



## Australian Supply Chain Professionals: Competencies, Use of Technologies and Future Challenges

# Foreword



**The competitive environment of the 21st Century continues to intensify with many businesses now operating internationally. Managers are becoming increasingly aware of the challenges being presented by globalisation, environmental concerns, political threats and other health and safety issues. Local businesses are not immune, as they too face similar challenges, if not through their global partners, through greater competition, consumer awareness and the rising cost of doing business.**

In order to operate efficiently and effectively, organisations need to adopt global standards and integrate business processes from the end consumer through the retailers, manufacturers and their suppliers, in order to provide products, services and information that add value to the ultimate customer. Many organisations have already appointed or are in the process of appointing Supply Chain and Logistics Executives who are being charged with the task of supply chain integration. This requires a wide range of strategies, technologies, standards and best practices along the supply chain. In the wake of these initiatives many economies are also facing a global skills shortage of supply chain and technology savvy practitioners.

The dichotomy faced by industry is the aging pool of supply chain experts and the increasing challenges in global supply chain management. Given this situation, this study sets out to establish a profile of our supply chain and logistics executives in Australia, the breath of their responsibilities and their experiences in this area.

The study also seeks to establish the skills set required of today's supply chain practitioners which will help ensure that the next crop of supply chain and logistics graduates will be up to the challenges of the profession. How well we employ the technologies and systems in today's supply chain and to what extent they have been used, have also been identified in this study. These findings will be critical if today's Supply Chain Executives are to tackle the major challenges expected over the next three to five years as identified in this study.

The research work done by the teams at the Australian Supply Chain Management Research Unit, Monash University and GS1 Australia, and supported by Efficient Consumer Response Australasia and the Supply Chain and Logistics Association of Australia are to be congratulated.

Maria Palazzolo  
CEO GS1 Australia



# Research Team



**Professor Amrik Sohal**

Amrik Sohal is a Professor in the Department of Management at Monash University and Associate Dean (India Development) for the Faculty of Business and Economics. He is also the Director of the Australian Supply Chain Management Research Unit.

His research and teaching is in the areas of operations and supply chain management, technology management and innovation/quality management. His professional contributions include presentations at many industry conferences and workshops as well a number of consultancies. He is currently President Elect of the Australian and New Zealand Academy of Management (President during 2009).



**Dr Daniel Prajogo**

Daniel Prajogo is a Senior Lecturer in the Department of Management, Monash University where he is also the Deputy Director of the Higher Degree by Research program. His primary research interests are in the areas of operations and supply chain management, quality management, and innovation management. He has been a regular presenter at national and international conferences and is currently engaged in a number of research projects funded by industry and the Australian government. His publications have appeared in a number of leading academic journals.



**Mr Steven Pereira**

Steven Pereira, Chief Information Officer, has been with GS1 Australia since August 1996. Steven's current responsibilities involve Business Systems, Standards & Emerging Technologies and Education. Steven sits on a number of tertiary institutions' industry advisory committees, including Deakin University, RMIT University and the University of Western Sydney. Steven is involved at a global level in the standards development process and is an international conference speaker. Steven has a Commerce Degree from the University of Western Australia and is a member of the Australian Institute of Management, the Logistics Association of Australia and an Associate of CPA Australia.



**Ms Christine Alemao**

Research assistance for this project was provided by Ms Christine Alemao who holds a Master of Psychology degree. She has worked as an Assistant HR Manager for a number of years with Oracle Financial Services Software Limited. Her interests are in exploring the human element in areas such as Supply Chain and Human Resources.

# Australian Supply Chain Management Research Unit (ASCMRU)

Over the past 15 years the Australian Supply Chain Management Research Unit (ASCMRU) at Monash has been providing research expertise in the area of supply chain and operations management, quality and innovation management, knowledge management and technology/information management.

ASCMRU is focused on research that examines the fundamental principles of the supply chain network to produce research outcomes as well as strong practical advice for specific industry sectors. The unit investigates all aspects of the supply chain from sourcing to manufacture to transportation and delivery in order to understand the intricacies of the supply chain, improve operational efficiencies, save costs and ultimately fulfil customer demands.

ASCMRU researchers have a strong track record of attracting external research funding, publications in leading journals, supervision of research students and organising international conferences and workshops.



## GS1 Australia

GS1 Australia is an industry supply chain organisation and the only organisation authorised by GS1 Global to administer the GS1 System in this country. A not-for-profit organisation with more than 16,000 businesses as members, GS1 Australia concentrates on helping businesses to work smarter and more efficiently using the GS1 System.

GS1 Australia is part of a worldwide network that supports companies in areas such as supply chain efficiency, traceability, inventory management, point of sale and collaborative planning. The GS1 System is used by retailers, brand owners and their trading partners in more than 145 countries. It consists of global standards for numbering, bar codes, electronic messaging, data synchronisation and radio frequency identification (RFID).





## ECR Australasia

Efficient Consumer Response (ECR) is a business concept aimed at better satisfying consumer needs, through businesses and trading partners working together.

In doing so, ECR best practices will deliver superior business results by reducing costs at all stages throughout the value chain, achieving efficiency and streamlined processes. ECR best practices can deliver improved range, consumer value, sales, service and convenience offerings. This in turn will lead to greater satisfaction of consumer needs.

ECR Australasia reflects a commitment to take costs out of the grocery supply chain and better satisfy consumer demands through the adoption of world's best practice. In an increasingly global food and grocery industry and a retail environment subject to rapid change, the future for Australian and New Zealand suppliers, retailers and wholesalers depends on increased efficiencies, reduced costs and added value for consumers.



## Supply Chain & Logistics Association of Australia

The Supply Chain and Logistics Association of Australia (SCLAA) is Australia's largest association for supply chain and logistics professionals and practitioners. It is a true member-based, not-for-profit association whose proceeds are channelled into member benefits. The SCLAA has established divisions in all states providing active networking and educational events programs to meet the needs of its members.

The Mission of the SCLAA is to serve and advance the interests of supply chain and logistics professionals and practitioners in Australia.

## Contact for further information

### Professor Amrik Sohal

Australia Supply Chain Management Research Unit, Faculty of Business and Economics

