills are communication related, with required ability to keep relationships and deal with customer service. These skills and jobs combination suggests Dimension 3 may be associated with jobs that are executed inside the organisation and jobs that are undertaken outside of the organisation. On the positive side of Dimension 4 we find lower paid jobs (£16k to £22k per annum) involving warehousing, manufacturing and logistics.

The skills required for these jobs are determination, understanding of manufacturing processes for duties involving administration, procurement and supervision. The other extreme of this dimension contains analytical skills (such as management skills, problem solving, negotiation), higher salaries (£31k to £55k per annum) and positions such as procurement consultant, senior buyer, production manager along with certified track of performance. Dimension 4 suggests operations-related work *versus* intellectual work. Dimension 5, the horizontal axis in Figures 4 and 6, shows, on the right hand side, planning/coordinators' or assistant-type positions requiring administrative/clerical skills such as general managerial skills, project management, organisational abilities. These jobs require an A level as educational level. On the left hand side of dimension 5, positions are more knowledge intensive, such as logistics specialist, production and purchase manager. The skills required for these jobs are very specific in nature, such as knowledge of lean management, scorecards, performance tracking, and distribution processes to manage the main business processes in logistics, production and procurement. These jobs require at least

a university degree. Dimension 5 appears to be related to the level of expertise of the job type. At one extreme there are strategic/knowledge intensive positions that require high level of expertise, while at the other extreme job positions are clerical in nature related to daily operations, with a stronger focus on general administration and staff supporting activities.

Dimension 6 shows, toward the positive extreme, lower salaries, ranging between £15k and £22k per annum as well as positions such as transport coordinator, production planner as well as category/warehouse manager. To the other extreme, salaries are higher, ranging between £40k and £51k per annum, for jobs such as logistics expert, production manager. Dimension 6 seems to be related to the level of salary paid for the different jobs, suggesting low *versus* high salary. In summary, job adverts that appeared on the website *jobs4supplychain.com* can be described in terms of six independent dimensions or orientations: planning *versus* managerial, junior *versus* senior, inside *versus* outside, operations-related work *versus* intellectual work, low expertise *versus* high expertise, and low salary *versus* high salary.

Job roles and related skills types

Within this framework, we observe that Cluster 1, situated mainly on the north (quite central) of Figure 6, can be described as being mainly planning and management related. In the same way, looking at its projection on other pairs of dimensions, we found that these jobs are mostly intellectual work types with an outside orientation, that they are paid relatively little money and that they do not require very high expertise. All this suggests that jobs belonging to Cluster 1 are early career jobs as employees within the companies operating in supply chains. These are the jobs that graduates from Universities would potentially get as a first employment, providing employers with lower-paid-intellectually-able workforce, which is happy to ‘gain experience’. Cluster 2 appears mostly in the east of figure 6, indicating these

jobs are for managerial positions, both junior and senior. Using similar considerations we found that the orientation of the job is towards the outside of the firm, that these jobs require both communication and negotiation skills and that they require high expertise level. Overall, these jobs are associated with top managerial positions, where thorough understandings of management as well as the ability to be outgoing networkers are critical characteristics. The variables that are grouped under Cluster 2 are, in fact, the most popular in the database. It appears that the most common employment offers are aimed at experienced individuals, inviting them to change jobs.

