

# **Skill requirements for logistics professionals: findings and implications**

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## **Abstract**

**Purpose** – The purpose of this paper is to explore the current profile of skills and knowledge of Australian logistics professionals and identify important requirements for the future.

**Design/methodology/approach** – The study targeted the population of 1,300 professional members of the Chartered Institute of Logistics and Transport in Australia, employing the triangulation of both mail survey and in-depth interview techniques. A total of 147 usable questionnaires were returned and seven interviews conducted. Data were analysed using the SPSS 13.0 software and thematic analysis technique.

**Findings** – It is found that all proposed business-, logistics- and management-related skills and knowledge are important for logistics professionals. Logistics-related skill and knowledge set was found to be the area that educational and training institution in Australia should particularly aim at to further equip local logistics workforce with substantial skills and knowledge to perform their job successfully. In addition, universities and other training institutions should focus on developing and providing specific courses, especially professional development courses, to prepare logistics professionals with a broader skill set for the future.

**Research limitations/implications** – The major limitation of this research is that the revised

BLM framework has just been tested only in Australia. Future research direction is desired, e.g. conducting the study using the same instruments in other countries to increase the reliability and validity of the proposed revised framework.

**Originality/value** – Although this study was designed on the BLM framework, it has gone further to elaborate the framework and incorporated a number of additional skills and knowledge which are considered to be critical in the contemporary business environment, and thus it helps to enrich the contemporary literature on logistics knowledge and skill set for logistics professionals. This study is also of benefit to managers in logistics firms as they can identify important skills and knowledge to improve on, while policy makers and educational and training bodies can also use the findings from this research to design and implement courses which are necessary to facilitate skill and knowledge development for logistics workforce.

**Keywords** Skill requirements, Logistics professionals, BLM framework, Australia, Skills facilitation, Knowledge development, Distribution management

## **1. Introduction**

Logistics and supply chain management plays a critical role in the economy of every country. Like any other economic sector, a skilled workforce in logistics and supply chain contributes greatly to the success of the sector. As business environments continue to change rapidly, logistics and supply chain sectors face many challenges, of which the need for well trained and skilled logistics professionals is absolutely essential. To reflect this, Closs (2000) suggested that ‘one of the major challenges to management in the next decade is the scarcity of trained supply chain managers’, and that ‘substantial change in logistics and supply chain education is necessary’ to meet these challenges. This perception has recently been reinforced by Carter and Carter (2007) who argued that supply management organisations would take on

a higher value role in the coming decade, and thus success would hinge on whether they can attract, develop, and retain individuals with the right skills and capabilities to excel in the future. This view is further elaborated by Green (2010) of the Accenture Supply Chain Academy in that leading companies in recent years have recognised the vital role that people play in driving innovation in their supply chain and improving their ability to produce results, rather than investing only on technology and processes.

Managing the supply chain has become increasingly more complex as logisticians attempt to adapt to turbulent and competitive market environments. Adding to the complexity is managing the paradox of achieving cost efficiencies whilst improving customer service and improving customer and supplier relationships within the supply chain (Christopher, 1998). Whereas logistics professionals may have been focusing on managing traditional logistics functions such as logistics information systems, transportation and warehousing, their contemporaries no longer operate in isolation from the organisation's value chain and instead must constantly interact with other functional areas within an organisation such as marketing and production, as well as integrate with those of their suppliers and customers. One issue that arises is what knowledge and skills are necessary for logistics professionals to be able to meet the broader challenges of their role in a globalised market. Logistics professionals must be multi-talented across a range of management skills as well as having the depth of logistics knowledge and abilities, which means they must have both generalist and specialist knowledge and skills (Gammelgaard and Larson, 2001; Razzaque and Sirat, 2001; Murphy and Poist, 2006).

This paper aims to address the above mentioned issue and is organised in four sections. First, a literature review is conducted to examine how the research issue has been addressed in the

contemporary literature and identify room for further investigation in this study. Secondly, the research methodology in this study with the adopted conceptual framework, data collection and sampling methods will be explained. Findings and conclusions will be presented next, followed by a discussion on both academic and managerial implications. Finally, a conclusion is presented together with some notes on directions for future research.

## **2. Literature review**

During the 1990s, a number of studies emerged that drew attention to the range of skills that logistics managers may require (for example see La Londe, 1990; Williams and Currey, 1990; Murphy and Poist, 1991a, b, 1993, 1998; Minahan, 1998; Trunick, 1998; Gibson, *et al.*, 1998). What is apparent from the studies is that logistics managers require many skills to be effective. Researchers have tested the importance of a wide variety of skills ranging from the four broad sets of people, analytical, communication and computer skills (see Gibson, Gibson and Rutner, 1998) through to 83 items classified by Murphy and Poist (1991b) as business skills, logistics skills and management skills. In a variety of other studies (Pilnick and Gabel, 1998; Young, 1998; Le May *et al.*, 1999) necessary skills for logistics managers spread over from technological to organisational and interpersonal ones. What becomes apparent is that to become a successful logistics manager, one may need to possess super-human characteristics to take on the plethora of activities.

The BLM framework of 33 business, 18 logistics and 32 management skills developed by Murphy and Poist (1991b) has since become a backbone model of research on skills and competencies of logistics professionals. It was found from this study that management skills are seen as the most important component for logistics professionals, with emphasis on traditional managerial skills such as motivation, planning, and organising. Next in importance

is the logistics skills followed by the business skills. These results are said to have implications for practitioners, head-hunters, employers and educators. Murphy and Poist have since conducted some other studies to explore the above-mentioned implications. The above finding was echoed in the subsequent study by Murphy and Poist (1991a) to compare the views of headhunters and practitioners which also found that some disagreements between these two groups of respondents were in the logistics and management skills. Respondents who were educators in the study by Murphy and Poist (1993) rated management skills as the most important, followed by logistics and business skills, and this finding was also confirmed by respondents who are practitioners in the later study (Murphy and Poist, 1998). Among 83 presented skills, educators also perceived nine management skills as the most important for senior logistics executives in this study, which confirms the earlier assertion that logistics executives should first be proficient in management skill set. Using the same BLM framework, Murphy and Poist (2006, 2007) also found that management skills are most important for both senior- and entry-level managers, followed in order by logistics and business skills, although there was a high degree of difference across the two groups. The BLM framework was also validated in the Asian context as evidenced in the study by Razzaque and Sirat (2001) which found that business and government skill received high score. This perhaps reflects the great influence of the local government policies and legislature and concern for society in the respective study countries.

Although the research has brought attention to the changing role of logistics managers, researchers such as Razzaque and Sirat (2001) suggest that the focus on the skills and attributes that make a good logistician has been rather scant. Similarly, Gammelgaard and Larson (2001) add that overall little has been written on these new logistics skills and competencies. Although the BLM framework has so far been used as a common tool to

evaluate skills and knowledge of logisticians, it has been validated mostly in the American context. Furthermore, it is also important to take into account factors that affect and change business environments, i.e. globalisation, outsourcing, technology developments, climate change and the increasing emphasis on risk management which may impact the preference for skills and competencies of logisticians. For example, a recent study conducted in the context of the new European Union environment found that skill preference will be given to international business expertise or skill levels in a relevant foreign language (Poist, *et al.*, 2001). With the exception of the recent US-based study by Murphy and Poist (2006), the amount of interest in the knowledge and skill sets for logistics managers appears to have somewhat subsided. Within Australia, there appears to have been even less interest with no related study found, although logistics plays an important role in the national economy and in the new business environments.

