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## ***Working Paper Series***

### **Analysing the Demand for Supply Chain Jobs through Job Advertisements**

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# **Analysing the demand for supply chain jobs through job advertisements**

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## **Analysing the demand for supply chain jobs through job advertisements**

To stay in touch with reality, universities need to adapt their courses to the needs of employers. We analyse 510 job advertisements in the area of supply chain management in order to understand the skills that employers are seeking from employees, the type of jobs that these will be conducting, and the personal characteristics that are preferred by employers. The information contained in the advertisements was captured by means of 132 keywords. The resulting data set was analysed using multivariate statistical tools: Ordinal Multidimensional Scaling and Cluster analysis. It was found that every advertisement can be described by means of six dimensions: managing versus planning; analysis versus applicability; experience required; a focus on the firm's internal processes versus a focus on the firm's external stakeholders; the level of expertise required; and the way in which employers reward employees according to the skills, duties and job type. Advertisements fell into two categories, those aimed at experienced individuals who were enticed to change jobs, and those aimed at graduates. Skills required from graduates included analytical skills, and ability to solve problems. The consequences for designing university courses in supply chain management are explored.

**Keywords:** Content Analysis, Multivariate Statistics, Advertisements, Graduate Employment.

## Introduction

With the increase in unemployment generated by this recent economic downturn it is paramount for jobseekers to be as competitive as possible to grab a job. Universities often offer often specialised training in order to develop skills that will enhance employability. Recently, there has been a proliferation of university courses specialising in supply chain management and logistics, because supply chain management is at the base of all the existing industries and sectors involving production, manufacturing, wholesaling, or retailing. But in order to design the courses, universities need to answer several questions: what kind of people are supply chain management employers looking for? What skills are required? What salaries are employers prepared to pay?

Researchers generally investigate employers' job requirements through surveys with recruiters (Howard and Kerin, 2006). However, self-reported data, such as information obtained from surveys, are believed to be less reliable than observational data (Llieva et al., 2002; Podsakoff et al., 2003). Whenever possible, it is better to collect observational data as the information they carry is more objective. 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. A fundamental assumption in this study

is that job adverts reflect the industry real situation. We assume that whenever a recruiter describes in the 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 the prospective employee will not find surprises, such as requests to either fulfil different duties from the ones advertised by the employers or extra non-advertised skills requirements.

The analytical approach followed in this research is known as 'content analysis', a term coined by Krippendorf (2004), according to Sodhi and Son (2010) who reviewed the literature in this area. Content analysis has been used widely in social sciences (Alise and Teddlie, 2010), including both marketing and economics. Some examples are the exploration of the information contained in price advertisements by Howard and Kerin (2006) and the investigation of economic development by De Cock et al. (2005). Other authors (Teng et al., 2010; Bradley and Meeds, 2004) used content analysis to analyse the use of technological-related terms in advertisements destined to consumers. There are various approaches to content analysis. In this research we use the methodology developed by Mar Molinero and Xie (2007).

To study the skills required in supply chain management, we collected data from 510 job adverts published between May and June 2011 on a popular supply chain management jobs website<sup>1</sup>. The characteristics of the job on offer were captured by means of keywords,

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<sup>1</sup> [www.jobs4supplychain.com](http://www.jobs4supplychain.com)

coded zero or one according to their presence of absence in the job advert. The resulting dataset was a matrix of 510 rows by 132 columns, which was analysed using multivariate statistical methods, in particular Ordinal Multi Dimensional Scaling (OMDS) and Hierarchical Cluster Analysis (HCA).

We are not aware of any other study in the area of supply chain management that has used statistical analysis to analyse the market for graduates and to advise on the design of university courses in this area of knowledge.

OMDS revealed that depending upon the job type, there are six things employers look for through an ad: managing versus planning skills; sense for practicality versus ability of analysis; previous experience; a focus on the firm's internal processes versus a focus on the firm's external stakeholders; low versus high expertise; and employers reward employees with low versus high salaries, depending on the skills, duties and job type. Further on, Cluster Analysis revealed that job ads are aimed at two types of people which we call "managers" and "clerks".

The next section describes the data and offers some exploratory analysis. This is followed by a methodological section in which the model and the results are discussed. The conclusion summarizes the findings.

## **The data**

The dataset consists of all the job adverts displayed on a supply chain management jobs website<sup>1</sup> between the 1<sup>st</sup> of May 2011 and the 30<sup>th</sup> 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. Hence, these 510 advertisements were appropriate for the purpose of our analysis.

The keywords were defined after a detailed examination of the text of the advertisements. Four sets of keywords 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 keywords that were employed to designate similar skills or duties. All variables were then



zero/one encoded. The final list of keywords, with the number of times it appeared in the advertisement (in brackets), was as follows:

- *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)

Table 1: duties related keywords

As one can deduce from the previous keywords, duties were not described in great detail. However, it is interesting to see the five most frequently advertised duties within a supply chain 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 supply

chain management related positions tend to focus towards production/manufacturing planning and costs reduction rather than consumer-based value creation. A look at the skills required sheds light on this issue. The keywords associated with skills required and the number of times that they were identified in the advertisements is as follows.