Cluster No.	Cluster name	Variables
1	Early career	c_early, ca_sup, ty_1, ty_4, ind_ret, north, midlands, sk_logi, sk_meth, sk_pmsk, sk_mask, sk_prob, sk_anal, du_cons, du_solv, pchar_enth, pchar_pres, cert_trac
2	Senior managers	c_expert, ca_pur, ty_managerial, s_benefit, s_comp, abroad, sk_comm, sk_lead, sk_prev, sk_team, sk_nego, sk_plan, sk_perf, sk_cust, sk_lean, sk_manu, sk_dist, sk_crit, sk_moti, sk_movi, sk_dete, sk_proce, du_rela, du_team, du_kpi, du_nego, du_plan, du_targ, du_perf, du_anal, du_moni, du_effic, du_strat, du_cost, du_supp, du_deci, du_stoc, du_oper, du_resp, edu_1, edu_3, edu_4, pchar_inde, pchar_ambi, pchar_busa, pchar_conf, pchar_init, cert_accr
3	Executives	trial, ty_18, ty_21, ind_tech, s_2830, s_3133, s_3436, s_3739, s_4042, London, sk_score, sk_mark, du_repo, pchar_anal
4	Senior planners	ca_for, ty_8, ty_9, ty_12, ind_fmcg, s_2527, sk_forecasting, sk_spre, du_fore
5	Junior managers	ca_ope, typroductionmanager, wales
6	Junior operatives and clerks	ca_warehouse, ty_2, ty_warehousemanager, ty_13, ty_14, ty_17, ty_19, ind_oilchem, ind_aero, ind_engi, s_1618, s_1921, s_2224, south, sk_stat, sk_pc, sk_orga, du_admi, du_proc
7	Operatives	ca_logistics, ty_purchasemanager, ty_logisticsmanager, ty_37, ind_tran, du_legal, du_corp, edu_2
8	Rookies	ca_cus, ty_customerservice, ty_logisticsexpert, ty_16, ind_auto, ind_ener, ind_phar, s_15, UK
9	Highly paid	s_4345, s_4648, s_4951, s_5254, s_5557, s_5860, s_61

Table 3: Results of Cluster Analysis

Cluster 3 was found to be associated with well-paid planning-related jobs at a senior level requiring the ability to interface with the outside world. Overall, this cluster indicates jobs associated to a senior buyer position, where the employee must have the ability to plan demand and procurement as well as the ability to negotiate and interface with the firm's suppliers. Cluster 4 is very similar to Cluster 3, but related to lower paid jobs requiring lower skills. The variables group under Cluster 5 suggest managerial positions at a junior level associated with managerial jobs requiring a high expertise level in organisational processes such as production/operations managers. Cluster 6 indicates operations-related jobs with a focus on the firm's external stakeholders. It points towards high salary jobs that require low expertise. Overall, Cluster 6 describes junior operations managers and clerks. These jobs

require administration skills, when at junior level and managerial skills when at senior level. Cluster 7 appears mostly in the north of figure 6; indicating junior positions both in planning and managing related jobs. Overall, Cluster 7 describes positions that require intellectual abilities without specific depth in the expert knowledge. These jobs focus on external stakeholders. Examples of these jobs may be logistics/procurement or customer service coordinators. Cluster 8 appears mostly in the north of figure 6, indicating junior positions. It indicates jobs requiring a high level of expertise, but with lower salaries. Overall, Cluster 8 describes buyer/customer service assistant positions, needing an understanding of the processes but their junior position does not allow them to have very high salaries. Cluster 9 appears mostly in the east of figure 6, indicating managerial related jobs at both junior and senior level. These are intellectually intensive jobs with a focus on the external world.

Overall, the last cluster describes the situation of some managers whose salaries vary widely from one type of position to another. Individuals applying for these jobs may be paid very little in a company and a lot in another company, despite the same job descriptions, skills and duties. We can conclude this section by saying that all these clusters can be grouped into two job categories: “managers” and “clerks”. Managers have generally better paid jobs and the skills required are often knowledge intensive. Individuals can be appointed as managers either at junior or senior level. The required skills and the rewards for the jobs are different, depending on the knowledge intensive or operations-orientated nature of the position.

Implications for Curriculum Development and Skills Training Policy

Knowing which skills employers require is helpful to (i) university graduates in planning their career; (ii) universities in planning the content of their programmes; and (iii) policy makers in devising skills development policy. In particular, universities offering management

related courses can enhance students' employability and make their course offering more attractive to prospective students. However, some questions arise from this analysis. Should universities prepare students with the management skills required for early career positions (so that they can be readily employable after university) or should they provide students with the skills to fast track their career path? Also, should universities prepare students for undertaking only managerial job-types or should they also provide students with the skills required in clerical positions, which are of vocational nature rather than technical? Some may argue that students need to access a job first, and then develop their career gradually. However, as we can see from this study, most junior positions are generally paid lower salaries. Junior, knowledge intensive positions are the types of jobs university students or early careers individuals may pursue as a first step into the management world since not much experience is required. However, there is additional requirement for technical skills students often do not develop at university.