### **3. Methodology**

#### *3.1 Research questions*

This study aims to examine the questions of what skills and knowledge are necessary for logistics professionals to be successful in their job and how these skills and knowledge profiles may change in the future. It also looks at the perceived importance of these skills and knowledge and the implication to educational providers in preparing students embarking on a logistics career.

#### *3.2 Methods of data collection*

Triangulation is utilised in this study. Triangulation is strongly suggested in transportation and logistics research literature as an effective and useful technique to achieve the width and depth of research issues (Cunningham *et al.*, 2000). The type of triangulation technique employed in

this paper is methodological triangulation, in which the authors used and combined qualitative and quantitative methods to obtain a comprehensive understanding and a wide and deep picture of the research question. The methods of data collection and interpretation used in this study are exploratory in-depth interviews to provide more inputs for the follow-up survey method (by using mail questionnaires).

### *3.3 Sampling design*

The exploratory phase of this research involves seven in-depth interviews with senior logistics executives who are members of the Chartered Institute of Logistics and Transport in Australia (CILTA). Owing to the elite nature of the interview population which is required to be those in senior designations of the logistics profession, the interviewee sample for this research was selected on convenience basis, i.e. from the authors' contact database. Given the target population being logistics professionals with their skills and knowledge as the unit of analysis in this research, the sampling frame for the questionnaire survey is constructed from the member directory of CILTA with the total sampling approach taken. A list of 1,300 members of CILTA is thus used as the mailing list. By the cut-off date, 147 questionnaires were returned, representing an 11.3 percent overall response rate.

### *3.4 Design of research instruments*

The interview aims to explore interviewees' understanding about logistics and supply chain management by asking for their elaboration on the possible differences in the role and responsibility between logistics and supply chain manager, and subsequently those in terms of their required skills and knowledge. A response card consisting of a brief description of the three groups of business, logistics and management skills was also given to interviewees while they were asked about the suitability of these skill groups for logistics professionals as

well as their rankings. Interviewees were also asked to indicate any new skill and knowledge that they would think important to be included, as well as any possible difference of requirements for logistics professionals at the entry and management levels.

Both fixed-alternative and open-ended response questions were utilised in the survey questionnaire. Respondents were asked to rank the perceived current and future importance (in ten years time) of 68 skills and knowledge on the scale with 1 indicating 'not important' and 5 denoting 'most important'. Table 1 presents the 68 skills and knowledge used in this study and their associated codes. Respondents were also asked to indicate whether they currently have the relevant skill and knowledge. The 68 skills and knowledge used for this research are mainly derived from the BLM framework of 33 business, 18 logistics and 32 management skills. However, they were thoroughly reviewed and scrutinised to ensure their relevant meaning and avoid repetition. This led to the rewording as well as deletion of some skills and knowledge in the original BLM framework. In addition, some other new skills and knowledge were added on the basis of findings from the in-depth interviews specifically on the aspect of how changes in the business environment would affect logistics professionals in terms of requirements of skills and knowledge necessary to perform their jobs successfully. As a result, in the business-related group, 13 skills were deleted, two of them were combined, and seven new skills were added making up 25 skills and knowledge in this group. In the logistics-related group, 20 skills and knowledge in the original framework were retained with some modification in wording to make them more user-friendly. Three new skills and knowledge were also added following the findings from the in-depth interviews. In the management-related group, 12 deletions were made from the original 32 skills and knowledge on the basis of review of repetition in semantic meaning. The above revision is reflected in Table II.

Respondents were also asked to identify potential changes that may impact on the skills and knowledge required by logistics professionals in the future. Educational needs required by logistics professionals were also explored in the survey questionnaire.

### *3.5 Administering research instruments*

Prior to the interviews, a list of prospective interviewees in various organisations was drawn up, and each of these interviewees was contacted by telephone inviting their participation in the interviews. The interviews were conducted on a one-to-one basis and averaged approximately 60 minutes. A tape recorder was used to record the whole interview with the prior consent of the interviewees. The survey questionnaire was pre-tested with a group of ten organisations. Once this was completed and all feedback was incorporated in a revised questionnaire, the finalised version was mailed, together with a cover letter and a self-addressed envelope, to the Secretariat of CILTA for further forwarding to their members.

## **4. Findings and discussion**

### *4.1 Measurement scale reliability analysis*

In this study, the statistical norm concerning the internal consistency adopted is above  $\pm 2.0$ , and the accepted value level of reliability (Cronbach's  $\alpha$  value) is above 0.60 for the scale. Table III shows the item-total correlation analysis and Cronbach's  $\alpha$  value of the scale measuring perceptions of 68 skills and knowledge. Since all the values in the 'Corrected item-total correlation' column, which shows the internal consistency of the whole scale, are above  $\pm 2.0$  (the lowest item has an item-total correlation of 0.38), it is decided that no variable is dropped from the scale, as each is considered a reliable skill/knowledge necessary for logistics professionals. When any individual variable is dropped from the scale, the scale's  $\alpha$  does not

fall below 0.971. The overall  $\alpha$ -value for the questionnaire is 0.972, which indicates that the survey instrument is very reliable.

#### *4.2 General perception of proposed skills and knowledge for logistics professionals*

Table IV presents the descriptive statistical results of the proposed 68 skills and knowledge which are deemed necessary for logistics professionals in the current and future states. Mean and standard deviation were computed to derive the descriptive profile of variables. Based on the mean scores, conclusions could be drawn on respondents' perception of the perceived importance of each skill and knowledge. Ranking of skills and knowledge in terms of importance could also be established based on their mean scores and standard deviation. Specifically, as the midpoint of the scale is 3 (neutral), those variables having a mean score greater than 3 would indicate that their importance is supported by the survey respondents, while those with a mean score less than 2 (little important) should be eliminated from the original model. The change in ranks of each variable from the current to future state is also computed using mean score differences. In addition, the test of significant at 95 percent confidence level using  $z$ -test (Zikmund, 2003) was also conducted to examine the generalisability of all variables involved.

As can be seen from Table IV, no skill and knowledge in the proposed set has the mean response lower than 2 in either current or future states, indicating that they are all accepted by respondents as necessary skills and knowledge for logistics professionals. However, in terms of perceived importance, four skills/knowledge (*managing returned products*, *packaging*, *salvage and scrap disposal*, and *knowing two or more languages*) were seen as least important to logistics professionals in the current state, although *managing returned products* would be of moderate importance in the future. This, to some extent, demonstrates the increasing

importance of reverse logistics in the future as logistics professionals would be entrusted to take care of all related operations and processes of the product's lifecycle, i.e. "from cradle to grave". However, the finding that *salvage and scrap disposal* was rated least important must be interpreted with caution, since this may be industry-specific rather than a universal outcome. For instance, this skill is important in the electronics but might be less likely so in the trucking industry. The finding that *knowing two or more languages* was not seen as of great importance reflects the context where respondents are operating in, i.e. English speaking as the mother tongue; nevertheless, this is also seen as of increasing importance in the future given the international exposure of logistics and supply chain operations.

In terms of ranking, the five most important skills and knowledge (in order) as currently perceived by respondents are *personal integrity*, *managing client relationships*, *problem-solving ability*, *cost control* and *ability to plan*. All these skills/knowledge have mean scores greater than 4, denoting that they are seen as greatly important skill sets that logistics professionals must possess. In the future state, these skills and knowledge are also seen as of the most important magnitude since they are still in the top five most important. However, rankings of individual skill/knowledge have changed slightly. While *personal integrity* and *problem-solving ability* retain their ranks as the most and third most important skill and knowledge necessary for logistics professionals, *ability to plan* has become the second most important in the future (from the 5<sup>th</sup> rank), the importance of *managing client relationship* has been downgraded from second to fourth rank, while the same is observed for *cost control* (from the 4<sup>th</sup> to 5<sup>th</sup> rank). What can be induced from the above is that planning capability is seen as critical for logistics professionals operating in an increasingly complex business environment with many uncertainties. At the same time, logistics professionals will need to

retain their personal integrity as an important virtue for business success, while also being vigilant in solving any problem that may arise in their operations.