- *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\_organ*: 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)

Table 2: skills related keywords

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.

The list of keywords associated with personal characteristics, and the number of times that they appeared in the ads is given below:

- *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)

Table 3: personal characteristics related keywords

The five most frequent personal characteristics required are: 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.

Among the variables in the 'extras' set, salary was split into very narrow categorical intervals of about £2,000 each in order to reflect the variety of salaries offered in different jobs adverts. 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. All these variables were encoded as zero/one. The names of the salary-related variables and their definitions are as follows:

- *sbenefit*: benefit package on top of normal salary (n=378)
- *s2830*: more than £28,000 and up to £30,000 p.a. (n=194)
- *s2527*: more than £25,000 and up to £27,000 p.a. (n=162)
- *s3436*: more than £34,000 and up to £36,000 p.a. (n=137)
- *s3133*: more than £31,000 and up to £33,000 p.a. (n=118)
- *s2224*: more than £22,000 and up to £24,000 p.a. (n=101)
- *s4042*: more than £40,000 and up to £42,000 p.a. (n=101)
- *s3739*: more than £37,000 and up to £39,000 p.a. (n=92)
- *s1921*: more than £19,000 and up to £21,000 p.a. (n=72)
- *scomp*: competitive salary (n=70)
- *s4345*: more than £43,000 and up to £45,000 p.a. (n=62)
- *s4951*: more than £49,000 and up to £51,000 p.a. (n=54)

- *s4648*: more than £46,000 and up to £48,000 p.a. (n=40)
- *s1618*: more than £16,000 and up to £18,000 p.a. (n=33)
- *s5557*: more than £55,000 and up to £57,000 p.a. (n=33)
- *s5254*: more than £52,000 and up to £54,000 p.a. (n=28)
- *s5860*: more than £58,000 and up to £60,000 p.a. (n=23)
- *s61*: more than £60,000 p.a. (n=19)
- *s15*: up to £15,000 p.a. (n=13)

Table 4: salary related keywords

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)

Table 5: required experience related keywords

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. Job location generated seven zero/one 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)

Table 6: regional location related keywords

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 supply chain management related fields. 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. The associated list of keywords is as follows:

- ty\_17: buyer (n=81)
- ty\_3: supply chain manager (n=58)
- ty\_7: 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)

Table 7: type of employment related keywords

Despite the variety of positions available in supply chain 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 industries represented in the adverts were the following:

- *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)

Table 8: industry related keywords

The most represented industries 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 keywords discussed under the various categories are related. In the next section we will model the associations between keywords using multivariate analysis.

## **Analysis**

The data collection and coding phase that has just been described resulted in a matrix of 510 advertisements (cases) and 132 zero/one keywords (variables). 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 and HCA. 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 and Wish, 1978). In order to understand how OMDS works, we could think about a geographical map. Maps represent towns as points in the plane if the map is two dimensional, or in the space if the map has three dimensions. Once coordinates are added to the map, let us say in grid form, it is possible to locate the position of a town. In geographical maps longitude, latitude, and height over the sea level are used as coordinates. However, by adding information onto the map we would easily add other dimensions. For example, a fourth dimension such as average annual rainfall could be added by colouring the map. By using all these coordinates in a map, we would be able to obtain specific information about a specific town such as its north/south position, its east/west position, its altitude above sea level, and its average annual rainfall. All four the dimensions will be easily visualised. If towns on a map are close, the distance will be small (and as a consequence, the proximity will be high). It would be possible to use the information in the map to construct a table of distances between towns, and many maps incorporate such a table.

The OMDS algorithm works in the opposite direction. It 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 OMDS algorithm derives the map from the set of distances in such a way that if the similarity is high, the points are located close to each other, and if the similarity is small, the points are located far apart

in the map. The location of the points is described through a set of coordinates, or scales. Normally, more than two scales are needed to represent a set of points in the space, and this gives its name to the technique (Ordinal Multi-Dimensional Scaling).

In our specific case, we were interested in representing proximities between keywords; i.e., visualising how often two specific keywords appear together in the same advertisement, identifying the different dimensions that are related to the contents of the advertisement, and interpreting such dimensions.