Monash University  
P.O. Box 197  
Caulfield East VIC  
Australia 3145

**T:** (03) 9903 2033

**F:** (03) 9903 2979

**E:** Amrik.Sohal@buseco.monash.edu.au

### Steven Pereira

Chief Information Officer

GS1 Australia  
Locked Bag 2  
Mt Waverley VIC  
Australia 3149

**T:** (03) 9550 3435

**F:** (03) 9558 9551

**E:** spereira@gs1au.org

# Contents

## 1. EXECUTIVE SUMMARY

### 1.1 Introduction

### 1.2 Summary of Major Findings

### 1.3 Conclusion

## 2. INTRODUCTION

## 3. RESEARCH METHODOLOGY

### 3.1 Company Profile

#### 3.1.1 Industry Sector

#### 3.1.2 Ownership of Companies

#### 3.1.3 Size of Companies (Number of employees)

#### 3.1.4 Sales Volume and Market Coverage

#### 3.1.5 Strategic Position of Respondent Company along the Supply Chain

### 3.2 Respondent Profile

#### 3.2.1 Respondents Position in the Company

#### 3.2.2 Reporting Structure

#### 3.2.3 Work experience in supply chain management and Years of Service in the Company

#### 3.2.4 Number of Direct Reports

#### 3.2.5 Highest Academic Qualifications

## 4. KEY FINDINGS

### 4.1 Areas of Responsibility

#### 4.1.1 Logistics/Distribution Activities and Business Analysis and Planning Activities

#### 4.1.2 Areas of Responsibility – Comparison with Earlier Research

### 4.2 Competencies and Skills for Supply Chain Professionals

#### 4.2.1 Communication and Teamwork Skills

#### 4.2.2 Technology Skills

#### 4.2.3 Initiative and Enterprise Skills

#### 4.2.4 Compliance and Legal Knowledge

#### 4.2.5 Supply Chain Competencies and Small/Medium/Large Enterprises

#### 4.2.6 Supply Chain Competencies and Skills – Comparison with Earlier Research

### 4.3 Supply Chain Technologies

#### 4.3.1 Internally/Externally Focussed Supply Chain Technologies

#### 4.3.2 Technologies used by Small/Medium/Large Enterprises and Supply Chain Stakeholders

#### 4.3.3 Supply Chain Technologies – Comparison with Earlier Research

### 4.4 Supply Chain Performance Measurement

#### 4.4.1 Supply Chain Performance Measurement

#### 4.4.2 Supply Chain Performance Measurement – Comparison with Earlier Research

### 4.5 Future Challenges for Supply Chain

#### 4.5.1 Impact of Environment

#### 4.5.2 Impact of Globalisation

#### 4.5.3 Supply Chain Integration

#### 4.5.4 Supply Chain Training and Development

#### 4.5.5 Impact of Information Technology

#### 4.5.6 Supply Chain Responsiveness/Agility

#### 4.5.7 Future Challenges for Supply Chain and Small/Medium/Large Enterprises

#### 4.5.8 Future Challenges for Supply Chain and Comparison with Earlier Research

## 5. CONCLUSIONS

## 6. REFERENCES

## LIST OF FIGURES

**Figure 1:** Industry Sectors

**Figure 2:** Type of Ownership of Respondent Companies

**Figure 3:** Organisational Size

**Figure 4:** Average Annual Sales (\$million) Over the Period 2004-2007

**Figure 5:** Percentage of sales in different markets (2004-2007)

**Figure 6:** Strategic Position along the Supply Chain

**Figure 7:** Respondent's Position in the Company

**Figure 8:** Reporting Line

**Figure 9:** Years of Service in the Company

**Figure 10:** Work Experience in Supply Chain

**Figure 11:** Number of Employees Directly Supervised

**Figure 12:** Highest Academic Qualification

**Figure 13(a):** Areas of responsibility – Logistics and Distribution Activities

**Figure 13(b):** Areas of responsibility – Analysis and Planning Activities

**Figure 14(a):** Communication and Teamwork Skills

**Figure 14(b):** Technology Skills

**Figure 14(c):** Initiative and Enterprise Skills

**Figure 14(d):** Compliance and Legal Knowledge

**Figure 15(a):** Internally Focussed Supply Chain Technologies

**Figure 15(b):** Externally Focussed Supply Chain Technologies

**Figure 16:** Supply Chain Performance Measurement

**Figure 17(a):** Impact of Environment

**Figure 17(b):** Impact of Globalisation

**Figure 17(c):** Supply Chain Integration

**Figure 17(d):** Supply Chain Training and Development

**Figure 17(e):** Impact of Information Technology

**Figure 17(f):** Supply Chain Responsiveness/Agility

# Executive Summary



## 1.1 INTRODUCTION

This study was conducted by Monash University in collaboration with GS1 Australia, the Supply Chain and Logistics Association of Australia (SCLAA), and Efficient Consumer Response (ECR) Australasia. The aim of this study was to take a snapshot of the Australian industry pertaining to a number of major issues such as: the roles of supply chain managers or personnel, the skills and abilities required for supply chain managers, the level of adoption of e-business in supply chain processes, supply chain performance measurement, and the future challenges of supply chain management. This was achieved by examining the perceptions of Australian supply chain professionals with regard to the above mentioned issues.

## 1.2 SUMMARY OF MAJOR FINDINGS

### The major findings were:

- A large portion (20%) of the respondents reported that they hold a TAFE diploma.
- With regard to areas of responsibility, logistics and distribution activities were given precedence over business analysis and planning activities.
- Soft skills such as communication and teamwork skills were identified by the respondents as the most important skills for supply chain professionals to effectively manage supply chains.
- Intra-company technologies were used more widely by the respondents than inter-company technologies
- Significant differences exist between small and large enterprises in their perception of the competencies and skills required for supply chain professionals.
- Intra-company technologies were used to a greater extent in large organisations as compared to small organisations.
- Key performance measures identified by the respondents were more operational rather than strategic in nature.
- Australian supply chain professionals have not yet fully recognised the strategic importance of supply chain management in the overall success of the network of customers and suppliers
- Recognition that strategic/managerial competencies and skills were of increasing importance for supply chain professionals in the future

- Of the 31 potential challenges listed, none were identified as absolutely critical for supply chain management. However, challenges relating to transportation costs (due to geographical distance and petrol supply/price) were identified by the respondents as having the highest impact on supply chains in the future.
- Related to lean manufacturing concepts, environmental (green) impacts, complexity of global supply chain channels, greater demand on supply chain visibility and real time data, were among other perceived challenges
- Significant differences between small and large organisations in their perception of future challenges for supply chains

## 1.3 CONCLUSION

This study highlights the increasing need to develop the role of supply chain managers into a more strategic function. It also underlines the competencies and skills required for supply chain professionals to remain competitive and equipped to manage the challenges for supply chain in the future.



# Research Methodology

## 2. INTRODUCTION

Supply chain management has emerged as one of the primary factors in determining the competitiveness of business organisations. In today's competitive environment, businesses have realised that the competition is no longer dependent solely on the capabilities of individual businesses but on the capability of a tightly integrated supply chain.

Supply chain management has experienced significant and rapid changes in recent years. These changes are driven by several factors, including business environment, globalisation, technological advances, particularly internet-based systems, and increased demands for performance. These changes require businesses to revisit the roles and responsibilities as well as the skills and competencies of their supply chain professionals (managers or personnel). There is a need to expand the role of the supply chain function in organisations to now include supplier coordination, supplier development, supplier market research, cost analysis, sourcing strategy formulation, benchmarking, make or buy decision, and supplier capability analysis. In essence, businesses must recognise the strategic role of supply chain management and its importance in the ability of businesses to remain competitive, and, therefore, they need to elevate the role of supply chain management from being considered as merely an administrative and operational function to a strategic one.

The emerging issue in supply chain is the use of information and communication technology (ICT) which has increasingly impacted on supply chain management, particularly in the process of collaboration between supply chain partners. ICT has made possible the sharing of large amounts of information along the supply chain which has enabled real-time collaboration and integration between supply chain partners, providing organisations with forward visibility, improving production planning, inventory management and distribution.

The changes in the business environment have also resulted in a significant impact on supply chain management. The rise in fuel costs and the recent pressure (from a market and regulatory perspective) for adopting "green" operations will have major consequences for all businesses along the supply chain. One of the potential effects of this new policy is that it will increase the cost of doing business which will undermine the competitiveness of businesses. This stance will be detrimental to Australian industry since it will lead firms to either close their local operations or relocate to other countries with less pressure on environmental issues.

This study was designed to address the issues raised above. The study was conducted by the Australian Supply Chain Management Research Unit in the Faculty of Business and

Economics at Monash University. It was financially supported by GS1 Australia. Additional support was provided by the Supply Chain and Logistics Association of Australia (SCLAA), and Efficient Consumer Response (ECR) Australasia. The study provides a snapshot of the Australian industry pertaining to the following:

1. The roles of and the skills and capabilities required for supply chain professionals to effectively manage supply chains;
2. The level of adoption of various technologies in supply chain processes;
3. Supply chain performance measurement; and
4. The future challenges of supply chain management.

## 3. RESEARCH METHODOLOGY

The research was conducted by means of a postal questionnaire survey which was developed in consultation with GS1 Australia. The questionnaire was designed based on a number of sources including academic journal articles, public media, and GS1's competencies training curriculum. Prior to the survey, the questionnaire was reviewed by the representatives of GS1 Australia, SCLAA, and ECR as well as a few of the firm's managers, with the intent to assess its readability, clarity, and feasibility. The targeted respondents were supply chain professionals who are members of GS1 Australia, the Supply Chain and Logistics Association of Australia (SCLAA), and Efficient Consumer Response (ECR) Australasia. 921 surveys were mailed out, and 148 responses were received, which constitutes a 16% response rate.

# Research Methodology

## 3.1 COMPANY PROFILE

This section presents details of the sample used in the study, relating to company background information such as the industry sectors sampled, as well as size, sales revenue and strategic position of the respondent companies.

### 3.1.1 INDUSTRY SECTOR

As shown in Figure 1 below, respondents to the survey represented a number of different industry sectors. These can be roughly divided into two groups namely production and services. The largest production group

consists of manufacturing companies, inclusive of food and beverage, accounting for 47% of the sample, while construction and agriculture businesses account for 5% of the sample.

The largest sector making up the non-production or services group is wholesale and retail trade, accounting for 21% of the sample. The remaining sample comprises of medical and healthcare (7%), information technology and telecommunications/electronics (6%) and transport and distribution (5%).

The industry sectors represented in the study sample mirrors the GS1 Australia membership, where approximately 52% are from manufacturing and 31% from wholesale/retail.

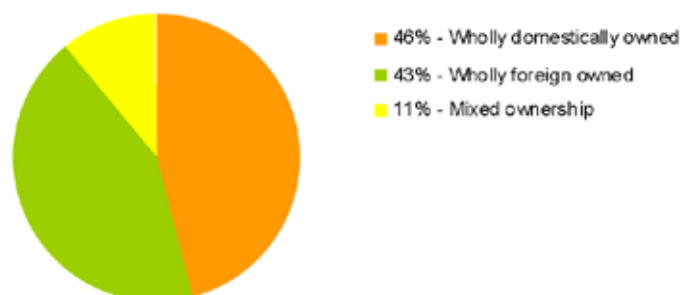
### 3.1.2 OWNERSHIP OF COMPANIES

The respondent companies have been grouped according to their ownership (Figure 2). Of the 148 companies that responded to the survey, almost one-half (46%) are wholly domestically owned and 43% are wholly foreign owned. The remaining 11% of the sample have varying degrees of mixed ownership.

Figure 1: Industry Sectors



Figure 2: Type of Ownership of Respondent Companies



# Research Methodology

### 3.1.3 SIZE OF COMPANIES (NUMBER OF EMPLOYEES)

The distribution of data with respect to the number of people employed in the responding companies (see Figure 3) reveals a roughly even spread across small-, medium- and large-size companies. One-third of the sample is represented by companies employing less than 50 people while another third employs more than 500 people. Within the large-size category, 25% employ more than 1,000 people. Combined, small and medium enterprises (SMEs) make up two-thirds of the sample.

The sample is reflective of the GS1 Australia membership profile where the vast majority of members fall in the SME category.

### 3.1.4 SALES VOLUME AND MARKET COVERAGE

Respondents were asked to indicate their company's average annual sales for the financial period 2004-2007 and the proportion of these sales represented in local, national and international markets. The results are presented in Figures 4 and 5 respectively.