Comparing between the current and future states, several skills and knowledge in the proposed set of skills and knowledge for logistics professionals have their ranks changed substantially. This is reflected in the last column in Table IV, which shows the gap score of ranks for each skill and knowledge between current and future states. A negative score indicates a decrease in ranking from the current to the future state, which means the perceived importance of a specific skill/knowledge has been decreased, and vice versa. It can be seen from Table IV that those skills and knowledge which have the biggest negative scores (decreased perceived magnitude of importance of eight, seven and five ranks respectively) are *understanding logistics terminologies*, *ability to delegate*, *traffic/transport management*, *effective supervision of staff*, and *occupational health and safety*, among others. On the other hand, those skills and knowledge which have the biggest positive scores (increased perceived magnitude of importance) are *use of logistics specialised softwares* (a rise of 13 ranks), *strategic management* (11 ranks), *risk management* (8 ranks), *identifying opportunities and threats* (8 ranks), *impact of climate change* (7 ranks), and *developing environmentally sustainable logistics systems* (7 ranks), among others. The above findings signify that those skills and knowledge at the basic operational level are decreasing in their importance, while logistics professionals in Australia emphasised the increasing importance in the future of those skills and knowledge relating to capability at the strategic level such as strategically managing the overall logistics processes as well as risks. It is also interesting to note the increasing concern of logistics professionals on the capability to understand and mitigate climate change's impact on logistics operations, which in turn can be interpreted into

logistics-related skill and knowledge such as the capability to design, operate and manage environmentally friendly logistics operations processes (“green logistics”).

The majority of the five least important skills and knowledge for logistics professionals are those related to the logistics skills and knowledge group (*packaging, managing returned products, and salvage and scrap disposal*). The other least important skills and knowledge are business-related (*international business regulations*) and management-related (*knowing two or more languages*). As discussed earlier, this may be induced as context-constrained where English is the mother tongue of respondents and Australia as a continent is geographically separated from the rest. However, the latter must be interpreted with much caution given the connectivity in terms of logistics operations between Australia and the rest of the world. The finding that respondents give a lesser extent of importance to logistics-related skills and knowledge is in line with other findings in the literature where logistics professionals need to be managers first rather than logisticians. This can be seen more clearly when skills and knowledge are classified into business, logistics and management groups with statistical results summarised in Table V. It is also worth noting that the perceived importance of each skill and knowledge group in the future state is increased compared to the current state.

Table VI depicts the current skill and knowledge profile of Australian logistics professionals. Respondents were asked to indicate whether they currently possess a particular skill and knowledge. Although the binary scale used for this purpose does not accurately reflect the respondents’ level of skill and knowledge possession, it does help to provide a preliminary portrait of their skill and knowledge profile. As can be seen from this table, 86% of respondents in this study viewed themselves as currently possessing management-related skill and knowledge set while the percentage for business- and logistics-related ones are 71% and

52% respectively. What can be deduced from this result is that, from the training and education perspective, respondents are quite proficient in terms of management and business areas, but it is quite alarming that just about half of them currently possess logistics-related skill and knowledge set. This might be partly because many respondents have concentrated their daily work on some specific areas but not the overall picture of the logistics and supply chain. Given the finding that logistics-related skills and knowledge are seen as important and necessary for the success of logistics professionals in Australia, educational and training institutions will need to act on this accordingly.

#### *4.3 Respondents' perception by demographic variables*

Statistical tests were conducted to explore whether there is a significant difference in respondents' perception of the proposed skills and knowledge at present and future, and whether their perception is dependent on other demographic variables such as their designation and work experience. First, a paired sample *t*-test was conducted to investigate whether there is any particular skill and knowledge in which their respective perceived present and future importance is significantly different from each other. As can be seen from Table VII, there are 11 skills and knowledge whose perceived present and future importance are significantly different from each other ( $p$ -value  $<0.05$ ), in that respondents perceived that these skills and knowledge would be significantly more important to possess in the future so that logistics professionals can fulfil their job successfully. On the business side, respondents emphasised the future importance of knowledge on local and international business regulations (skills 1, 8), impact of globalisation and climate change (skills 7, 19), and information system management (skill 22). On the logistics side, respondents also emphasised the future importance of application of ICT in logistics such as the use of specialised logistics softwares (skill 28), minimising the effect of demand uncertainty (skill 29), logistics

personnel recruitment (skill 37), global logistics operations (skill 39), as well as developing environmentally sustainable logistics systems (skill 48), which are in line with ongoing trends on technological application in business and increasing awareness of the need for the environmental sustainability. On the management side, there was not much difference in respondents' perception of current and future importance of the proposed skills and knowledge, except that the knowledge of two or more languages in the future was specifically emphasised (skill 68). This finding is quite expected in the context of Australian logistics professionals given the social context of an English-speaking nation.

Based on description of job title, respondents were classified into two main groups: 99 respondents at senior level (with designations such as CEO, director, deputy director, general manager, manager, etc.) and 48 at entry level (for all other designations). Table VIII presents the statistical summary of the findings. As can be seen from this table, in terms of current importance there are 11 skills and knowledge in which the difference in perception of respondents at the entry and senior levels is significant. Specifically, senior level respondents rated significantly more important than do respondents at the entry level the skills and knowledge of *analysing statistical data, the impact of globalisation, marketing, human resource management, strategic management, understanding economic principles, engineering logistics, ability to organise, expertise in interpersonal relations, and ability to train subordinates*. The higher emphasis by senior level respondents on some skills such as strategic management, knowledge of impact of globalisation, ability to train subordinates, etc. is quite expected given the respondents' designation profile. Entry level respondents, however, rated significantly more important than do respondents at the senior level the knowledge of two or more languages. This is also understandable as entry-level respondents are those directly involved in logistics business activities at the operational level. As far as

future importance of skills and knowledge is concerned, there are five skills and knowledge that respondents at the entry level rated significantly more important than do those at the senior level, namely, *Australian business regulations, modelling of operations systems, infrastructure planning and management, understanding transport regulations, and salvage and scrap disposal*. At the aggregate level, there is no significant difference in the perception of respondents at the senior level towards current and future importance of business, logistics and management skills and knowledge. However, those at the entry level rated these three skills and knowledge groups significantly more important in the future compared to the current state. This is reflected in Table IX.

#### *4.4 Educational programs for the future*

This section explores how educational providers are implicated from the results of this study. In the survey questionnaire, respondents were asked to indicate the educational programs that they would need to undertake in the next ten years to prepare and perform their job as a logistics professional. The result is summarised in Table X. It can be seen from this table that a majority number of respondents favoured to have some professional development courses in the future to prepare themselves as a logistics professional. This is also in line with responses in the 'other' selection category, in that respondents indicated *skill sets, management training, certificate of competency, IT courses, specific target short courses, and cultural awareness of foreign country business* as the most popular training programs in the future. This is also aligned with the earlier finding that logistics-related skills and knowledge need further attention from educators and trainers for the current workforce. Interestingly, the second most desired training program is postgraduate qualifications, only followed by undergraduate degree and diploma qualifications. This can be partly explained by looking at the respondents' profile, in that 76 percent currently hold logistics or business-related

qualifications. It is understood from this finding that some professional short courses or in-depth knowledge courses (postgraduate courses) would be the preferred choice, given the respondents' existing professional qualification background.