The first step in the application of the algorithm is to define a measure of proximity (similarity) between any two objects, in this case keywords. Many measures of similarity exist, but it should be remembered that the keywords are all encoded zero/one. It is possible to calculate several measures of proximity between binary data (Yin and 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 keywords are "similar" if they both appear together in the same advertisement. For example, if supply job consultant jobs (ty\_4) require the ability to conduct statistical analysis (Sk\_stat), we will find that both keywords will take the value one together. This information is contained in the 510 by 132 data set, but it is difficult to notice it by mere inspection of the data set. It is only when the two keywords are plotted next to each other in the space that their relationship is visually revealed. However, nothing can be deduced from

the fact that an advertisement does not contain the keyword ty\_4, the keyword Sk\_stat, or both. Following this reasoning, the measure of proximity between two keywords was obtained by counting how many times they simultaneously assume value 1 in the same advertisement over all the 510 advertisements. This measure is known as "Russell and Rao" after the persons who first proposed it. The simultaneous appearance of the word in the job advert is a measure of similarity because the higher the number of coincidences, the more similar the keywords are.

Because of the 132 keywords 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 and 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 9 shows the values of Stress<sub>1</sub> for the different dimensional representations, and Figure 1 shows this 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 9: Dimensionalities and Stress I

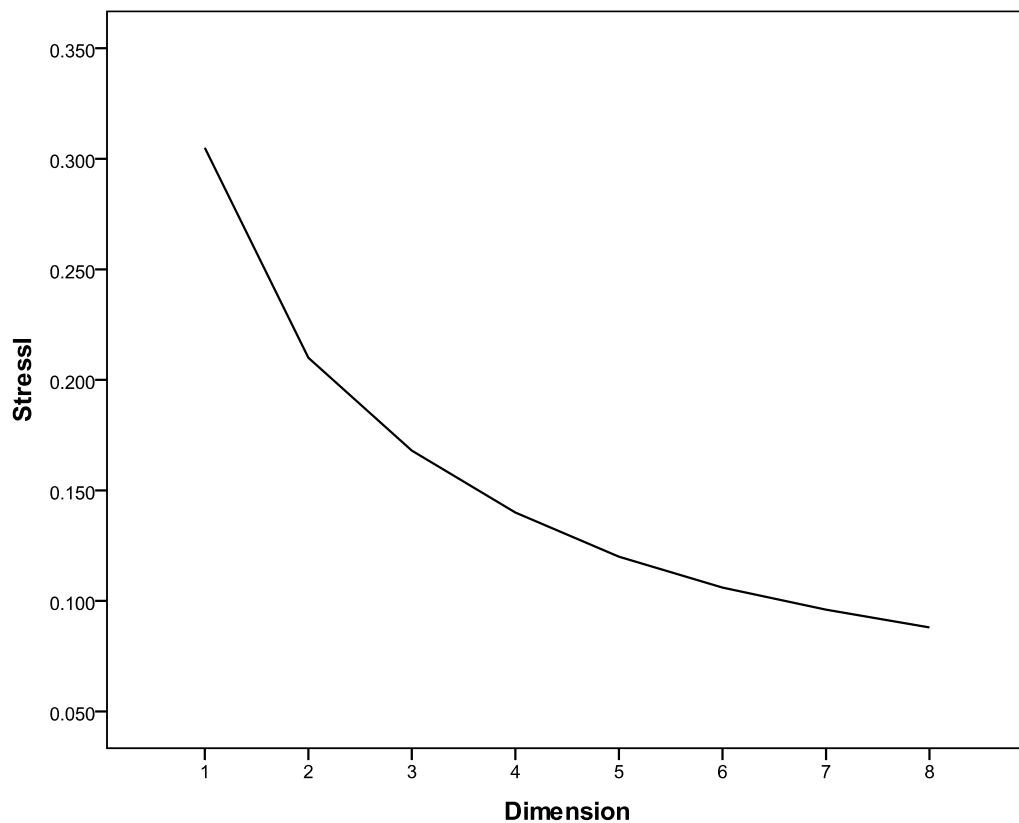


Figure 1: Stress I–Dimensionalities plot

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”.

Experience has taught us that not all dimensions can always be interpreted. 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 keywords on Dimension 1 and Dimension 2 can be seen in Figure 2. The projection on dimensions three and four is reported in Figure 3. In this occasion also dimensions five and six were interpreted and these were plotted in figure 4. We will interpret the meaning of the dimensions further below.