One-half of the respondents reported their average annual sales over this period as less than \$100 million (Figure 4). Of the remaining sample, around an equal proportion reported their average annual sales to be between the range \$100-\$249 million (14%), \$250-\$999 million (14%) and \$1,000 million or more (16%).

As shown in Figure 5, a large proportion of the respondents did not provide a response to the question relating to sales in different markets. Almost one-half (47%) of the respondents indicated low annual sales revenues (20% or less of their total sales) from international markets. By contrast, almost one-third of the respondents indicated that more than 80% of their total annual sales were from national markets. The results presented in Figure 5 suggest limited penetration of international market but considerable national activity. This provides a great opportunity for Australian companies to be engaged globally and ensure long-term survival. The limited international engagement may explain the low level of supply chain activity as discussed later in this report.

Figure 3: Organisational Size

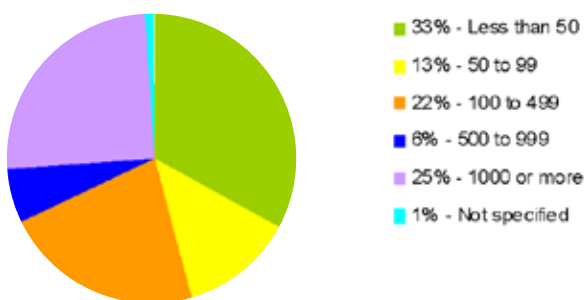


Figure 4: Average Annual Sales (\$million) over the Period 2004-2007

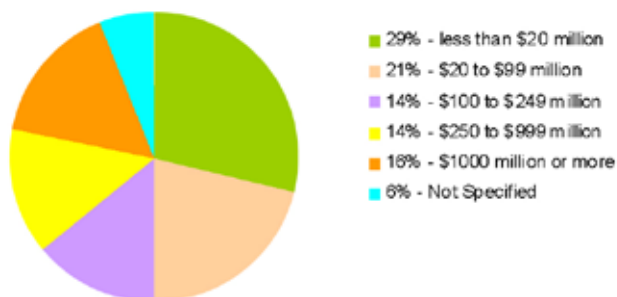
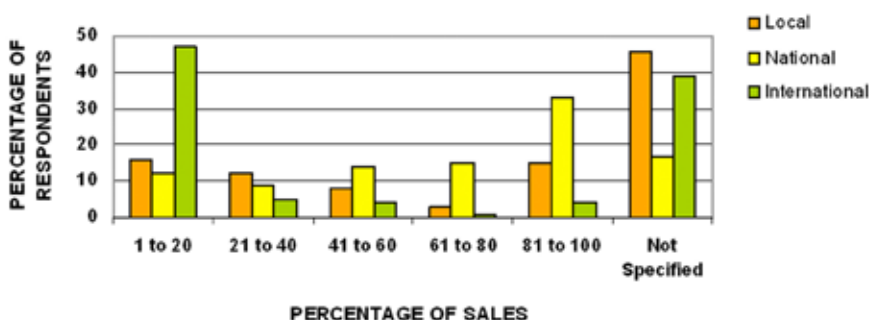


Figure 5: Percentage of Sales in Different Markets (2004-2007)



### 3.1.5 STRATEGIC POSITION OF RESPONDENT COMPANY ALONG THE SUPPLY CHAIN

Figure 6 shows the respondent companies' position along the supply chain. End product manufacturers and their immediate suppliers (first-tier suppliers) account for just over one-half of the sample while wholesalers and distributors account for nearly one-third of the sample. Retailers (7%) and transport/logistics providers (6%) make up the remainder of the sample.

### 3.2.1 RESPONDENTS' POSITION IN THE COMPANY

As shown in Figure 7, just over one-fifth (21%) of the respondents to the survey represented top management (CEO/GM/MD/Supply Chain Director) with the remainder represented by middle management. Almost 60% of the respondents had direct responsibility for supply chain management with 9% holding the position of Supply Chain Director and 49% having the title of Supply Chain Manager.

A significant proportion of the sample was represented by Production/Operation Managers and Quality Managers (12%) and Accounting/Finance and Information System Managers (9%). This provides an appropriate sample for this study with respondents having both knowledge of strategic goals of their companies and understanding of supply chain activities.

### 3.2 RESPONDENT PROFILE

The following section presents findings in relation to the respondent's position in the company, education and employment experience and reporting structure.

Figure 6: Strategic Position along the Supply Chain

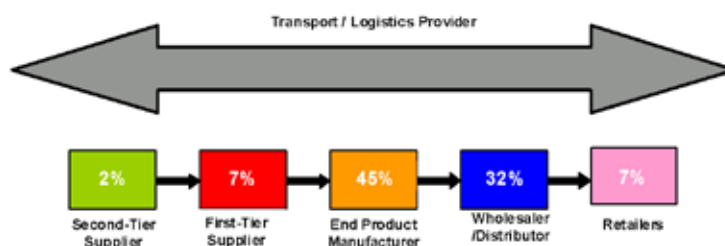


Figure 7: Respondent's Position in the Company



# Research Methodology

## 3.2.2 REPORTING STRUCTURE

As Figure 8 below shows, the majority of the respondents (mostly in middle management – see Figure 7 above) reports directly to the Supply Chain Director (12%) or the Managing Director/General Manager (67%). These results suggest a relatively flat structure. Of the remaining sample, 13% report to Production/Operations Manager. Of the remaining sample, 13% report to Production/Operations Manager.

## 3.2.3 WORK EXPERIENCE IN SUPPLY CHAIN MANAGEMENT AND YEARS OF SERVICE IN THE COMPANY

As shown in Figure 9, almost two-thirds of the respondents indicated that they had been with their current employer for between one and five years. At the other extreme, 8% of the respondents indicated that they had been with their current employer for more than 20 years. The remaining 27% fall in the range between six to 20 years of service with their current employer.

With respect to total experience in supply chain management, the results presented in Figure 10 show that Australia has considerable expertise available locally. Almost one-half of the respondents indicated that they had up to 10 years of work experience in supply chain management with another third indicating that they had between 11 and 20 years work experience. An earlier study (Sohal et al., 2006) showed that Australian supply chain managers and professionals came from a variety of different disciplines, indicating that since supply chain flows across the organisation, a mix of skills contributes to constantly evaluate ways to generate value to the supply chain profession.

Figure 8: Reporting Line

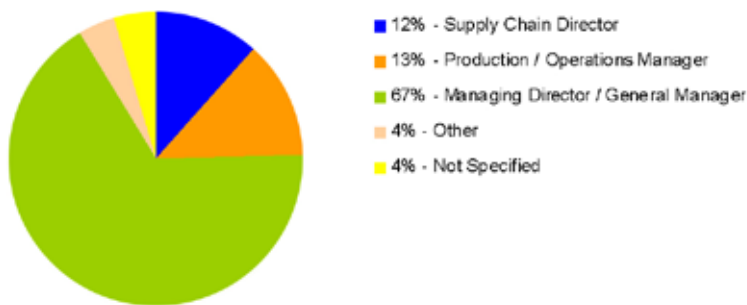


Figure 9: Years of Service in the Company

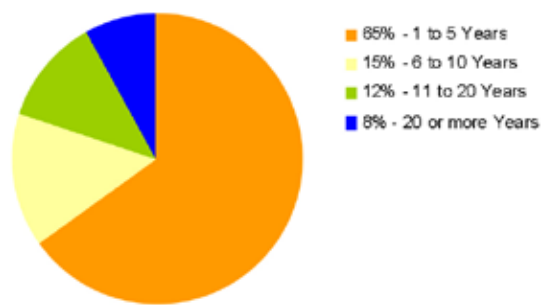
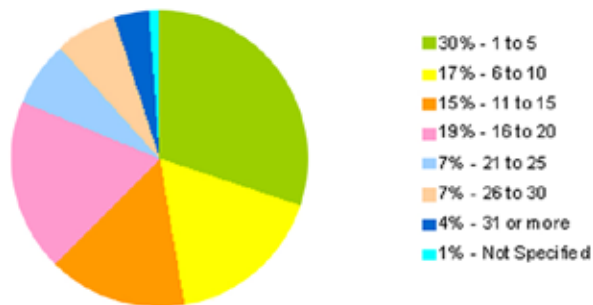


Figure 10: Work Experience in Supply Chain



### 3.2.4 NUMBER OF DIRECT REPORTS

The respondents were asked to indicate how many people they had directly reporting to them. The results, presented in Figure 11, indicate that almost three-quarters of the respondents (71%) have up to 10 employees reporting to them with another 10% indicating that they have between 11 and 19 direct reports. These figures suggest that respondents may have many functional responsibilities and perhaps are responsible for both administrative and operational roles.

### 3.2.5 HIGHEST ACADEMIC QUALIFICATIONS

Figure 12 shows the highest academic qualifications obtained by the respondents. Almost one-half (46%) of the respondents reported that they hold a Bachelor's degree. This figure is slightly higher than that reported in a survey of supply chain professionals conducted in 2005 (Sohal et al., 2006) in which 41% of the respondents reported their highest qualification as a Bachelor's degree.

Another 14% of the respondents reported that they hold a Master's degree. In comparison with the earlier study mentioned above, 26% of the respondents reported holding a post-graduate qualification. It is interesting to note that a large proportion of respondents (20%) reported that they hold a TAFE diploma, suggesting the relevance and extensive usage of such vocational training courses.