In response to the question of how education programs to prepare logistics professionals for the next ten years should be developed and conducted, the majority of responses indicated that the industry should be involved in this process. In other words, universities should develop and conduct these programs in consultation with logistics associations. In addition, it was also suggested by respondents that such a development and conduct of logistics education programs be supported by other business associations, while international universities should also be involved to provide reference of necessary educational programs. This result supports the earlier finding that respondents would prefer professional development courses in that educators and trainers provide skills and knowledge that are in line with the needs of industry professionals. All in all, universities designing and conducting educational program on their own is not a preferred choice. The above findings are presented in Table XI.

## **5. Academic and managerial implications**

This research has several academic implications. First of all, it helps to enrich the contemporary literature on logistics knowledge and skill sets for logistics professionals, which is currently rather scant. Second, although this study was designed on the BLM framework, it has gone further to elaborate the framework and incorporated a number of additional skills and knowledge which are considered to be critical in the contemporary business environment, while refining several other existing variables in the current framework. Findings from this research also indicate the consistency in findings from several earlier studies in the field, while also discovering that new skills and knowledge which are critical for logistics

professionals should be continuously explored and empirically validated along with changes in the logistics business environment.

This study is also of benefit to managers in logistics firms as they can identify important skills and knowledge to improve on, while policy makers and educational and training bodies can also use the findings from this research to design and implement courses which are necessary to facilitate skill and knowledge development for the logistics workforce. On the one hand, as management-related skills and knowledge were rated the most important group, it is paramount that educators and trainers continue to focus their curriculum development and teaching designs on areas perceived as critical to logistics professionals such as customer relationship management and problem solving and decision making. Meanwhile, more emphasis should also be placed on areas of increasing concern such as logistics cost control and management, and ability to plan business processes effectively. These skills and knowledge can be imparted as part of the overall tailor-made curriculum development in strategic management in logistics and supply chain, which also includes topical aspects such as risk management and environmental management. Some necessary teaching tools can be developed accordingly such as business strategy games in which learners need to employ their knowledge on various aspects of planning, cost management, customer service management, etc. to achieve business performance objectives within the given constraints. On the other hand, the finding that nearly half of the current logistics workforce does not possess necessary logistics-related skills and knowledge requires further attention of educators and trainers. While many logistics professionals have learnt their logistics skills and knowledge on the job, these might be too constrained within their daily job scope and thus logistics and supply chain management education programs to provide holistic logistics knowledge are desired to fill this knowledge gap. This should not be the job of only training institutions but collaboration with

professionals in the logistics and supply chain industry is also required. This can be conducted using various formats, in which using industry professionals as guest lecturers to provide insight on practical application aspects as well as industry-specific knowledge (such as use of logistics specialised software) is a common method.

## **6. Conclusion**

This research aims to build and empirically validate a model of skills and knowledge which are necessary for logistics professionals to perform their job successfully based on the existing BLM framework with substantial refinement based on critical screening and analysis of changes that may impact logistics business environment. It has been found from this study that all proposed skills and knowledge in the model are empirically validated, while findings on the relative importance of business, logistics and management skill and knowledge sets are consistent with earlier research. In addition, the logistics-related skill and knowledge set was found to be the area that educational and training institutions in Australia should particularly aim at to further equip the local logistics workforce with substantial skills and knowledge to perform their job successfully.

## References

- Carter, P. and Carter, J. R. (2007), "The Future of Supply Management – Part III: Organization + Talent", *Supply Chain Management Review*, Vol. 11, No. 8, pp. 37 – 43.
- Christopher, M. (1998), *Logistics and Supply Chain Management*, Financial Times, London.
- Closs, D. J. (2000), "Preface", *Journal of Business Logistics*, Vol. 21, No. 1, p. i.
- Cunningham, L., Young, C. & Lee, M. (2000), "Methodological Triangulation in Measuring Public Transportation Service Quality", *Transportation Journal*, Fall, pp. 35–47.
- Gammelgaard, B. and Larson, P. D. (2001), "Logistics Skills and Competencies for Supply Chain Management", *Journal of Business Logistics*, Vol. 22, No. 2, pp. 27-49.
- Gibson, B., Gibson, M. and Rutner, S. (1998), *Careers in Logistics*, Council of Logistics Management, Oak Brook, IL.
- Green, A. (2010), "Building the Skills to Support a High-Performance Supply Chain", *Supply Chain E-Magazine*, July/August, available at: [www.scemagazine.com](http://www.scemagazine.com).
- La Londe, B. J. (1990), "Update Logistics Skills for the Future", *Transportation and Distribution*, January, pp. 16-48.
- Le May, S. A., Carr, J. C., Periatt, A. J. and McMahon, R. D. (1999), *The Growth and Development of Logistics Personnel*, Council of Logistics Management, Oak Brook, IL.
- Minahan, T. (1998), "How the Supply Chain Changes your Job", *Purchasing*, Vol. 124, No. 2, pp. 57-58.
- Murphy, P. R. and Poist, R. F. (1991a), "A Comparison of Headhunter and Practitioner Views regarding Skill Requirements of Senior-level Logistics Professionals", *Logistics and Transportation Review*, Vol. 27, No. 3, pp. 277-294.
- Murphy, P. R. and Poist, R. F. (1991b), "Skill Requirements of Senior-level Logistics Executive: An Empirical Assessment", *Journal of Business Logistics*, Vol. 12, No. 2, pp. 73-94.

- Murphy, P. R. and Poist, R. F. (1993), "Career Preparation of Senior-level Transportation and Logistics Executives: Educator Perspectives", *Transportation Practitioners Journal*, Vol. 60, No. 2, pp. 161-173.
- Murphy, P. R. and Poist, R. F. (1998), "Skill Requirements of Senior-level Logisticians: Practitioner Perspectives", *International Journal of Physical Distribution & Logistics Management*, Vol. 28, No. 4, pp. 284-293.
- Murphy, P. R. and Poist, R. F. (2006), "Skill Requirements of Contemporary Senior- and Entry-level Logistics Managers: A Comparative Analysis", *Transportation Journal*, Vol. 45, No. 3, pp. 46-60.
- Murphy, P. R. and Poist, R. F. (2007), "Skill Requirements of Skill Requirements of Senior-level Logisticians: A Longitudinal Assessment", *Supply Chain management*, Vol. 12, No. 6, pp. 423-432.
- Pilnick, S. and Gabel, J.E. (1998), *A Case of Mission Impossible*, Human Systems International, Boca Raton, FL.
- Poist, R. F., Scheraga, C. A. and Semeijn, J. (2001), "Preparation of Logistics Managers for the Contemporary Environment of the European Union", *International Journal of Physical Distribution & Logistics Management*, Vol. 31, No. 7/8, pp. 487-504.
- Razzaque, M. A. and Sirat, M. S. B. (2001), "Skill Requirements: Perceptions of the Senior Asian Logisticians", *International Journal of Physical Distribution and Logistics Management*, Vol. 31, No. 5, pp. 374-395.
- Trunick, P. A. (1998), "New Demands for Tomorrow's Manager", *Transportation and Distribution*, December, pp. 18-19.
- Williams, A. W. and Currey, P. (1990), "Desired attributes of logistics managers and a learning hierarchy in management education", *Logistics and Transportation Review*, Vol. 26, No. 4, pp. 369-379.

Young, L. (1998), "Human Element", *Materials Management and Distribution*, December, P. 27.

Zikmund, W. (2003), *Business Research Methods*, 7th edition, Thomson Learning, South-Western Publishers, Mason, Ohio, USA.