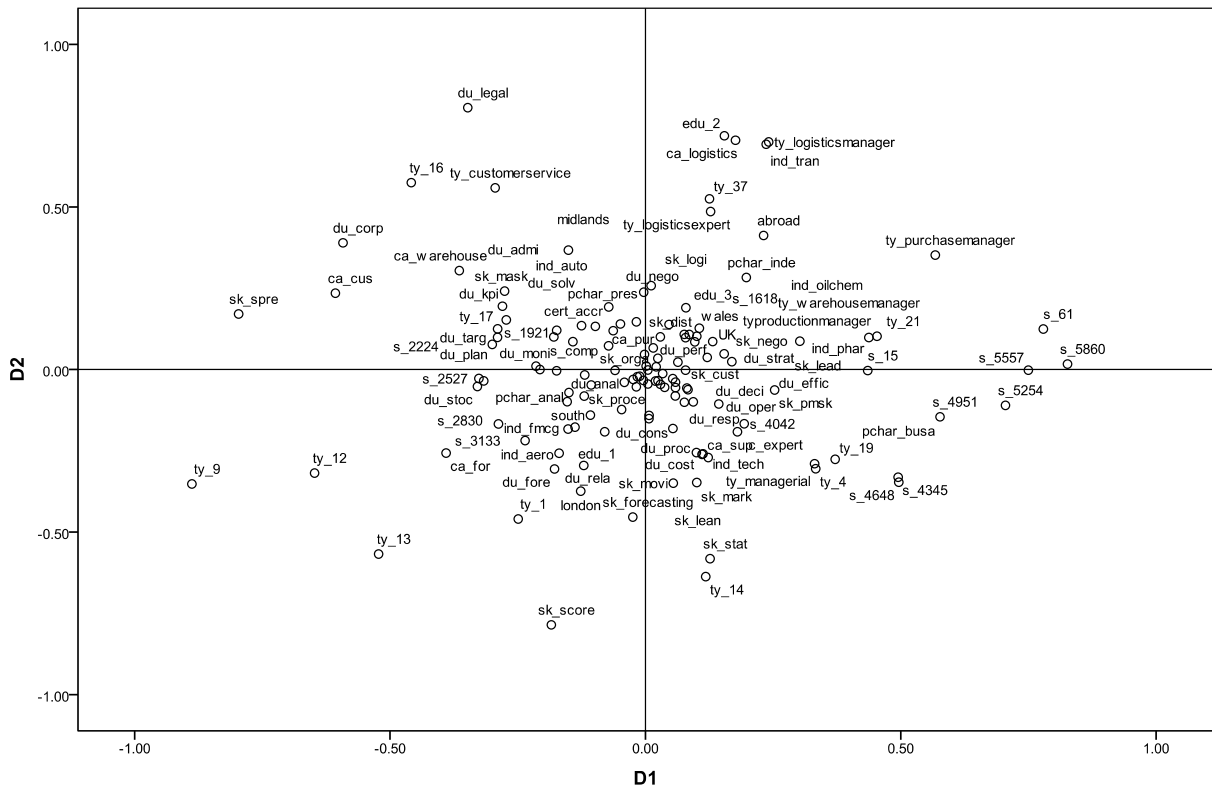


Figure 2: multidimensional scaling configuration. Plot of dimensions 1 versus 2.

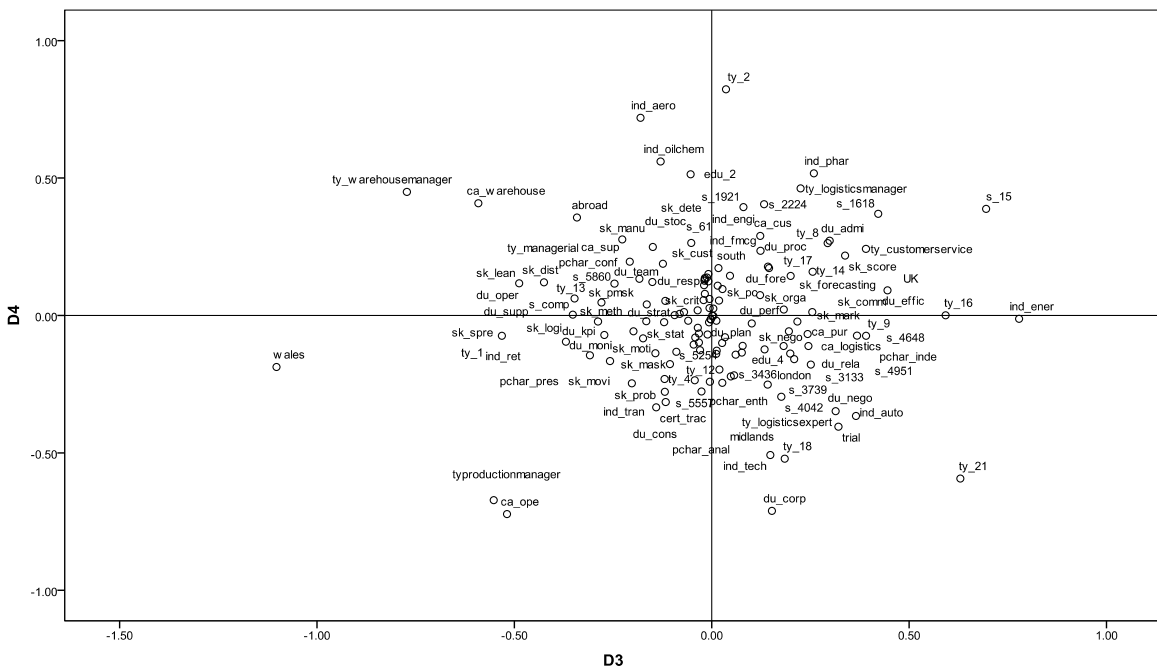


Figure 3: multidimensional scaling configuration. Plot of dimensions 3 versus 4.