A previous survey conducted by D'Netto and Sohal (1999) revealed that 78.8% of production managers had completed a diploma or degree, indicating that several professionals in this area have worked their way up from junior positions, without any specialised formal degree in supply chain.

Figure 11: Number of Employees Directly Supervised

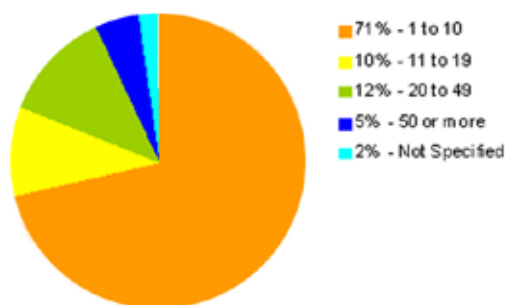
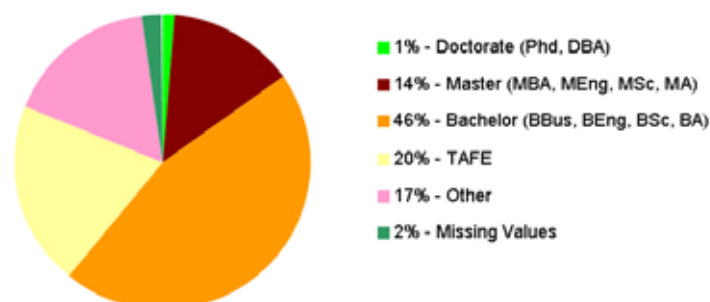


Figure 12: Highest Academic Qualification



# Key Findings



This section of the report presents the results of the current study. All results are presented graphically and each graph depicts mean scores.

## 4.1 AREAS OF RESPONSIBILITY

Respondents to the survey were asked to indicate the extent to which they have responsibility for a number of different areas related to supply chain management. As shown in Figures 13 (a) and (b), responses were provided on a 5-point Likert scale ranging from 1 = "not at all" to 5 = "very large extent". Means were calculated from the responses provided and these are presented in the figures in descending order.

### 4.1.1 LOGISTICS/ DISTRIBUTION ACTIVITIES AND BUSINESS ANALYSIS AND PLANNING ACTIVITIES

The top four areas of responsibility identified relate to what is typically regarded as logistics/ distribution activities. Respondents indicated that they were responsible to a "large extent" for warehousing, inventory control and distribution (see Figure 13(a)).

Supply Chain / Business analysis and planning activities such as quality management (including control and improvement) and production planning and scheduling were identified as important areas of responsibility within the supply chain from an organisational, tactical perspective (Figure 13(b)).

Figure 13(a): Areas of Responsibility - Logistics and Distribution Activities

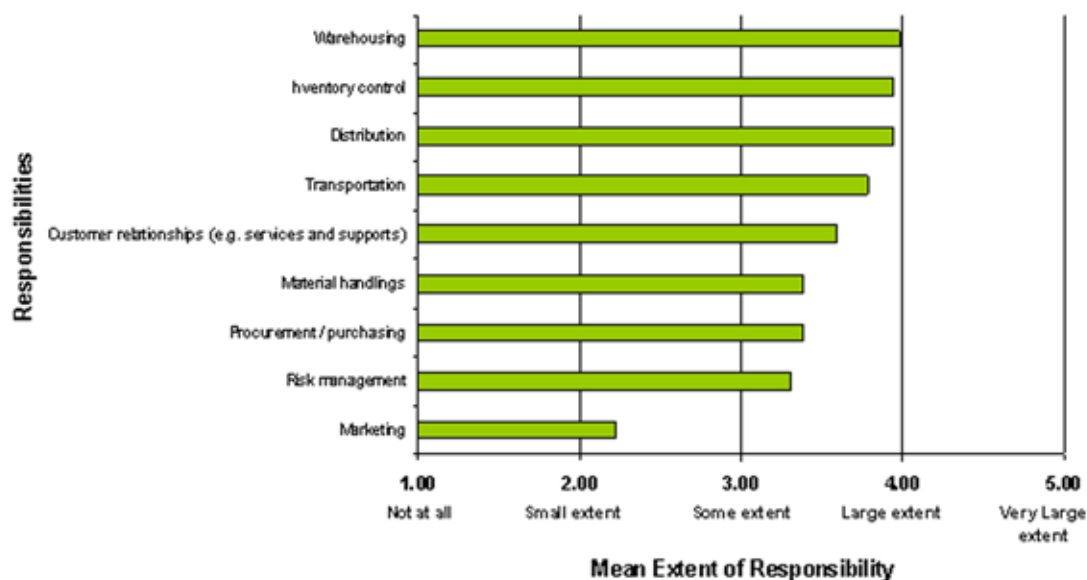


Figure 13(b): Areas of Responsibility -Analysis and Planning Activities

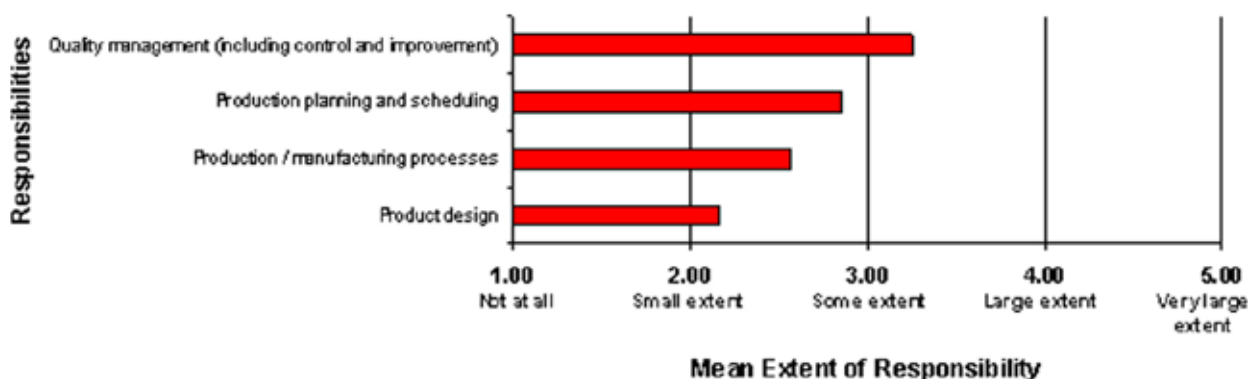


Figure 14(a): Communication and Teamwork Skills

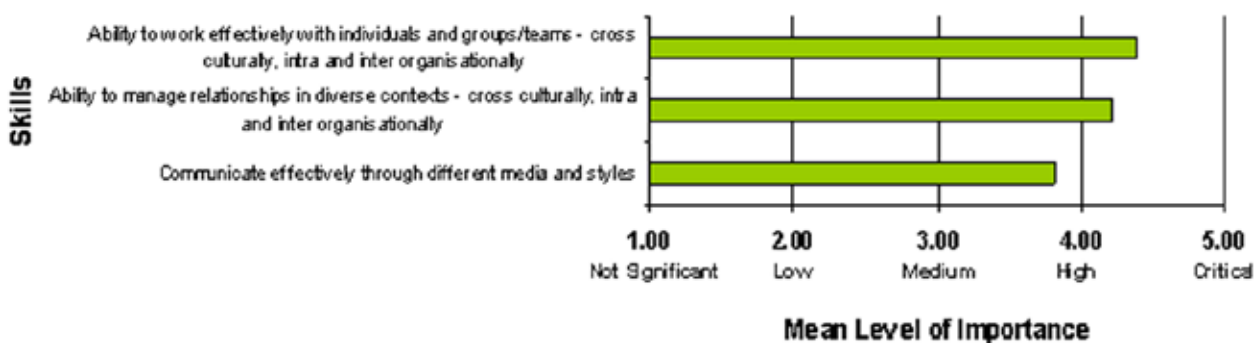
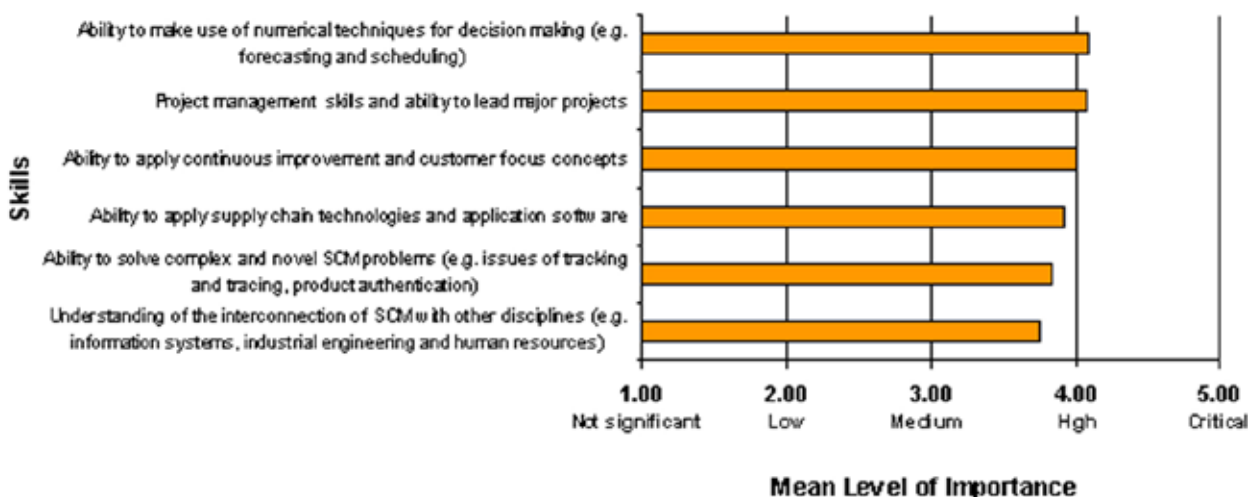


Figure 14(b): Technology Skills



# Key Findings

## 4.1.2 AREAS OF RESPONSIBILITY – COMPARISON WITH EARLIER RESEARCH

Inventory control and warehousing continue to be a key focus in modern supply chains as they are critical to the success or failure of many supply chains. A study of international supply chains by Baker (2007) indicated that inventory is used as a strategy to minimise supply chain risks, in order to manage transportation delays and random demand variations. It is important to analyse inventory reduction strategies and risks associated with different supply chain strategies, in order to recognise the trade-offs between inventory and other supply chain elements such as purchasing, manufacturing and transport. Based on this, the role of warehouses in supply chain may include a mix of elements such as inventory holding, order consolidation, cross-docking and postponement activities.