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**Table I.**

Skill/knowledge	Code
Australian business regulations	Skill 1
Modelling of operations systems	Skill 2
Knowledge of client's systems	Skill 3
Financial management	Skill 4
Public relations	Skill 5
Analysing statistical data	Skill 6
The impact of globalisation	Skill 7
International business regulations	Skill 8
Cost control	Skill 9
Marketing	Skill 10
Managing client relationships	Skill 11
General business administration	Skill 12
Managing corporate knowledge	Skill 13
Human resource management	Skill 14
Managing organisational culture	Skill 15
Risk management	Skill 16
Ethical behaviour	Skill 17
Being a good corporate citizen	Skill 18
Impact of climate change	Skill 19
Strategic management	Skill 20
Understanding economic principles	Skill 21
Information system management	Skill 22
Industrial relations	Skill 23
Occupational health and safety	Skill 24
Infrastructure planning and management	Skill 25
Planning the location of facilities	Skill 26
Contract management	Skill 27
Use of logistics specialised softwares	Skill 28
Product demand forecasting	Skill 29
Spare parts support	Skill 30
Understanding transport regulation	Skill 31
Order processing	Skill 32
Traffic/transport management	Skill 33
Distribution communications	Skill 34
Purchasing	Skill 35
Materials handling	Skill 36
Recruiting logistics personnel	Skill 37
Packaging	Skill 38
International logistics	Skill 39
Inventory control	Skill 40
Managing returned products	Skill 41
Salvage and scrap disposal	Skill 42
Production planning	Skill 43
Understanding logistics terminology	Skill 44
Customer service	Skill 45
Engineering logistics	Skill 46
Warehousing	Skill 47
Developing environmentally sustainable logistics systems	Skill 48
Ability to plan	Skill 49
Effective written communication	Skill 50
Self-confidence	Skill 51

**Table I. (continued)**

Skill/knowledge	Code
Effective supervision of staff	Skill 52
Negotiation skills	Skill 53
Ability to delegate	Skill 54
Problem-solving ability	Skill 55
Self-motivation	Skill 56
Individual time management	Skill 57
Ability to motivate staff	Skill 58
Enthusiasm	Skill 59
Personal integrity	Skill 60
Adapting to organisational change	Skill 61
Effective verbal communication	Skill 62
Ability to organise	Skill 63
Expertise in interpersonal relations	Skill 64
Knowledge of operations	Skill 65
Ability to train subordinates	Skill 66
Identifying opportunities and threats	Skill 67
Knowing two or more languages	Skill 68

**Table II.**

Original BLM framework	Framework in this study
<i>Business (33 skills)</i>	<i>Business (33 – 13 deletions – 2 combinations + 7 additions = 25 skills)</i>
General business administration	General business administration
Marketing management	Marketing
Human resource management	Human resource management
Public relations	Public relations
Business strategy	Strategic management
Transport and logistics	Deleted, to be in traffic/transport management in logistics-related group
Business ethics	Ethical behavior
Accounting	Cost control
Business writing	Deleted, to be part of effective written communication in management-related group
Financial management	Financial management
Labor relations	Industrial relations
Microeconomics	Understanding economic principles
Macroeconomics	Understanding economic principles
Quantitative methods	Modeling of operations systems
Procurement	Deleted, to be in purchasing in logistics-related group
Organizational psychology	Managing corporate knowledge
Production management	Deleted, to be included in strategic management
Computer science	Information system management
Information system management	Information system management
Statistics	Analyzing statistical data
Industrial engineer	Deleted, combined with civil engineering to become engineering logistics in logistics-related group
Business and government	Australian business regulations
Business law	International business regulations
Business and society	Being a good corporate citizen
Transport engineer	Deleted, combined with industrial engineering to become engineering logistics in logistics-related group
Industrial sociology	Deleted
International business	International business regulations
Business history	Deleted
Economic geography	Deleted
Insurance and real estates	Deleted
Speech communication	Deleted, to be part of effective verbal communication in management-related group
Regional planning	Infrastructure planning and management
Foreign languages	Deleted, to be covered in knowing two or more languages in management-related group
	New: knowledge of client's systems
	New: the impact of globalization
	New: managing client relationships
	New: managing organizational culture
	New: risk management
	New: impact of climate change
	New: occupational health and safety
<i>Logistics (18 skills)</i>	<i>Logistics (20 skills with modification + 3 additions = 23 skills)</i>

**Table II. (continued)**

Original BLM framework	Framework in this study
Customer service	Customer service
International logistics	International logistics
Inventory management	Inventory control
Materials handling	Materials handling
Order management	Order processing
Production scheduling	Production planning
Packaging	Packaging
Purchasing	Purchasing
Salvage and scrap disposal	Salvage and scrap disposal
Transport and traffic management	Transport/traffic management
Warehousing management	Warehousing
Logistics-related regulations	Understanding transport regulations
Facilities location	Planning the location of facilities
Forecasting	Product demand forecasting
Parts and service support	Spare parts support
Personnel movement	Recruiting logistics personnel
Return goods handling	Managing returned products
Logistics information management	Use of logistics specialised softwares
	New: understanding logistics terminology
	New: engineering logistics (combined industrial engineering and civil engineering)
	New: developing an environmentally sustainable logistics systems
<i>Management (32 skills)</i>	<i>Management (32 – 12 deletions = 20 skills)</i>
Written communication	Effective written communication
Interpersonal relations	Expertise in interpersonal relations
Plan	Ability to plan
Organize	Ability to organize
Decision-making ability	Problem-solving ability
Train/mentor	Ability to train subordinates
Personal integrity	Personal integrity
Self-motivation	Self-motivation
Self-confidence	Self-confidence
Enthusiasm	Enthusiasm
Motivate others	Ability to motivate staff
Managerial control	Deleted, to be part of effective supervision of staff
Oral communication	Effective verbal communication
Supervise others	Effective supervision of staff
Delegate	Ability to delegate
Time management	Individual time management
Negotiate	Negotiation skills
Adapt to change	Adapting to organizational change
Persuasion	Deleted, to be part of negotiation skills
System concept	Deleted, to be part of managing corporate knowledge in business-related group
Listen and empathize	Deleted, to be part of expertise in interpersonal relations

**Table II. (continued)**

Original BLM framework	Framework in this study
Analytic reasoning	Deleted, to be part of problem-solving ability
Operational logistics tasks	Knowledge of operations
Assertiveness	Deleted, to be part of expertise in interpersonal relations
Personal grooming	Deleted, to be part of personal integrity
Personal dress	Deleted, to be part of personal integrity
Statesmanship	Deleted, to be part of expertise in interpersonal relations
Visualize future threats/opportunities	Identifying opportunities and threats
Quantitative expertise	Deleted, to be part of modeling operations systems in business-related
Outgoing personality	Deleted, not considered as part of management skills
Computer expertise	Deleted, to be part of information system management in business-related group
Foreign languages	Knowing two or more languages