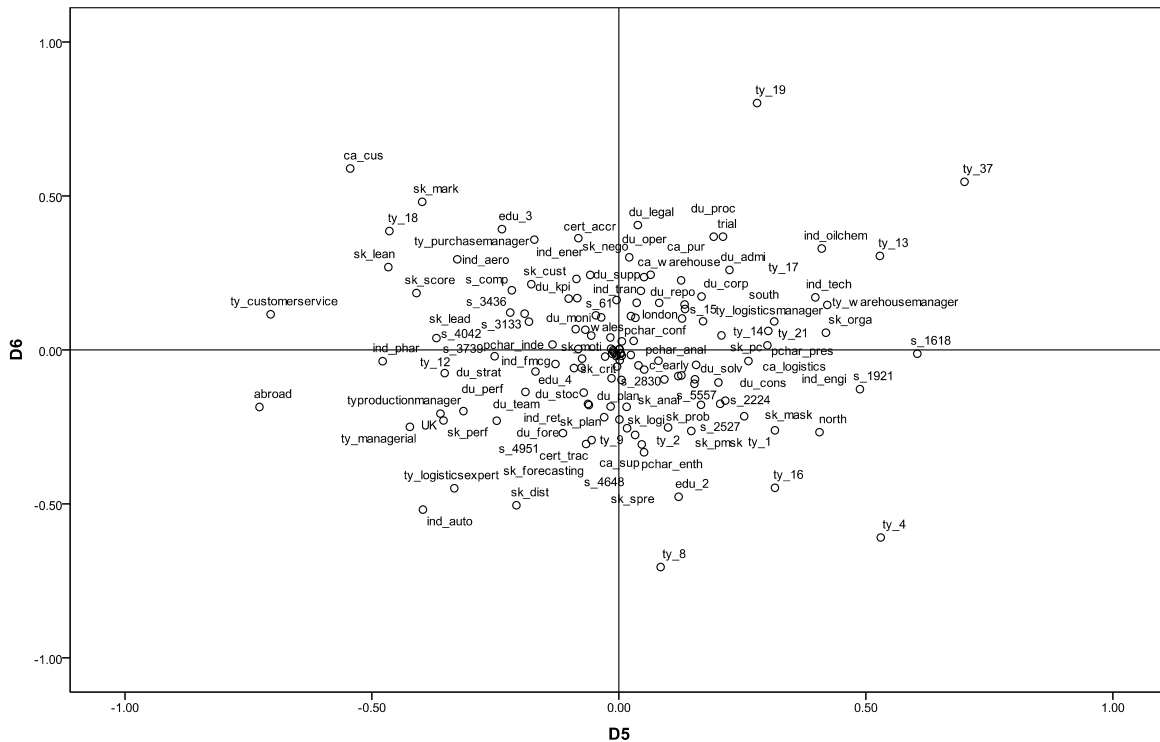


Figure 4: multidimensional scaling configuration. Plot of dimensions 5 versus 6.

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 Figure 5. 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 standard way of deciding how many clusters should be identified; hence good common sense should be used in judging the number of clusters we are interested in. As a general rule of thumb, we could say we do not want too many clusters because we would get lost in detail; however we do not want too few clusters either, as clusters may group very different entities.