## 4.2 COMPETENCIES AND SKILLS FOR SUPPLY CHAIN PROFESSIONALS

The competencies and skills examined below are primarily based on the GS1 Australia's skills requirements matrix for supply chain management. This was developed by a consortium of academic and industry partners under the GS1 Australia Supply Chain Management Futures Forum.

In this section, respondents were asked to indicate the level of importance of a number of different skills and competencies for managing supply chain activities. Responses were presented on a 5-point Likert scale where 1 = "not significant" and 5 = "critical".

### 4.2.1 COMMUNICATION AND TEAMWORK SKILLS

Figure 14(a) shows the means calculated for the three different soft skills included in the survey for managing supply chain activities. The ability to work effectively with individuals and groups/teams – cross culturally, intra and inter organisationally was considered the most important communication and team work skill with a mean score of 4.39, followed by the ability to manage relationships in diverse contexts – cross culturally, intra and inter organisationally (4.23 mean score).

These skills were identified as the most important and demonstrate the respondents' perception of the requirements for the successful integration of different businesses along the supply chain, both domestically and globally.

### 4.2.2 TECHNOLOGY SKILLS

The respondents conferred a "high" degree of importance to technology skills such as the ability to make use of numerical techniques for decision making (e.g. forecasting and scheduling) and project management skills and ability to lead major projects with mean scores of 4.10 and 4.09 respectively. Other skills such as the ability to solve complex and novel SCM problems (e.g. issues of tracking and tracing, product authentication) and understanding of the interconnection of SCM with other disciplines (e.g. information systems, industrial engineering and human resources) were given medium to high weightage (Figure 14(b)).

The results suggest that supply chain professionals require knowledge of a broad range of technologies. Without this knowledge they are unlikely to achieve a high level of integration along the supply chain.



### 4.2.3 INITIATIVE AND ENTERPRISE SKILLS

In the initiative and enterprise skill category, respondents identified the ability to manage risks in supply chain and their associated issues as the most important skill with a mean score of 4.11 (Figure 14 (c)). Other skills such as the ability to manage change within the local context and the ability to develop and implement long term business strategies were considered to be of high importance with mean scores of 4.00 and 3.93 respectively. Advancing SCM knowledge through professional engagement was assigned a medium level of importance. A similar finding was brought to light in a survey conducted by McKinsey (2008), wherein executives in operational roles perceived a higher increase in the degree of supply chain risk over the past five years, indicating the rising challenges in supply chain management due to a number of factors discussed previously (see the Introduction section).

Based on current thinking in supply chain management, these figures suggest that Australian supply chain professionals have not yet fully recognised the strategic importance of supply chain management in the overall success of the network of customers and suppliers.

### 4.2.4 COMPLIANCE AND LEGAL KNOWLEDGE

As shown in Figure 14(d), the respondents conferred a medium level of importance to the understanding of contractual and legal / regulatory aspects of the business, the awareness of ethical issues at the national and international level and the respect for diversity, social justice principles, the environment and corporate governance with mean scores ranging from 3.51 to 3.77.

In many organisations these activities are the responsibility of specialists with a legal background and may explain the lower response obtained in this survey. However, we believe that supply chain professionals of the future should be reasonably conversant in this area.

### 4.2.5 SUPPLY CHAIN COMPETENCIES AND SMALL/MEDIUM/LARGE ENTERPRISES

A comparative analysis of the competencies and skills for supply chain professionals across small, medium and large enterprises indicate significant differences between small and large enterprises with regard to the importance of a few competencies. They include:

1. Understanding of the interconnection of SCM with other disciplines (e.g. information systems, industrial engineering and human resources) with mean scores of 3.55 and 4.03 for small and large businesses respectively.
2. Ability to manage change within the local context (mean scores of 3.74 and 4.28 for small and large businesses respectively).
3. Ability to develop and implement long-term business strategies (mean scores of 3.62 and 4.18 for small and large businesses respectively).
4. Ability to apply continuous improvement and customer focus concepts (mean scores of 3.79 and 4.13 for small and large businesses respectively).

# Key Findings

Figure 14(c): Initiative and Enterprise Skills

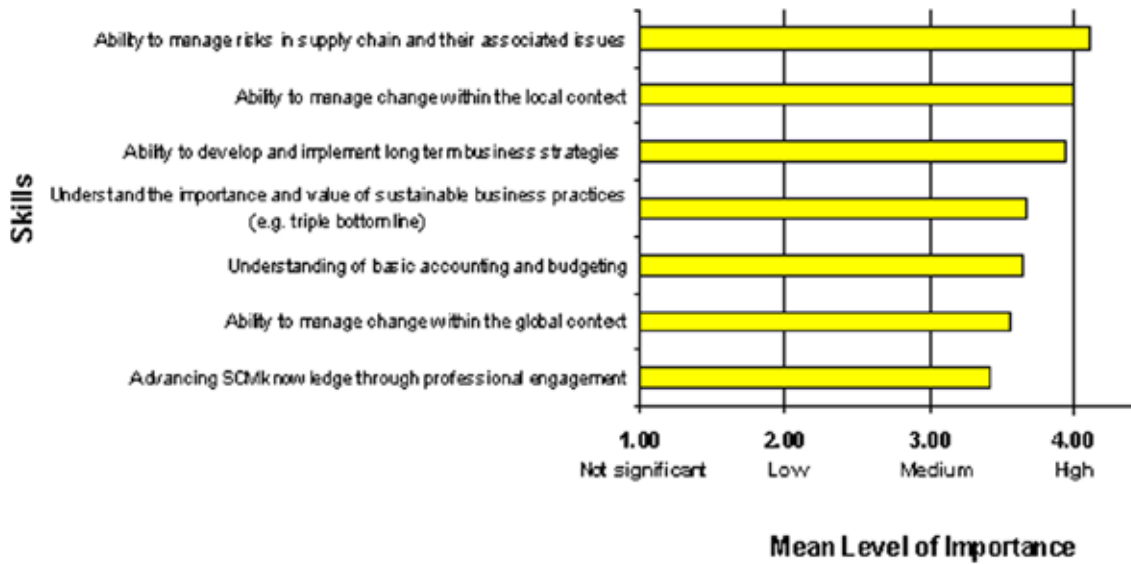
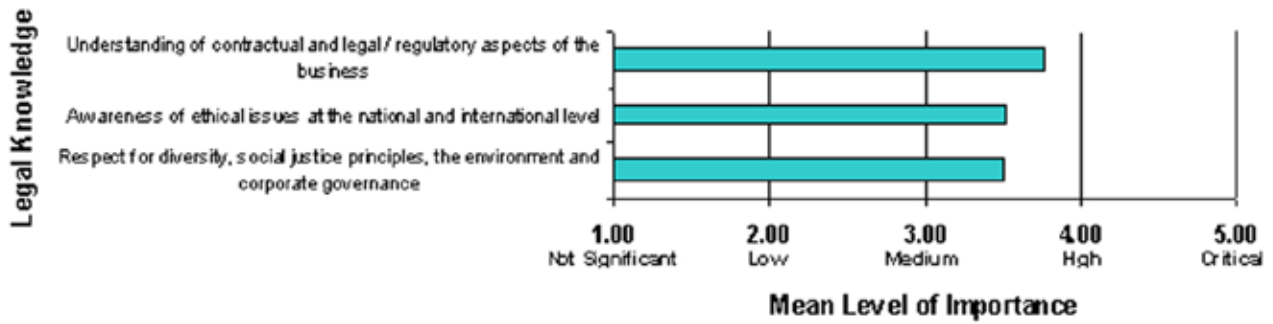


Figure 14(d): Compliance and Legal Knowledge



#### 4.2.6 SUPPLY CHAIN COMPETENCIES AND SKILLS – COMPARISON WITH EARLIER STUDIES

These results tie in with the literature on the skills and competency requirements for supply chain professionals conducted by Murphy and Poist (1994, 1998). The authors proposed that senior-level logisticians required three kinds of skills, namely business skills, logistics skills and management skills. The findings of their survey of executive search firms, logistics practitioners and logistic educators indicated that management skills were the most important, followed by logistics skills and business skills.