**Table III.**

Skills	Scale mean (if item deleted)	Scale variance (if item deleted)	$\alpha = 0.972$	
			Corrected item-total correlation	Cronbach's $\alpha$ (if item deleted)
1	248.82	1,758.48	0.39	0.972
2	248.71	1,739.51	0.51	0.972
3	248.73	1,744.09	0.46	0.972
4	248.14	1,756.99	0.42	0.972
5	248.97	1,746.11	0.40	0.972
6	248.56	1,745.48	0.55	0.972
7	248.98	1,741.86	0.45	0.972
8	249.37	1,726.24	0.61	0.972
9	248.08	1,749.50	0.57	0.972
10	248.91	1,736.79	0.56	0.972
11	248.05	1,749.67	0.54	0.972
12	248.50	1,753.10	0.45	0.972
13	248.57	1,746.25	0.56	0.972
14	248.44	1,736.73	0.59	0.972
15	248.46	1,741.73	0.58	0.972
16	248.36	1,748.83	0.54	0.972
17	248.15	1,757.36	0.43	0.972
18	248.54	1,736.83	0.61	0.972
19	249.30	1,744.44	0.48	0.972
20	248.35	1,743.46	0.60	0.972
21	248.79	1,740.52	0.56	0.972
22	248.57	1,746.58	0.53	0.972
23	248.70	1,731.53	0.65	0.971
24	248.27	1,741.77	0.57	0.972
25	248.67	1,733.65	0.64	0.971
26	248.89	1,721.10	0.72	0.971
27	248.58	1,736.14	0.58	0.972
28	249.09	1,729.00	0.59	0.972
29	248.97	1,724.02	0.67	0.971
30	249.24	1,722.84	0.56	0.972
31	248.65	1,729.53	0.64	0.971
32	249.25	1,725.82	0.65	0.971
33	248.85	1,723.68	0.68	0.971
34	249.08	1,715.17	0.75	0.971
35	248.99	1,732.37	0.63	0.972
36	249.04	1,713.07	0.78	0.971
37	248.93	1,721.64	0.68	0.971
38	249.50	1,719.09	0.64	0.971
39	249.18	1,718.43	0.66	0.971
40	248.86	1,717.24	0.71	0.971
41	249.41	1,716.53	0.66	0.971
42	249.63	1,719.77	0.62	0.972
43	249.20	1,715.19	0.66	0.971
44	248.85	1,738.83	0.53	0.972
45	248.22	1,731.02	0.60	0.972
46	249.35	1,730.02	0.55	0.972
47	249.03	1,720.99	0.67	0.971
48	249.19	1,719.39	0.70	0.971
49	248.08	1,752.06	0.51	0.972

**Table III. (continued)**

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Skills	Scale mean (if item deleted)	Scale variance (if item deleted)	$\alpha = 0.972$	
			Corrected item-total correlation	Cronbach's $\alpha$ (if item deleted)
50	248.13	1,762.32	0.38	0.972
51	248.26	1,761.59	0.35	0.972
52	248.22	1,745.79	0.52	0.972
53	248.24	1,738.95	0.67	0.971
54	248.33	1,749.22	0.51	0.972
55	248.07	1,760.02	0.43	0.972
56	248.14	1,742.36	0.56	0.972
57	248.28	1,743.74	0.61	0.972
58	248.38	1,733.74	0.60	0.972
59	248.29	1,752.41	0.44	0.972
60	247.88	1,751.71	0.47	0.972
61	248.41	1,744.83	0.54	0.972
62	248.16	1,743.53	0.60	0.972
63	248.34	1,739.18	0.66	0.971
64	248.47	1,743.89	0.59	0.972
65	248.33	1,735.07	0.67	0.971
66	248.68	1,727.75	0.73	0.971
67	248.35	1,738.60	0.63	0.972
68	249.93	1,738.55	0.50	0.972

Table IV.

Skills	Current state					Future state					Rank change
	$M$	STD	Rank	$z$ -stat.	$z$ obs	$M$	STD	Rank	$z$ -stat.	$z$ obs	
60	4.51	0.93	1	1.96	19.65	4.44	1.18	1	1.96	14.72	0
11	4.33	0.85	2	1.96	18.91	4.28	1.16	4	1.96	13.33	-2
55	4.32	0.78	3	1.96	20.61	4.29	1.05	3	1.96	14.86	0
9	4.31	0.81	4	1.96	19.61	4.27	1.09	5	1.96	14.11	-1
49	4.31	0.85	5	1.96	18.65	4.33	1.12	2	1.96	14.37	3
50	4.26	0.82	6	1.96	18.61	4.22	1.07	7	1.96	13.86	-1
56	4.24	0.98	7	1.96	15.46	4.19	1.21	11	1.96	11.90	-4
4	4.24	0.89	8	1.96	16.99	4.18	1.14	12	1.96	12.46	-4
17	4.24	0.85	9	1.96	17.56	4.26	1.06	6	1.96	14.39	3
62	4.23	0.89	10	1.96	16.74	4.20	1.11	9	1.96	13.03	1
52	4.16	0.97	11	1.96	14.61	4.16	1.14	16	1.96	12.25	-5
45	4.16	1.14	12	1.96	12.36	4.16	1.32	13	1.96	10.69	-1
53	4.14	0.88	13	1.96	15.68	4.20	1.11	8	1.96	13.10	5
51	4.13	0.89	14	1.96	15.32	4.10	1.14	18	1.96	11.73	-4
24	4.12	0.96	15	1.96	14.11	4.07	1.15	20	1.96	11.30	-5
57	4.11	0.87	16	1.96	15.47	4.15	1.12	17	1.96	12.39	-1
59	4.10	0.96	17	1.96	13.83	4.08	1.18	19	1.96	11.14	-2
54	4.06	0.92	18	1.96	14.05	4.01	1.11	26	1.96	11.07	-8
65	4.05	0.95	19	1.96	13.47	4.04	1.15	23	1.96	11.01	-4
63	4.05	0.89	20	1.96	14.21	4.05	1.13	22	1.96	11.34	-2
20	4.04	0.90	21	1.96	14.05	4.19	1.13	10	1.96	12.77	11
67	4.03	0.94	22	1.96	13.35	4.16	1.14	14	1.96	12.43	8
16	4.03	0.88	23	1.96	14.23	4.16	1.08	15	1.96	12.94	8
58	4.01	1.08	24	1.96	11.28	4.03	1.29	25	1.96	9.72	-1
61	3.98	0.96	25	1.96	12.35	4.05	1.18	21	1.96	10.83	4
14	3.95	1.04	26	1.96	11.15	4.03	1.16	24	1.96	10.80	2
15	3.93	0.95	27	1.96	11.91	4.01	1.14	27	1.96	10.73	0
64	3.92	0.90	28	1.96	12.44	3.94	1.10	29	1.96	10.35	-1
12	3.89	0.93	29	1.96	11.62	3.85	1.11	34	1.96	9.27	-5
18	3.84	1.00	30	1.96	10.18	3.90	1.18	32	1.96	9.22	-2
6	3.82	0.93	31	1.96	10.68	3.82	1.11	35	1.96	8.91	-4
13	3.82	0.89	32	1.96	11.10	3.92	1.13	30	1.96	9.89	2
22	3.82	0.93	33	1.96	10.65	4.00	1.14	28	1.96	10.63	5
27	3.81	1.07	34	1.96	9.13	3.90	1.22	31	1.96	8.96	3
31	3.73	1.10	35	1.96	8.10	3.77	1.23	37	1.96	7.56	-2
25	3.71	1.02	36	1.96	8.49	3.86	1.19	33	1.96	8.75	3
66	3.71	0.99	37	1.96	8.62	3.78	1.18	36	1.96	8.00	1
23	3.69	1.05	38	1.96	7.97	3.72	1.22	41	1.96	7.16	-3
2	3.68	1.14	39	1.96	7.23	3.75	1.30	39	1.96	6.99	0
3	3.65	1.14	40	1.96	6.92	3.75	1.37	38	1.96	6.63	2
21	3.60	1.02	41	1.96	7.13	3.67	1.16	42	1.96	7.04	-1
1	3.57	0.91	42	1.96	7.58	3.73	1.11	40	1.96	8.05	2
33	3.54	1.14	43	1.96	5.73	3.59	1.29	50	1.96	5.56	-7
44	3.54	1.11	44	1.96	5.86	3.55	1.26	52	1.96	5.32	-8
40	3.52	1.20	45	1.96	5.29	3.60	1.37	49	1.96	5.30	-4
26	3.50	1.12	46	1.96	5.38	3.61	1.34	47	1.96	5.53	-1
10	3.48	1.09	47	1.96	5.31	3.62	1.29	45	1.96	5.80	2
37	3.46	1.17	48	1.96	4.72	3.63	1.29	44	1.96	5.86	4
29	3.42	1.15	49	1.96	4.46	3.61	1.31	48	1.96	5.60	1