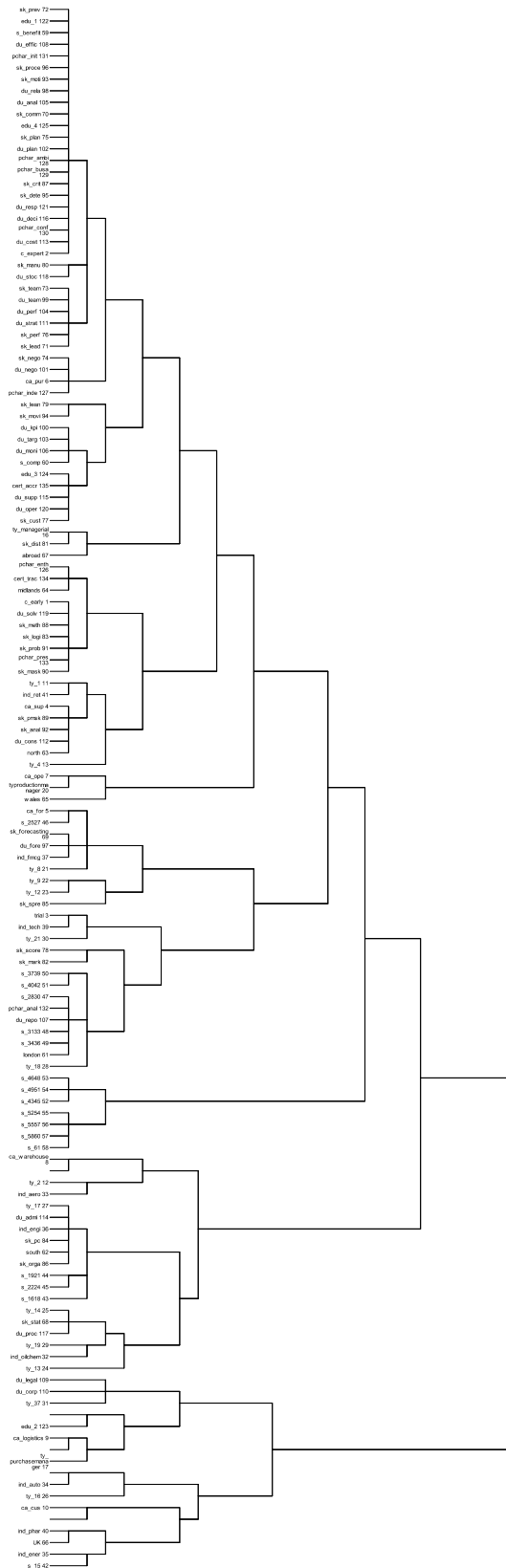


Figure 5: Dendrogram using Ward's method

Nine clusters of keywords were identified from the dendrogram. We will now proceed to discuss cluster membership. Full details about cluster membership can be found in Appendix 1.

Cluster 1 groups keywords 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 keywords 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 keywords 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 keywords related to planning, as most of the skills required are analytical skills in order to forecast production.

Cluster 5 groups production/operations managers' keywords. The prospective employee must undertake the duties of a production manager and be familiar with operations in general.

Cluster 6 groups keywords 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 keywords 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 keywords related to assistant positions in procurement or customer service. These positions have low pay (£15k per annum) 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 keyword 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 keywords in figures 2 and 3 were also replaced by their cluster membership, but they are not reproduced here.

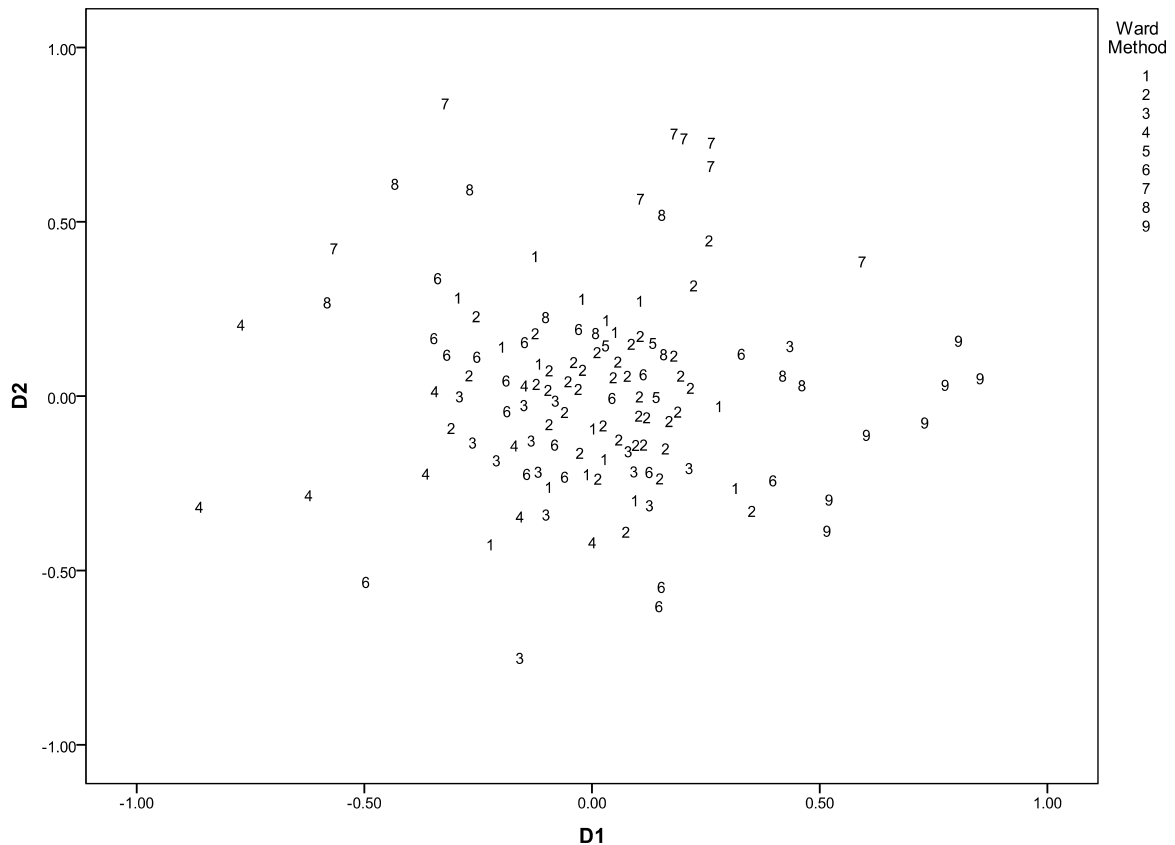


Figure 6: projections of the multidimensional configuration on dimensions 1 and 2 labelled by cluster membership.