Gammelgaard and Larson's (2001) research added another layer into the skill requirements of logistics professionals. They put forward a three-factor model of SCM skill areas for SCM practitioners, namely interpersonal/managerial basic skills, quantitative/technological skills and SCM core skills. In addition, they also emphasised that logisticians need to possess good communications skills, to be able to communicate across functions and organisations in order to promote and coordinate SCM, as well as to manage the upward and downward communication within the organisation. It is noteworthy that good management skills appear to be of critical importance for supply chain professionals.

Another contribution in this area was the study conducted by Mangan and Christopher (2005), who adopted a triangular research approach to attain the views of three different stakeholders namely providers of education and training, students, participants on programmes and corporates that purchase these programmes, to determine the competencies/skills and key knowledge areas required by logistics and supply chain managers. The key competencies and skills that emerged from the research were analytical, interpersonal, leadership, change management and project management.

Changes in business environment, increased globalisation, outsourcing and technological advances have necessitated the evolution of supply chain management professionals from an administrative function to a strategic one. Giunipero and Percy's (2000) study, conducted in the US, illustrated critical skills required of supply chain professionals. The five most important skills identified were interpersonal communication, ability to make decisions, ability to work in teams, negotiations and customer focus.

A subsequent research on large US-based businesses conducted by Giunipero et al. (2006) demonstrated the progression towards a strategic skill set in supply chain management. The authors recognised five skill areas namely team building skills, strategic planning skills, communication skills, technical skills and broader financial skills. This corroborates the current research findings on the competencies and skills for supply chain professionals in Australia.

In summary, the above literature validates the findings of our study that strategic/managerial competencies and skills are of increasing importance for supply chain professionals in the future.

# Key Findings

## 4.3 SUPPLY CHAIN TECHNOLOGIES

The technologies analysed below encompass a broad range of technologies available to supply chain management. The respondents were asked to report on the usage of a number of internally focussed and externally focussed supply chain technologies in their company. Responses were provided on a 5-point Likert scale ranging from 1 = "not at all" to 5 = "very large extent". The results are presented in Figures 15 (a) and 15 (b).

### 4.3.1 INTERNALLY/ EXTERNALLY FOCUSED SUPPLY CHAIN TECHNOLOGIES

The major technologies that were used to "some extent" are primarily internally focussed technologies and include warehouse management system, data capture systems (e.g., bar code scanning) and enterprise resource planning (ERP) with mean scores of 3.47, 3.27 and 3.14 respectively (see Figure 15(a)). These findings are quite surprising given the fact that data capture is at the heart of any technologically based supply chain integration initiative. In the externally focussed technology category, electronic data interchange (EDI)/eMessaging was reportedly used to "some extent" with a mean score of 3.40 (see Figure 15 (b)).

In contrast, mean scores for technologies like global positioning system, radio frequency identification (RFID), online reverse auction/e-auction, online bidding/tendering and public e-marketplaces (e.g., global healthcare exchange) were very low, indicating low adoption of these technologies.

### 4.3.2 TECHNOLOGIES USED BY SMALL/ MEDIUM/LARGE ENTERPRISES AND SUPPLY CHAIN ENTITIES

A further level of analysis reveals that there are significant differences across small, medium and large enterprises in their adoption of supply chain technologies. Technologies such as enterprise resource planning (ERP), advance planning and optimisation (APO), data capture systems (e.g., bar code scanning) and warehouse management system are used to a greater extent in large organisations as compared to small organisations. Similarly there are significant differences between medium and large organisations in their usage of technologies such as online reverse auction/eAuction and advanced planning and optimisation.

Drilling down further reveals a significant difference in the usage of scan packing applications between end product manufacturers and downstream entities with mean scores of 2.40 and 3.15 respectively.

Figure 15(a): Internally focused Supply Chain Technologies

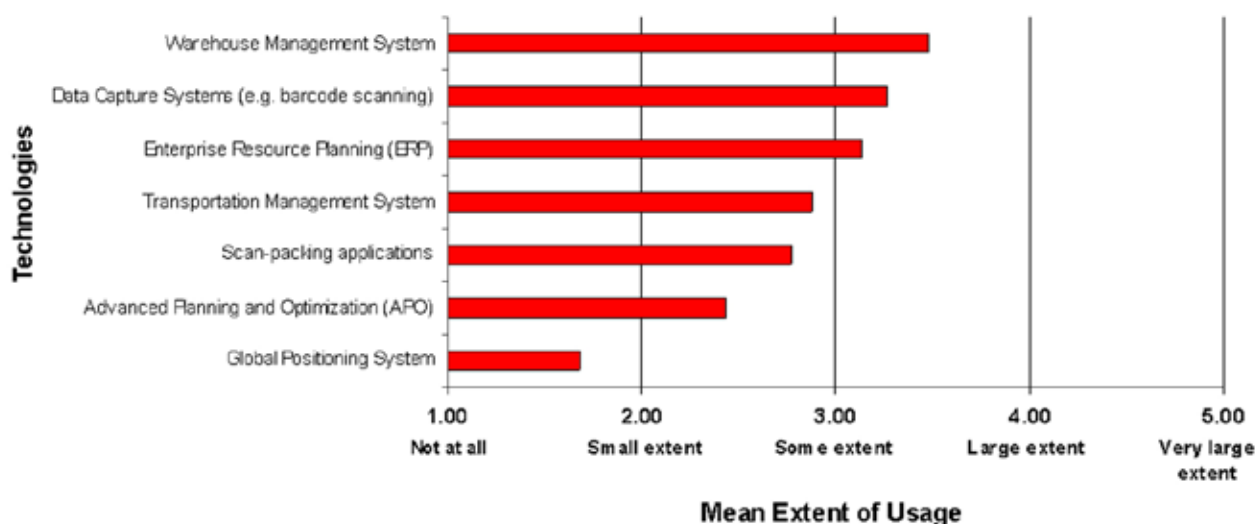
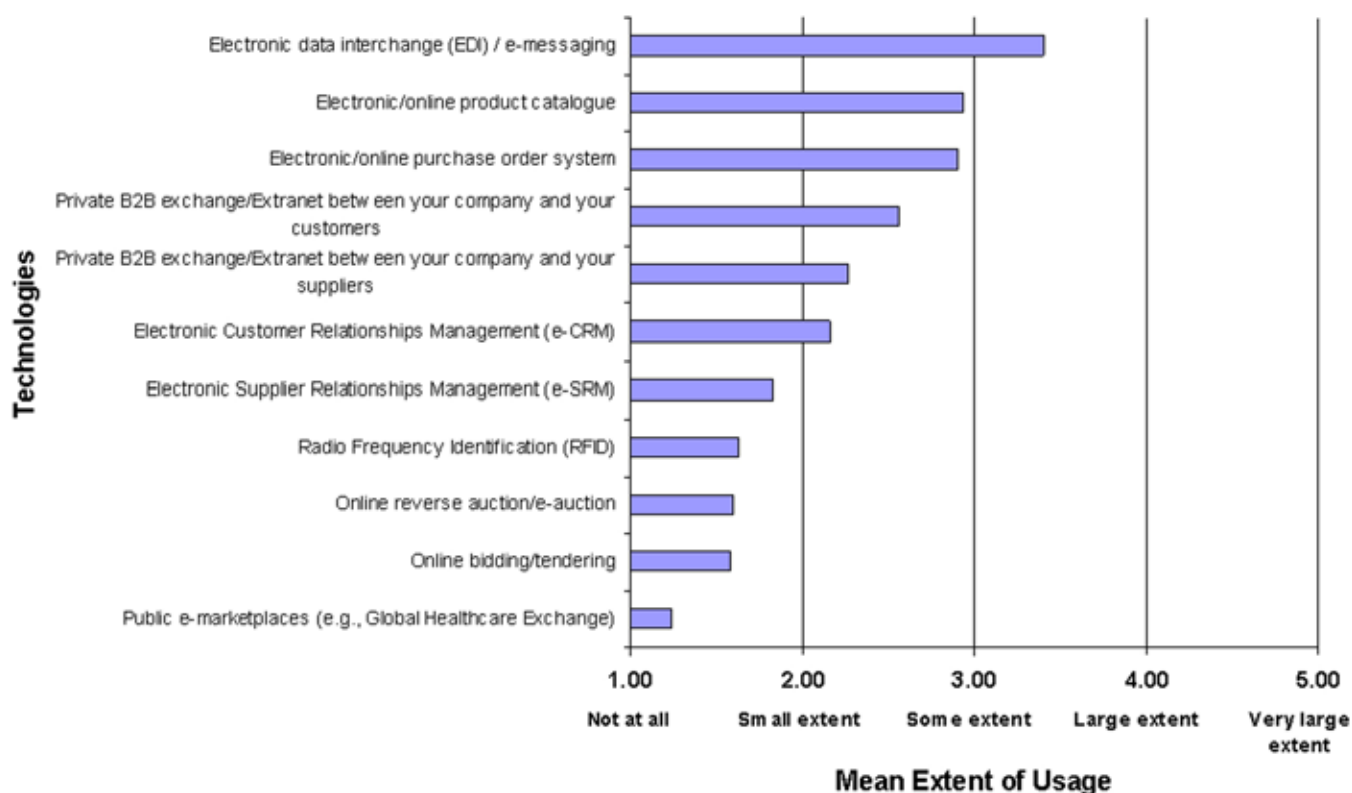


Figure 15(b): Externally Focused Supply Chain Technologies



### 4.3.3 SUPPLY CHAIN TECHNOLOGIES – COMPARISON WITH EARLIER RESEARCH

A noticeable shift can be observed in supply chains, as the “build-to-order” model replaces the “build-to-forecast” method. Supply chain management of the former is more critical as it involves close communication between the various agencies in the chain and the ability to respond accordingly. The adoption of supply chain technologies like enterprise resource planning (ERP), extranets, and B2B markets, to name a few, enable companies to improve their operations and effectively integrate the various links of the chain (Dawson, 2002). Recent years have

witnessed a tremendous growth in supply chain management softwares like warehouse management, transportation management systems and supply chain planning and execution. The use of third-party software systems, collaborative technology and the use of expert systems are some of the emerging trends (Green 2001).