**Table IV. (continued)**

Skills	Current state					Future state					Rank change
	<i>M</i>	STD	Rank	<i>z</i> -stat.	<i>z</i> obs	<i>M</i>	STD	Rank	<i>z</i> -stat.	<i>z</i> obs	
5	3.41	1.25	50	1.96	4.03	3.52	1.30	53	1.96	4.89	-3
7	3.41	1.23	51	1.96	4.04	3.61	1.44	46	1.96	5.17	5
35	3.40	1.06	52	1.96	4.57	3.48	1.26	54	1.96	4.59	-2
47	3.35	1.20	53	1.96	3.58	3.42	1.39	58	1.96	3.68	-5
36	3.35	1.16	54	1.96	3.64	3.43	1.30	56	1.96	4.00	-2
34	3.31	1.17	55	1.96	3.18	3.40	1.34	59	1.96	3.62	-4
28	3.30	1.20	56	1.96	3.03	3.63	1.40	43	1.96	5.46	13
39	3.21	1.27	57	1.96	2.02	3.42	1.49	57	1.96	3.42	0
48	3.20	1.18	58	1.96	2.03	3.57	1.43	51	1.96	4.83	7
43	3.18	1.31	59	1.96	1.69	3.29	1.48	60	1.96	2.39	-1
30	3.14	1.38	60	1.96	1.26	3.22	1.51	62	1.96	1.80	-2
32	3.14	1.15	61	1.96	1.43	3.12	1.32	64	1.96	1.13	-3
19	3.09	1.08	62	1.96	0.99	3.46	1.37	55	1.96	4.09	7
46	3.03	1.25	63	1.96	0.33	3.15	1.40	63	1.96	1.29	0
8	3.01	1.21	64	1.96	0.14	3.27	1.38	61	1.96	2.39	3
41	2.97	1.29	65	1.96	-0.26	3.03	1.41	65	1.96	0.29	0
38	2.89	1.28	66	1.96	-1.03	2.95	1.47	66	1.96	-0.45	0
42	2.76	1.31	67	1.96	-2.26	2.88	1.45	68	1.96	-1.03	-1
68	2.46	1.18	68	1.96	-5.50	2.90	1.47	67	1.96	-0.78	1

**Table V.**

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Groups	Current importance		Future importance	
	<i>M</i>	STD	<i>M</i>	STD
Business group	3.79	0.60	3.88	0.90
Logistics group	3.34	0.87	3.45	1.07
Management group	4.04	0.67	4.07	0.97

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**Table VI.**

	Possession of this skill (%)	Absence of this skill (%)
Business group	71	29
Logistics group	52	48
Management group	86	14

**Table VII.**

Skills	Current importance		Future importance		<i>p</i> -value
	<i>M</i>	STD	<i>M</i>	STD	
1	3.57	0.91	3.73	1.11	0.023
2	3.68	1.14	3.75	1.30	0.346
3	3.65	1.14	3.75	1.37	0.228
4	4.24	0.89	4.18	1.14	0.371
5	3.41	1.25	3.52	1.30	0.095
6	3.82	0.93	3.82	1.11	0.929
7	3.41	1.23	3.61	1.44	0.008
8	3.01	1.21	3.27	1.38	0.000
9	4.31	0.81	4.27	1.09	0.606
10	3.48	1.09	3.62	1.29	0.115
11	4.33	0.85	4.28	1.16	0.467
12	3.89	0.93	3.85	1.11	0.542
13	3.82	0.89	3.92	1.13	0.151
14	3.95	1.04	4.03	1.16	0.319
15	3.93	0.95	4.01	1.14	0.285
16	4.03	0.88	4.16	1.08	0.097
17	4.24	0.85	4.26	1.06	0.799
18	3.84	1.00	3.90	1.18	0.478
19	3.09	1.08	3.46	1.37	0.000
20	4.04	0.90	4.19	1.13	0.052
21	3.60	1.02	3.67	1.16	0.311
22	3.82	0.93	4.00	1.14	0.025
23	3.69	1.05	3.72	1.22	0.664
24	4.12	0.96	4.07	1.15	0.563
25	3.71	1.02	3.86	1.19	0.073
26	3.50	1.12	3.61	1.34	0.116
27	3.81	1.07	3.90	1.22	0.202
28	3.30	1.20	3.63	1.40	0.000
29	3.42	1.15	3.61	1.31	0.024
30	3.14	1.38	3.22	1.51	0.283
31	3.73	1.10	3.77	1.23	0.651
32	3.14	1.15	3.12	1.32	0.851
33	3.54	1.14	3.59	1.29	0.485
34	3.31	1.17	3.40	1.34	0.187
35	3.40	1.06	3.48	1.26	0.356
36	3.35	1.16	3.43	1.30	0.250
37	3.46	1.17	3.63	1.29	0.027
38	2.89	1.28	2.95	1.47	0.396
39	3.21	1.27	3.42	1.49	0.007
40	3.52	1.20	3.60	1.37	0.369
41	2.97	1.29	3.03	1.41	0.319
42	2.76	1.31	2.88	1.45	0.095
43	3.18	1.31	3.29	1.48	0.117
44	3.54	1.11	3.55	1.26	0.848
45	4.16	1.14	4.16	1.32	1.000
46	3.03	1.25	3.15	1.40	0.119
47	3.35	1.20	3.42	1.39	0.346
48	3.20	1.18	3.57	1.43	0.000
49	4.31	0.85	4.33	1.12	0.756
50	4.26	0.82	4.22	1.07	0.645

**Table VII. (continued)**

Skills	Current importance		Future importance		<i>p</i> -value
	<i>M</i>	STD	<i>M</i>	STD	
51	4.13	0.89	4.10	1.14	0.699
52	4.16	0.97	4.16	1.14	0.928
53	4.14	0.88	4.20	1.11	0.459
54	4.06	0.92	4.01	1.11	0.508
55	4.32	0.78	4.29	1.05	0.733
56	4.24	0.98	4.19	1.21	0.439
57	4.11	0.87	4.15	1.12	0.595
58	4.01	1.08	4.03	1.29	0.723
59	4.10	0.96	4.08	1.18	0.858
60	4.51	0.93	4.44	1.18	0.319
61	3.98	0.96	4.05	1.18	0.327
62	4.23	0.89	4.20	1.11	0.637
63	4.05	0.89	4.05	1.13	0.922
64	3.92	0.90	3.94	1.10	0.781
65	4.05	0.95	4.04	1.15	0.856
66	3.71	0.99	3.78	1.18	0.403
67	4.03	0.94	4.16	1.14	0.089
68	2.46	1.18	2.90	1.47	0.000