Author/s	Core aspects of curriculum development to address	Skills fostered through existing curricula	Skills required by industrial employers
(Lorentz et al., 2013)	• Competence gaps • Level of proficiency	• Relationship management • Cross-functional orientation • Segmentation strategy • Service level	• Demand forecasting and supply planning • Sourcing and supplier management • Customer and distribution channel management • Production planning and control • Information systems for logistics and production
(Bernon & Mena, 2013)	• Strategy development, **vs** • Competency-based material	• Project work • Team/role-playing • Leadership skills • Marketing strategy	Strong focus on technical skills (e.g. transport, logistics, network design, inventory management)
(Lutz & Birou, 2013)	• Lack of market relevance • Lack of practical skills • Poor research capabilities	Highly theoretical approach	Need for right balance between theory and skills development
(Onar et al., 2013; Sohal, 2013)	Negligible level of knowledge and skills taught	Increasing emphasis on technical skills	• Focused practical knowledge • Ability to solve problems
(Messina et al., 1991; Wilton, 2011)	Stronger communication and interaction between academia and industry	Theoretical knowledge	• Knowledge of industrial processes • Ability to conduct primary research

Table 4: Skills demand and university curricula development

Current research (table 4) shows that curricula in supply chain management mainly focus on theoretical understanding of the principles of supply chain management although the use of technology is wide spread and technical skills are essential in this field. Theoretical understanding is in fact a core objective of higher education. However, industrial employers

apparently would seek technically trained students who can really understand the complexity of different problems related to supply chain management. Nevertheless, the preferred approach would lose the theoretical soundness of academia and would push higher education towards the supply of vocational skills. Since employees with the right skills may progress fast from a junior to a senior managerial position, universities may also want to provide students with the skills that will fast track their careers.

Furthermore, providing access to work experience as part of the management course at universities (e.g., placement schemes and company implants) may also contribute to students' career development. The second group, clerks, are generally in junior positions for which no higher education is required. These jobs are generally administrative or operational in nature and the skills required are practical rather than knowledge intensive as illustrated by spreadsheet modelling, pc use, operational planning and project management. These jobs are the types of jobs aimed at individuals with A levels[4]. However, university students with a preference for administration and project management may also apply for those positions. Individuals' personal characteristics and skills are important for advancement in the workplace (Hillman & Dalziel, 2003; Bennett, 2009). If students have not acquired right skills or experience to show to employers that they are worth taking better salaries, then they may work in the same position for very long time. Therefore, universities should also provide a mix of skills allowing students to fast track their career once they enter into a managerial job.

In summary, a series of lessons should be taken into consideration when planning management courses. Perhaps the answer lies in the complementarity of public policy aimed at the development of technical skills with real market needs.

[4] A levels is a requirement in the UK to demonstrate a minimum standard in acquired skills. It corresponds to the US AP High School Diploma.

First of all, previous experience is a very frequent word in job adverts. However, previous experience is often required for junior positions. This may suggest that what employers actually search for through previous experience is not the ability to undertake very specific tasks within the position, but an overall understanding of the processes that are related to that specific position. This is confirmed by the other requirements appearing frequently in job adverts such relating to 'understanding of the job/industry processes'. This makes sense if we look at the duties most frequently advertised: prompt decision making (arguably decisions cannot be taken if there is no understanding of the processes), driving efficiency and analysing the market and the supply chain. Thus, employers are asking for potential employees who already at an early stage show some level of understanding of the industry processes. Arguably, employers may find it easier to train for a specific position people who do not know exactly how to undertake the job, but already have an understanding of the industry, the market and the supply chain processes (e.g., logistics, production, procurement, customer service and so on). Therefore, policy makers may want to allocate resources to universities to implement university-industry collaboration within programmes aimed at developing technical skills in prospective employees.