Having discussed the clusters, we can look at figures 2, 3 and 4 and attempt to attach meaning to the dimensions. In order to label the dimensions we will concentrate on the keywords that are plotted at the extreme of the axes, and we will take into account their cluster membership. The logic of this procedure can be illustrated by means of a geographical example. When looking at a map of Europe we notice that

the Scandinavian countries (known to be towards the north) are located towards the top, and that Italy and France (known to be towards the south) are to be found at the bottom. On the left hand side of the map we find France, Spain and Portugal whereas on the right hand side lies Poland. This leads us to label the vertical axis as north-south, and the horizontal axis as west-east. We will apply this same logic in order to label the dimensions in the OMDS maps.

By observing figure 1 again, 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 keywords 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). Towards the negative side, there are jobs like manager, supply chain expert or 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 analysis related 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 expert, production and purchase manager. The skills required are very specific in nature, such as knowledge of lean management, scorecards, performance tracking, distribution processes in order 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 strategic related positions that require high level of expertise, while on the other hand 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. Dimension 6 suggests low *versus* high salary.

We can summarize the above discussion by saying that jobs advertised that appeared on the website [jobs4supplychain.com](http://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.

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 supply chain management as well as the ability to be outgoing networkers are critical characteristics. The keywords 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 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 keywords 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 5; 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 5, 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 5, indicating managerial related jobs at both junior and senior level. These are intellectually intensive jobs with a focus on the external world. Overall, this last cluster describes the situation of some managers, whose salaries widely vary 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, given 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.

We also conclude that the skills required and the rewards for the duties undertaken are different and dependent upon the knowledge intensive or operations-orientated nature of the position. Junior, knowledge intensive positions are the types of jobs University students or early careers individuals may pursue as a first step into the supply chain management world since no much experience is required. Universities may want to develop in students the skills granting fast employability. On the other hand, senior managers need a greater deal of experience; however they do not always need all the skills that graduates may have. Employees with the right skills may progress fast from a junior to a senior

managerial position. Hence, Universities may also want to develop in students the skills that will fast track their careers. Furthermore, providing access to work experience as part of the supply chain management course at university (e.g., placement schemes, company implants just to mention a couple of options) may also contribute to the career speed of the student.

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 more orientated towards practicalities such as spreadsheet modelling, pc use, planning and project management rather than being knowledge intensive. These jobs are the types of jobs aimed at individuals with A levels. However, university students with a preference for administration and project management may also apply for those positions, adding value to the company. Universities may, therefore, also want to develop practical skills in order to enhance the employability of the graduates.

### **The implications for supply chain management courses teaching**

Knowing what employers in supply chain management require is extremely helpful to university graduates in order to plan their career. It is equally important for Universities offering supply chain management related courses so to 1) enhance students' employability on the market place, as well as 2) making their study offering more appealing to

prospective students. However, some questions arise from this analysis. Should universities prepare students with the supply chain 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 managerial job-types only or should universities also provide students with the skills required in a clerk-type position?

Some may argue students need to access a job first, and then develop. However, as we can see from this study, most junior positions are generally paid lower salaries. Furthermore, individuals' personal characteristics and skills are important for advancement in the workplace (Bennett, 2009; Hillman and Dalziel, 2003). If students are not given the right skills or experience to show employers they are worth better salaries, then they may work for very long time in the same position. Perhaps should universities develop those skills allowing students to fast track their career once in a supply chain management job? The answer is not easy.

Summarising, a series of lessons should be taken into consideration when planning supply chain management courses.

1. Previous experience is a very frequent word in jobs 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 finds confirmation in the other keywords 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), drive efficiencies and analyse the market and the supply chain. Hence, it appears employers are asking for potential employees that 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 that do not know how to undertake the job, but who already have an understanding of the industry, the market and the supply chain processes (e.g., logistics, production, procurement, customer service and so on).

2. When looking at the skills sought, the most frequent keywords 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 that have the ability to think critically, so to have analytical and planning abilities that can be applied to specific contexts. Hence, universities may take this call from employers and

may be willing to train students at analysing topics/situations critically, perhaps through problem based learning activities as opposed to traditional teaching.

3. 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 the employers. Interpersonal communication along with good negotiation skills and determination are valuable skills helpful to undertake 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 employers are not only searching for critical thinkers with analytical skills that understand the industrial processes, but also require the ability to communicate effectively and frankly with stakeholders. Universities may want to address these last points by improving students' communication skills and by stressing the importance of ethical behaviour, accountability and responsibility toward your employer and society.