**Table VIII.**

Skills	Current importance					Future importance				
	Entry level		Senior level		<i>p</i> -value	Entry level		Senior level		<i>p</i> -value
	<i>M</i>	STD	<i>M</i>	STD		<i>M</i>	STD	<i>M</i>	STD	
1	3.67	0.91	3.53	0.92	0.789	3.98	0.89	3.62	1.18	0.013
2	3.77	1.21	3.64	1.11	0.856	3.98	1.14	3.64	1.36	0.029
3	3.50	1.30	3.73	1.06	0.095	3.85	1.41	3.70	1.35	0.732
4	4.29	0.94	4.22	0.86	0.975	4.40	0.94	4.07	1.22	0.387
5	3.33	1.45	3.45	1.15	0.133	3.56	1.35	3.51	1.28	0.761
6	3.71	1.09	3.88	0.85	0.028	3.90	1.10	3.78	1.12	0.702
7	3.19	1.50	3.52	1.06	0.013	3.56	1.60	3.64	1.36	0.110
8	3.08	1.25	2.98	1.20	0.559	3.50	1.27	3.16	1.42	0.472
9	4.27	0.94	4.32	0.74	0.330	4.33	0.97	4.23	1.14	0.786
10	3.21	1.32	3.61	0.93	0.023	3.58	1.46	3.64	1.22	0.093
11	4.10	1.04	4.44	0.73	0.156	4.15	1.15	4.34	1.17	0.877
12	3.79	1.11	3.94	0.83	0.088	3.96	0.99	3.80	1.17	0.228
13	3.85	1.01	3.80	0.83	0.940	4.13	0.94	3.82	1.20	0.075
14	3.67	1.26	4.09	0.88	0.003	4.10	1.10	4.00	1.20	0.916
15	3.85	1.07	3.97	0.89	0.365	4.00	1.05	4.01	1.18	0.545
16	3.98	0.98	4.05	0.83	0.692	4.31	0.90	4.08	1.16	0.464
17	4.08	1.01	4.31	0.76	0.413	4.29	0.87	4.24	1.14	0.236
18	3.81	1.07	3.86	0.98	0.570	4.02	1.02	3.84	1.25	0.146
19	3.02	1.28	3.12	0.98	0.136	3.56	1.40	3.41	1.36	0.788
20	4.02	1.16	4.05	0.75	0.027	4.25	1.10	4.16	1.15	0.645
21	3.56	1.27	3.62	0.88	0.024	3.75	1.18	3.64	1.16	0.708
22	3.83	1.08	3.81	0.85	0.604	4.10	1.08	3.95	1.17	0.542
23	3.63	1.20	3.72	0.97	0.097	3.90	1.08	3.64	1.28	0.234
24	4.02	1.10	4.17	0.89	0.937	4.17	1.00	4.03	1.22	0.246
25	3.81	1.10	3.67	0.98	0.900	4.13	0.98	3.73	1.26	0.029
26	3.46	1.13	3.52	1.12	0.594	3.79	1.22	3.53	1.39	0.121
27	3.98	1.08	3.73	1.07	0.753	4.21	1.03	3.76	1.29	0.262
28	3.42	1.38	3.24	1.10	0.284	3.85	1.53	3.52	1.33	0.869
29	3.48	1.34	3.39	1.05	0.119	3.77	1.28	3.53	1.33	0.418
30	3.02	1.49	3.20	1.32	0.452	3.27	1.50	3.20	1.53	0.636
31	3.79	1.18	3.71	1.06	0.701	4.02	1.04	3.65	1.30	0.019
32	2.98	1.21	3.21	1.12	0.766	3.15	1.22	3.11	1.37	0.211
33	3.58	1.18	3.52	1.12	0.777	3.81	1.23	3.48	1.31	0.147
34	3.29	1.30	3.31	1.10	0.602	3.54	1.34	3.33	1.35	0.430
35	3.50	1.11	3.35	1.04	0.865	3.73	1.12	3.35	1.30	0.119
36	3.35	1.23	3.34	1.13	0.978	3.60	1.18	3.34	1.35	0.086
37	3.38	1.35	3.49	1.08	0.215	3.69	1.19	3.60	1.35	0.192
38	2.88	1.41	2.90	1.22	0.249	3.08	1.53	2.88	1.44	0.513
39	3.33	1.43	3.15	1.18	0.166	3.69	1.53	3.29	1.47	0.883
40	3.63	1.21	3.47	1.20	0.714	3.79	1.27	3.51	1.41	0.156
41	3.02	1.38	2.95	1.25	0.534	3.21	1.35	2.95	1.43	0.664
42	2.71	1.27	2.78	1.34	0.557	2.98	1.26	2.83	1.53	0.013
43	3.27	1.25	3.14	1.35	0.356	3.52	1.30	3.18	1.55	0.052
44	3.56	1.18	3.53	1.08	0.947	3.75	1.19	3.45	1.28	0.301
45	4.10	1.34	4.19	1.04	0.485	4.23	1.26	4.13	1.35	0.432
46	2.83	1.55	3.13	1.08	0.001	3.17	1.60	3.14	1.30	0.050
47	3.35	1.26	3.35	1.17	0.919	3.46	1.35	3.40	1.41	0.534
48	3.21	1.34	3.19	1.10	0.256	3.69	1.45	3.52	1.43	0.952
49	4.21	1.03	4.35	0.75	0.075	4.52	0.90	4.24	1.21	0.339

**Table VIII. (continued)**

Skills	Current importance					Future importance				
	Entry level		Senior level		<i>p</i> -value	Entry level		Senior level		<i>p</i> -value
	<i>M</i>	STD	<i>M</i>	STD		<i>M</i>	STD	<i>M</i>	STD	
50	4.15	0.99	4.31	0.72	0.266	4.29	0.90	4.19	1.15	0.467
51	4.08	1.11	4.15	0.77	0.250	4.19	1.12	4.06	1.15	0.798
52	4.04	1.20	4.22	0.83	0.123	4.31	0.97	4.08	1.22	0.428
53	4.06	1.08	4.18	0.77	0.791	4.27	1.05	4.16	1.14	0.690
54	3.83	1.10	4.17	0.80	0.141	3.98	0.96	4.03	1.18	0.225
55	4.25	0.93	4.35	0.69	0.341	4.33	0.86	4.27	1.14	0.317
56	4.15	1.13	4.29	0.90	0.401	4.23	1.13	4.17	1.25	0.597
57	4.04	1.09	4.14	0.74	0.265	4.29	1.07	4.08	1.15	0.917
58	3.83	1.23	4.09	1.00	0.182	4.15	1.18	3.98	1.34	0.650
59	3.96	1.09	4.16	0.89	0.338	4.11	1.13	4.07	1.21	0.861
60	4.46	1.11	4.54	0.84	0.248	4.52	1.07	4.39	1.24	0.414
61	3.92	1.05	4.01	0.92	0.695	4.06	1.02	4.05	1.26	0.149
62	4.08	1.15	4.30	0.73	0.128	4.23	1.06	4.18	1.15	0.643
63	3.88	1.21	4.13	0.68	0.024	4.02	1.19	4.07	1.10	0.840
64	3.73	1.12	4.01	0.75	0.017	3.92	1.05	3.95	1.13	0.622
65	3.98	1.19	4.09	0.81	0.262	4.08	1.13	4.02	1.16	0.966
66	3.54	1.18	3.79	0.88	0.037	3.83	1.15	3.75	1.19	0.877
67	3.88	1.10	4.11	0.84	0.466	4.10	1.08	4.19	1.17	0.457
68	2.58	1.38	2.40	1.08	0.022	3.08	1.51	2.82	1.45	0.741

**Table IX.**

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Skill group	Entry level				<i>p</i> -value
	Current importance <i>M</i>	STD	Future importance <i>M</i>	STD	
Bus	3.72	0.76	3.98	0.72	0.000
Log	3.35	0.96	3.61	0.93	0.000
Man	3.93	0.85	4.13	0.82	0.001

**Table X.**

Educational programs	Number of responses
Professional development courses	90
Postgraduate qualifications	38
Undergraduate courses	13
Diploma	4
Others	2

**Table XI.**

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How should education programs be developed	Number of responses
In consultation with logistics associations	121
In consultation with other business associations	98
In consultation with international universities	77
Design and conduct training programs on their own	21
Others	11

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