Second, the most frequently required skills are 'critical thinking', 'analytical skills' and 'planning skills'. These skills are sought by employers because they are critical to the success of the tasks undertaken in the following frequently advertised duties: planning, drive efficiencies, lower production/distribution costs, problem solving. It is clear that employers are searching for individuals who possess critical, analytical and planning abilities that can be applied to specific contexts. Accordingly, universities may incorporate experiential learning opportunities where students can analyse real-life problems in specific situations, perhaps through problem based learning activities as opposed to traditional teaching methods. Policy

makers may also incentivise university programmes based on problem based learning framework and embed this into national education programmes.

Third, communication is another frequently requested skill. The ability to communicate effectively with stakeholders and the ability to work in teams are highly sought skills by employers. Interpersonal communication along with good negotiation skills and determination are valuable skills for undertaking frequently advertised duties such as keeping relationships within the firm and outside of the firm or being accountable/responsible for your own actions. It appears that employers are not only searching for critical thinkers with analytical skills who understand industrial processes, but also require the ability to communicate effectively and maintain good relationships with stakeholders. Therefore, universities may focus on improving students' communication skills and stress the importance of ethical behaviour, accountability and responsibility toward employers and the society. When employers advertise management jobs to university graduates, they draft the advertisements with care, specifying skills that are required, tasks that will be undertaken, and personal characteristics they expect from the graduates. Advertisements are, therefore, an important source of information for skills development and are readily available in the media. Universities could use this source in designing the structure of degree programmes in subjects such as management. Policy makers may fund initiatives of sensitisation of the youth towards citizenship within a dynamic knowledge society, while reducing the potential risk of mismatching expectations between employers and fresh graduates who often face a tougher reality of competition in the job market (Selingo, 2015).

Although in some subject areas there is higher propensity for a practical approach to teaching (Brennan, 2014), most management or business programmes in the UK universities in the past fifteen years have not been experiential enough in nature (Holman, 2000). Most of them do not provide students with the opportunity to develop skills and the working

experience that are requested by prospective employers (Purdie et al., 2013). When student cohorts increase under the government's push for raising student numbers (Clark, 2015), universities are pressured to increase efficiency and standardisation (Holman, 2000). This may be the result of an ideological struggle in universities between a push towards experiential and transformative learning which improves skills, and the contrasting managerialism in resources allocation which shapes curricula development and deliverance (Holman, 2000; Trowler, 2001) on the basis of cost efficiency and to the cost of skills formation.

In this scenario practitioners and policy makers recognise that overall economic performance masks 'deep-rooted problems […] such as torpid productivity and a pervasive mismatch between skills and jobs' (Sindreu & Douglas, 2015), that the communication between universities and employers is absent (Ramirez & Rainbird, 2010), or perhaps that universities when planning their management programmes are not aware of their own educational supply chain. After the Brown review (Brown, 2010) employability has become more relevant to universities as a point of differentiation. More critical approaches need to be explored by universities (Currie et al., 2010), although the focus shifted completely on the industry (Martin et al., 2008; Lloyd & Payne, 2009). However, are universities the right place for training students in soft skills? Are these skills not the ones that are acquired through continuous learning and practical experience? Universities appear drifting into becoming training centres rather than centres for the creation and dissemination of knowledge. While we advocate against instrumentalising higher education for sustaining elite power, we also stress the lack of provision by universities for developing higher skilled graduates who can contribute to the fourth industrial revolution which starts taking place (Schwab, 2016). The problem of technical skills formation is an issue affecting knowledge-based economies in general (Antonelli & Fassio, 2014; Gallouj et al., 2014). Universities could devise highly

competitive programmes focused on developing technical skills in a small number of selected students who may well become the highly skilled innovators that firms are after, while keeping standard undergraduate and postgraduate programmes which often focus more on student numbers rather than student quality[5].