Technologies like electronic data interchange (EDI) are used by businesses as a tool for efficient replenishment and improved coordination with suppliers rather than for integrating supply chains (Hill and Scudder, 2002). However, since EDI is expensive and can restrict the exchanged information, the retail sector, for example, is moving towards new ways of information exchange like electronic marketplaces (Sparks and Wagner, 2003).

A study of suppliers-retailers in Taiwan suggested that the existing relationships between partners either enable or constrain the positive effect of IT on interorganisational collaborations. It is essential for managers to understand that a socio-technical approach is required for successful supply chain collaborations (Chae et al., 2005).

# Key Findings

## 4.4 SUPPLY CHAIN PERFORMANCE MEASUREMENT

The performance measures examined in this section represent a broad range of quantitative and qualitative measures. Respondents were asked to indicate the importance of a number of supply chain performance metrics in the operations of their company. The responses were presented on a 5-point Likert scale ranging from 1= 'not important' to 5 = 'critical'.

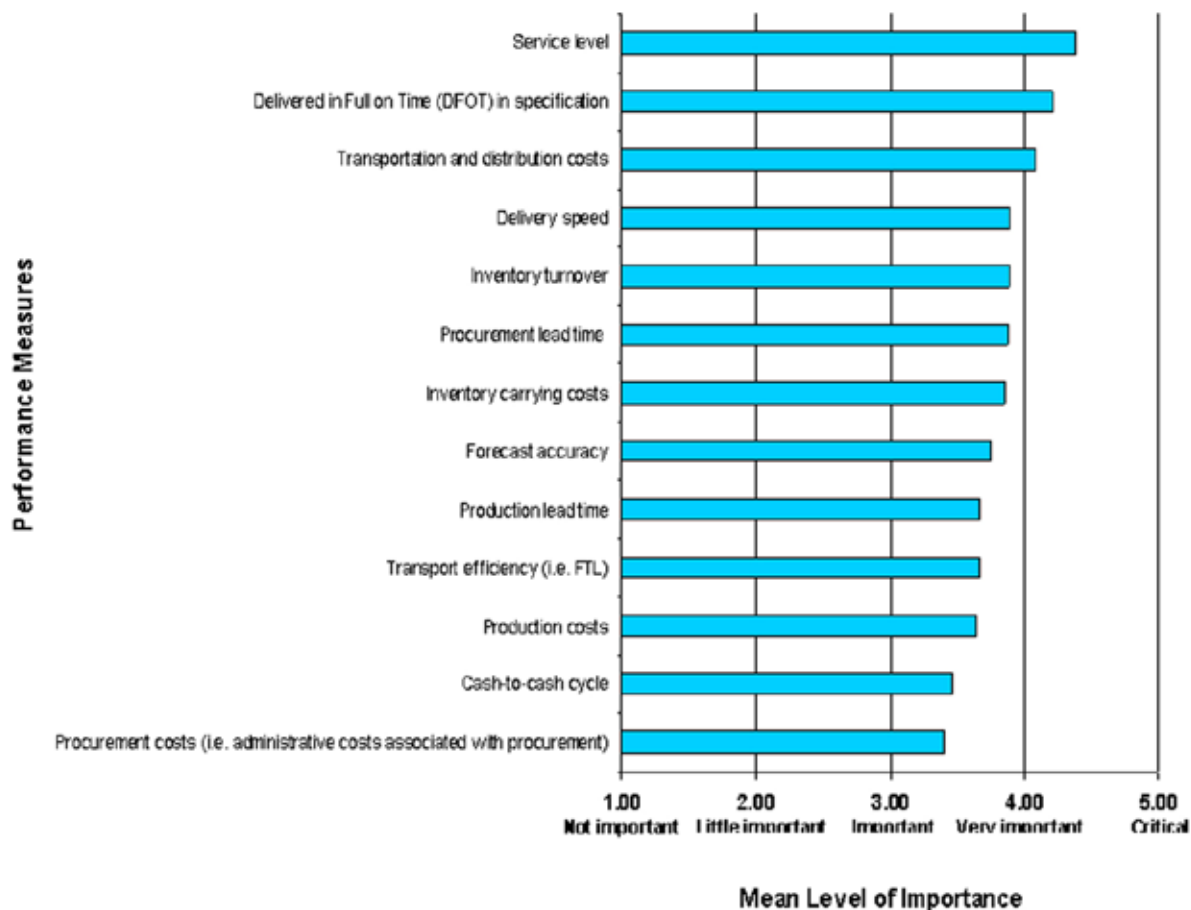
### 4.4.1 SUPPLY CHAIN PERFORMANCE MEASURES

As illustrated in Figure 16, the key performance metrics identified by the respondents are more operational rather than strategic in nature. This, according to Lambert and Pohlen (2001), is largely due to a disconnect between the strategies of an organisation and supply chain, as a result of which managers are driven by operational measures. Performance measures that are identified as "very important" and which are customer focused include:

- service level (mean score 4.38)
- delivered in full on time (DIFOT) in specification (mean score 4.21)
- transportation and distribution costs (mean score 4.08)

Likewise measures such as delivery speed, inventory turnover and procurement lead time are considered important with an average mean of 3.89. In contrast performance measures such as cash-to-cash cycle and procurement costs are given lesser importance.

Figure 16: Supply Chain Performance Measurement



#### 4.4.2 SUPPLY CHAIN PERFORMANCE MEASUREMENT – COMPARISON WITH EARLIER RESEARCH

Due to the complexity of supply chain, it often becomes difficult to collate and categorise metrics for evaluating the supply chain performance (Shepherd and Gunter, 2006). Previous research has grouped supply chain performance measures based on different criteria such as a) quantitative and qualitative measures like resources, output and flexibility as identified by Beamon (1999), b) cost and non-cost measures and c) their strategic, tactical and operational focus (Gunasekaran et al., 2001). In yet another study, supply chain performance is measured by five dimensions namely reliability, responsiveness, flexibility, cost and efficiency indicators (Stephens, 2001).

At the other end of the spectrum lie criticisms against the performance measurement systems in supply chain management, for reasons such as its lack of connection with the strategic goals of the organisation, its focus on cost as a primary measure (Beamon, 1999), a lack of a balanced approach between financial and non-financial measures, a lack of system thinking and loss of supply chain context (Chan, 2003).

It is essential for both managers and employees to take custody of and be actively involved in the design of a simpler and more effective performance measurement system. It is also important to realise that not every measure can be a Key Performance Measure. A combination of strategic performance measurements, managerial performance measurements and operational performance measurements is needed and should be linked to shareholders'

and customers' expectations. The future of performance measurement in supply chain needs to deliberate certain areas of change such as the shift of economic hub for world manufacturing and trade to non-western parts of the world, which in turn will require measuring of cultural interactions in supply networks. Secondly the ability to monitor and predict changes in the world's climate and its impact on both local and international trade will require different types of performance measurement in the future. Lastly, rising price levels due to declining reserves of fossil fuels will require organisations to address aggregate supply network costs through a comparison of financial performance measurement and agreement on measurement standards across organisations (Morgan 2007).

# Key Findings

## 4.5 FUTURE CHALLENGES FOR SUPPLY CHAINS

In this section, respondents were asked to assess the level of future challenges for supply chains over the next three to five years. A total of 31 potential challenges were listed in the questionnaire. The responses were presented on a 5-point Likert scale ranging from 1 = "None" to 5 = "Critical". The results are presented under six major headings namely environment, globalisation, supply chain integration, training and development, information technology and supply chain responsiveness on the future of supply chain. None of the challenges were identified as absolutely critical for the future.

### 4.5.1 IMPACT OF ENVIRONMENT

As shown in Figure 17 (a), transportation costs (due to geographical distance and petrol supply/price) is identified by the respondents to have the highest impact on supply chains in the future with a mean score of 4.28. A similar finding was highlighted in a recent survey conducted by McKinsey (2008), wherein senior executives from around the globe credited the rising prices of energy to have an important impact on their supply chain strategies.

Other environmental issues relating to the management of scarce resources, such as lean concepts in supply chain, environmental (green) impact of products and processes and limited natural resources are perceived by the respondents to have medium degrees of impact with mean scores of 3.67, 3.65 and 3.47 respectively.