## **Conclusion and discussion**

Employers in supply chain management advertise jobs to university graduates. Employers draft the job advertisements with care, specifying the skills that are required, the tasks that will be undertaken, and what personal characteristics they expect the graduates to have.

Advertisements are, therefore, important sources of information and are readily available. Universities could use this source in order to design the structure of degrees in subjects such as supply chain management. However, most supply chain management programmes across the UK are very theoretical and do not provide students with the opportunity to develop the skills and the working experience that are requested by prospective employers.

Perhaps the communication between universities and employers is absent, or perhaps, universities when planning their supply chain management programmes are not aware of their own educational supply chain. After the Brown review (Brown, 2010) employability has become more and more relevant to universities as point of differentiation and a more critical approach in universities is needed (Currie et al., 2010). If universities really want to improve employability, they cannot afford ignoring employers' needs and wants. Supply chain management programmes may be shaped around the skills that students will need in industry for the duties that they will perform. Furthermore, stronger focus on problem based learning and the development of critical thinking may be a strong asset that brings a competitive advantage. Employers might engage in a stronger way with universities once they realise that universities shape their courses towards the education of their future employees. Universities would also contribute to a more functional society by decreasing the chances of unemployment due to the mismatch between skills demanded by employers and the skills offered by students.

## References

- Alise MA and Teddlie C. (2010) A Continuation of the Paradigm Wars? Prevalence Rates of Methodological Approaches Across the Social/Behavioral Sciences. *Journal of Mixed Methods Research* 4: 2: 103-126.
- Bennett R. (2009) Reaching the Board: Factors Facilitating the Progression of Marketing Executives to Senior Positions in British Companies. *British Journal of Management* 20: 1: 30-54.
- Bradley SD and Meeds R. (2004) The effects of sentence-level context, prior word knowledge, and need for cognition on information processing of technical language in print ads. *Journal of Consumer Psychology* 14: 3: 291-302.
- Brown R. (2010) *Higher Education and the Market*.
- Currie G, Knights D and Starkey K. (2010) Introduction: A Post-crisis Critical Reflection on Business Schools. *British Journal of Management* 21: s1-s5.
- De Cock C, Fitchett J and Volkmann C. (2005) Constructing the New Economy: A Discursive Perspective. *British Journal of Management* 16: 1: 37-49.
- Hillman A and Dalziel T. (2003) Boards of directors and firm performance: integrating agency and resource dependence perspectives. *Academy of Management Review* 28: 3: 383-396.
- Howard D and Kerin R. (2006) Broadening the scope of reference price advertising research: A field study of consumer shopping involvement. *Journal of Marketing* 70: 4: 185-204.
- Krippendorff K. (2004) *Content Analysis: an introduction to its methodology*, London: SAGE.
- Kruskal J and Wish M. (1978) *Multidimensional scaling*, Beverly Hills and London: Sage Publications.
- Llieva J, Baron S and Healey NM. (2002) Online surveys in marketing research: pros and cons. *International Journal of Market Research* 44: 3: 361-376.
- Mar Molinero C and Xie A. (2007) What do UK employers want from OR/MS? *Journal of the Operational Research Society* 58: 12: 1543-1553.
- Podsakoff PM, MacKenzie SB, Lee J-Y and Podsakoff NP. (2003) Common method biases in behavioral research: a critical review of the literature and recommended remedies. *Journal of Applied Psychology* 88: 5: 879-903.
- Sodhi MS and Son B-G. (2010) Content analysis of OR job advertisements to infer required skills. *Journal of the Operational Research Society* 61: 9: 1315-1327.
- Teng C-I, Huang L-S and Hsieh P-C. (2010) How to Use Technical Terms in Ads? An FCB Grid Perspective. *British Journal of Management* 21: 4: 1044-1056.
- Ward J. (1963) Hierarchical grouping to optimize an objective function. *Journal of the American Statistical Association* 58: 236-244.
- Yin Y and Yasuda K. (2005) Similarity coefficient methods applied to the cell formation problem: a comparative investigation. *Computers & Industrial Engineering* 48: 471-489.

## Appendix 1

Cluster	Keywords
1	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	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	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	ca_for, ty_8, ty_9, ty_12, ind_fmcbg, s_2527, sk_forecasting, sk_spre, du_fore
5	ca_ope, typroductionmanager, wales
6	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	ca_logistics, ty_purchasemanager, ty_logisticsmanager, ty_37, ind_tran, du_legal, du_corp, edu_2
8	ca_cus, ty_customerservice, ty_logisticsexpert, ty_16, ind_auto, ind_ener, ind_phar, s_15, UK
9	s_4345, s_4648, s_4951, s_5254, s_5557, s_5860, s_61

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