The problem of skills mismatch affects the industry also outside the UK as reported by a recent article in the Washington Post, indicating that graduates today lack "some basic skills, particularly problem solving, decision making, and the ability to prioritize tasks" (Selingo, 2015), which are technical in nature. So, if universities really want to improve employability, they cannot afford ignoring employers' needs. Management programmes may be shaped around the skills that students will need in industry (Wilson, 2001; Wilton, 2011). However, the shift of attention towards the industrial needs may result in a declining focus on the needs of the society. Public policy on education and training aims to increase social inclusion by reducing unemployment. The interest of policy makers may clash with industrial requirements. Given the characteristics of the knowledge-based economy and future demand for highly skilled personnel, regulators and universities need to improve the provision of skills development by redesigning educational curricula to develop creativity and critical thinking as well as higher technical skills. The paradox that the knowledge-based economy face is that the industry needs intellectual investment in high-level technological development, while the government has a duty to care for citizens by facilitating the acquisition of lower to medium skills through training and educational policies. As indicated by Pavitt (1998) 'the rate and direction of the development of a country's science base is strongly influenced by its level of economic development, and the composition of its economic and social activities. In other words, it is socially shaped.' (p.793).

[5] www.timeshighereducation.com/features/danny-dorling-six-trends-in-university-admissions/2018407.article

While stronger focus on problem based learning and the development of critical thinking may provide a means to bring competitive advantage to firms, these skills are not taught in further education and general training programmes. Employers may engage more actively with universities in shaping their curricular to meet the future skills demand, while policy makers may come up with a controlled path of upskilling aimed at diffusing higher skills among the intermediate skilled workforce (e.g., students leaving universities), taking part of the training burden on, and negotiating with firms on training support for the unemployed.

Universities and centres of excellence in research could be involved in the upskilling of innovating workforce, whereas training centres could collaborate with firms in the provision of technical skills training, subsidised by the government (Pavitt, 1997). In this way universities could contribute to a more cohesive society (Brown & Hesketh, 2004) by decreasing the chances of unemployment due to the skills mismatch. Considering the need for higher skills to improve national competitiveness, intensive courses with leading research centres might provide young researchers and scientists the skills for innovation.

Conclusion

This paper analysed future skills demand and technological knowledge development in the UK to address the problem of employability dilemma in terms of technical and soft skills formation. This study investigated the mechanisms underlying the training dilemma that UK higher education institutions experience: the creation of employable graduates under the pressure of the diverging demands of the industry and the government. While the former encourages the implementation of soft skills that make people readily employable in organisations that do not require higher skills (contributing this way to the reduction of unemployment), the latter seeks for potential innovators, i.e. highly skilled personnel who can contribute to the firm's competitiveness. Currently, most UK universities address this

dilemma by trying to satisfy both demands. They create programmes with some technical components, while trying to train people in soft skills. This forced strategy does not succeed in generating graduates with higher skills, nor graduates with good soft skills, but rather shallow generalists, as students are often trained at semi-skilled level. Why do universities produce generalists rather than innovators?

Innovation and upskilling are key requirements for a competitive knowledge economy. However, the investment in these take effect in the long term, struggling to contribute to short term priority of employment creation (generalists are likely to search for semi-skilled jobs, but highly trained graduates may not compromise on the type of jobs they pursue). Universities are caught by the need to achieve high employment rates for their graduates by focusing on generalist skills that allow them to adapt to changing market needs. The trend of lacking investment in higher skills for innovation may have severe consequences for the long term socio-economic development. To revert such a downward spiral, universities, policy makers and firms should start collaborating with a long term aim to create programmes enabling students to gain practical experience of the workplace, develop critical thinking through problem structuring and solving, develop communication skills through practical experience in business, and learn ethical practice in managing relationships with stakeholders.

This study provies a new perspective on skills demand and skill formation by analysing not only employers' needs for skill types but also an emerging institutional clash in the job market and its implications for skills training policy and curriculum development. In terms of methodological contributions of this study, researchers analysing qualitative data may find useful the combined application of OMDS and HCL techniques as a tool of analysis in semantic data mining to improve the descriptive power of their analyses, and might consider

this a more complete and appealing alternative to frequencies comparisons or inter-items correlation.

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Appendices

Appendix A.1: duties related variables

- *Du_effic:* drive efficiencies (n=358)
- *Du_plan: planning* (n=307)
- *Du_cost: lower production/distribution costs* (n=291)
- *Du_anal: analyse market/supply chain* (n=289)
- *Du_deci: prompt decision making* (n=277)
- *Du_resp: take accountability/responsibility for actions* (n=274)
- *Du_rela: keep relationships with stakeholders (n=236)*
- *Du_team: being able to work in team (n=226)*
- *Du_perf: drive performance (n=185)*
- *Du_moni: monitor performance (n=185)*
- *Du_solv: problem solving (n=178)*
- *Du_nego: negotiations (n=175)*
- *Du_repo: reporting (n=152)*
- *Du_stoc: stocks management (n=139)*
- *Du_oper: keep control of operations (n=137)*
- *Du_strat: formulate support strategy (n=134)*
- *Du_targ: meet targets (n=134)*
- *Du_supp: executive/managers support work (n=128)*
- *Du_kpi: work/keep control over KPI (n=126)*
- *Du_fore: forecasting (n=119)*
- *Du_cons: make recommendations/consultative role (n=98)*
- *Du_admi: general administration work (n=76)*
- *Du_proc: procurement on lead times (n=73)*
- *Du_legal: compliance of legal standards (n=10)*
- *Du_corp: compliance of corporate standards (n=10)*

Appendix A.2: technical skills related variables

- *Sk_prev: previous experience (n=492)*
- *Sk_proce: understanding of the job/industry processes (n=390)*
- *Sk_crit: critical thinker (n=307)*
- *Sk_comm: interpersonal communication (n=280)*
- *Sk_dete: determined (n=271)*
- *Sk_anal: analytical skills (n=234)*
- *Sk_team: team work (n=233)*
- *Sk_plan: planning skills (n=231)*
- *Sk_pc: computer literate (n=183)*
- *Sk_nego: negotiation skills (n=155)*
- *Sk_cust: customer orientation (n=146)*
- *Sk_pmsk: project management skills (n=139)*
- *Sk_lead: leadership (n=122)*
- *Sk_prob: problem solving (n=113)*
- *Sk_perf: performance driven (n=109)*
- *Sk_manu: understanding of manufacturing processes (n=96)*
- *Sk_forecasting: forecasting (n=93)*
- *Sk_moti: motivated (n=92)*
- *Sk_movi: motivational (n=92)*
- *Sk_mask: organisational/management skills (n=83)*
- *Sk_orga: highly organised (n=75)*
- *Sk_logi: understanding of logistics (n=70)*
- *Sk_stat: statistical analysis (n=66)*
- *Sk_meth: methodical (n=64)*
- *Sk_dist: understanding of distribution processes (n=45)*
- *Sk_lean: lean approach (n=38)*
- *Sk_mark: understanding of marketing (n=35)*
- *Sk_spre: spreadsheets manipulation (n=6)*
- *Sk_score: understanding of distribution scorecard (n=4)*

Appendix A.3: personal characteristics related variables

- *Init: personal initiative (n=364)*
- *Ambi: ambitious (n=327)*
- *Busa: business acumen (n=319)*
- *Conf: confident personality (n=292)*
- *Anal: analytical/mathematical (n=209)*
- *Enth: enthusiastic (n=98)*
- *Pres: able to work under pressure (n=64)*
- *Inde: independent (n=60)*

Appendix A.4: salary and benefits related variables

- *sbenefit: benefit package on top of normal salary (n=378)*
- *scomp: competitive salary (n=70)*

- *s_15: up to £15,000 p.a. (n=13)**
- *s_1618: more than £16,000 and up to £18,000 p.a. (n=33)*
- *s_1921: more than £19,000 and up to £21,000 p.a. (n=72)*
- *s_2224: more than £22,000 and up to £24,000 p.a. (n=101)*
- *s_2527: more than £25,000 and up to £27,000 p.a. (n=162)*
- *s_2830: more than £28,000 and up to £30,000 p.a. (n=194)*
- *s_3133: more than £31,000 and up to £33,000 p.a. (n=118)*
- *s_3436: more than £34,000 and up to £36,000 p.a. (n=137)*
- *s_3739: more than £37,000 and up to £39,000 p.a. (n=92)*
- *s_4042: more than £40,000 and up to £42,000 p.a. (n=101)*
- *s_4345: more than £43,000 and up to £45,000 p.a. (n=62)*
- *s_4648: more than £46,000 and up to £48,000 p.a. (n=40)*
- *s_4951: more than £49,000 and up to £51,000 p.a. (n=54)*
- *s_5254: more than £52,000 and up to £54,000 p.a. (n=28)*
- *s_5557: more than £55,000 and up to £57,000 p.a. (n=33)*
- *s_5860: more than £58,000 and up to £60,000 p.a. (n=23)*
- *s_61: more than £60,000 p.a. (n=19)*

**Note: although these positions may look like they are paid very little amount of money it happens that some entry-level positions offer so little money. We justify this with firms willing to pay very little for their employees, yet, these positions are still appealing for formerly unskilled workers who requalify and achieve UK NVQ qualifications – corresponding to US CTE – by attending classes delivered at Further Education Colleges or enrolling in a Foundation Degree at a University.*

Appendix A.5: geographical location related variables

- *South (n=210)*
- *North (n=87)*
- *Midlands (n=81)*
- *London (n=65)*
- *UK: these are UK wide jobs (n=46)*
- *Abroad: these are jobs requiring travels/permanence abroad (n=12)*
- *Wales (n=8)*

Appendix A.6: type of employment related variables

- *ty_17: buyer (n=81)*
- *ty_3: supply chain manager (n=58)*
- *ty_1:supply chain analyst (n=56)*
- *ty_12: demand planner (n=35)*
- *ty_2: supply chain coordinator (n=33)*
- *ty_18: senior buyer (n=25)*
- *ty_20: purchasing manager/procurement manager (n=24)*
- *ty_8: materials planner (n=23)*
- *ty_4: supply chain consultant (n=18)*
- *ty_31: operations manager (n=18)*
- *ty_19: category manager/commodity manager (n=16)*
- *ty_9: production planner (n=13)*
- *ty_14: demand planning manager (n=13)*
- *ty_21: purchasing consultant/procurement consultant (n=11)*
- *ty_13: production planner manager (n=10)*
- *ty_45: distribution centre manager (n=9)*
- *ty_16: assistant buyer/purchasing assistant (n=7)*
- *ty_28: logistics specialist (n=7)*

- *ty_22: purchasing director/procurement director (n=6)*
- *ty_27: logistics manager (n=6)*
- *ty_37: transport coordinator (n=6)*
- *ty_43: warehouse supervisor (n=6)*
- *ty_25: logistics coordinator (n=5)*
- *ty_24: logistics analyst (n=4)*
- *ty_36: inventory manager (n=4)*
- *ty_33: production manager (n=3)*
- *ty_48: customer service manager (n=3)*
- *ty_5: supply chain director (n=2)*
- *ty_47: customer service assistant (n=2)*
- *ty_34: expeditor (n=1)*
- *ty_35: inventory planner (n=1)*

Appendix A.7: industrial sector related variables

- *engi: engineering (n=122)*
- *fmcg: food and drink (n=113)*
- *ret: retail (n=110)*
- *tech: technology (n=48)*
- *tran: transportation and rail (n=31)*
- *auto: automotive (n=29)*
- *phar: pharmaceutical and biotech (n=20)*
- *ener: energy and utilities (n=15)*
- *aero: aerospace and defence (n=13)*
- *chem: chemicals (n=6)*
- *oil: oil and mining (n=2)*

Appendix A.8: dendrogram obtained with Ward's method, each round contains the cluster variables and the dashed line indicates the yield of the final clusters.