### 4.5.2 IMPACT OF GLOBALISATION

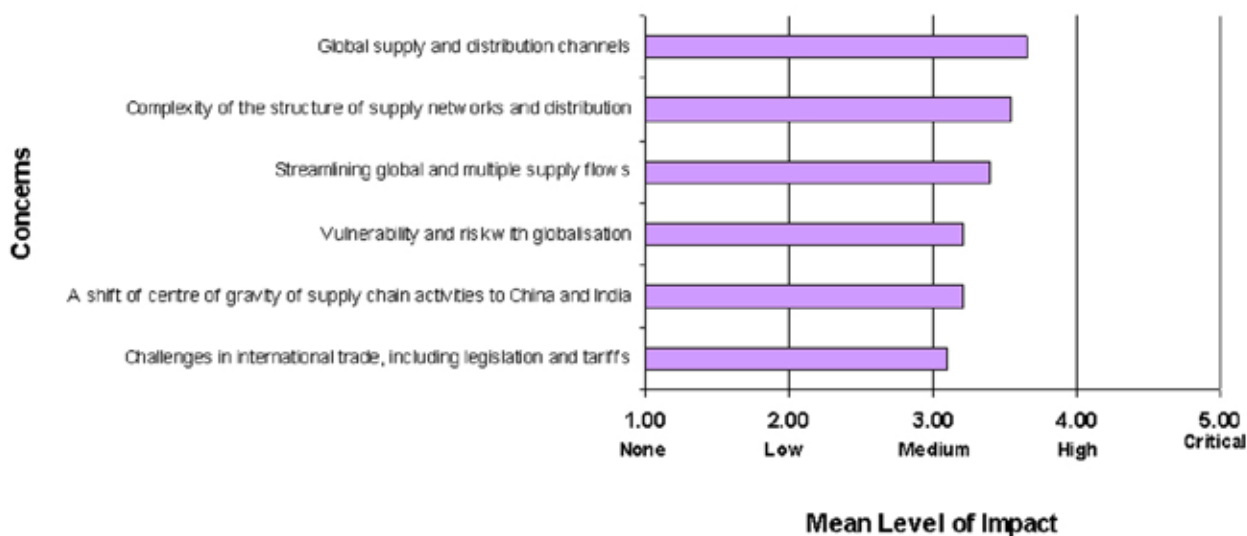
Effects of globalisation such as global supply and distribution channels and complexity of the structure of supply networks and distribution are identified by the respondents to have a medium to high degree of impact on supply chains in the future. In contrast, effects such as a shift of centre of gravity of supply chain activities to China and India and challenges in international trade, including legislation and tariffs are recognised to have a medium level of impact on supply chains with an average mean of 3.16 (Figure 17 (b)).



Figure 17 (a): Impact of Environment



Figure 17 (b): Impact of Globalisation



# Key Findings

## 4.5.3 SUPPLY CHAIN INTEGRATION

Challenges relating to greater visibility requirements of supply chain and integrating processes with supply chain partners are identified to have a medium to high impact on the future of supply chains, with mean scores of 3.86 and 3.74 respectively (Figure 17(c)). The low usage of various supply chain technologies indicate that supply chain professionals may not have yet fully recognised the major challenges of integration.

In contrast, shift in outsourcing supply chain activities from 3PL to 4PL was identified as having the lowest level of impact amongst all the challenges listed in the survey.

## 4.5.4 SUPPLY CHAIN TRAINING AND DEVELOPMENT

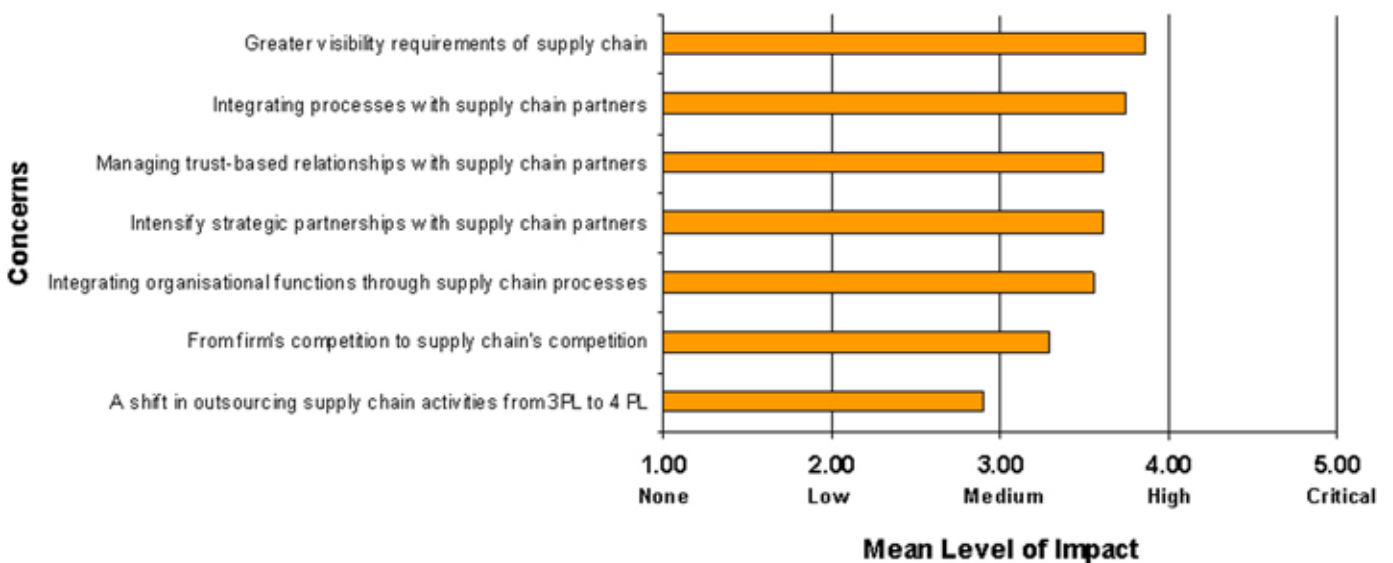
Supply chain management has become very complex due to a number of challenges that affect business in general. The respondents to this survey perceived supply chain education, training and careers development and skills shortage and aging population as two areas to have a medium degree of impact on supply chains in the future, with mean scores of 3.67 and 3.52 respectively (Figure 17 (d)).

This is further validated by a recent study (McKinsey, 2008), wherein senior executives from around the global identified the difficulty of attracting and retaining talent as a key challenge in managing supply chain talent globally.

## 4.5.5 IMPACT OF INFORMATION TECHNOLOGY

Respondents identified information technologies such as real-time operating data to reduce time and cost and technological adoptive capabilities to have a medium to high level of impact on supply chains in the future with mean scores of 3.84 and 3.50 respectively (Figure 17 (e)). These results indicate that the strategic benefits of information and communication technologies may not be fully recognised.

Figure 17 (c): Supply Chain Integration



## 4.5.6 SUPPLY CHAIN RESPONSIVENESS/AGILITY

An agile supply chain is required for companies to stand above their competitors. As shown in Figure 17 (f), top areas of concern identified by the respondents to have a medium impact on supply chains in the future related to measuring supply chain performance (qualitative and quantitative metrics), responsiveness and agility to fragmentation and variety of customer's needs and lead time compression (end-to-end supply chain pipeline) with an average mean of 3.76.

Figure 17 (d): Supply Chain Training and Development

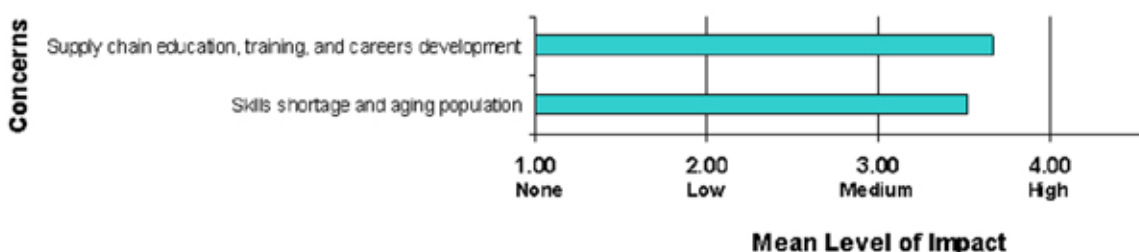


Figure 17 (e): Impact of Information Technology

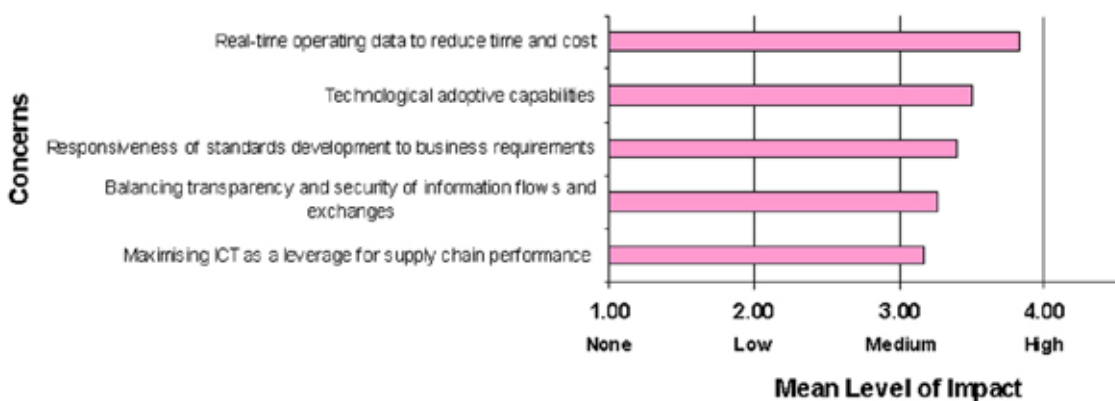
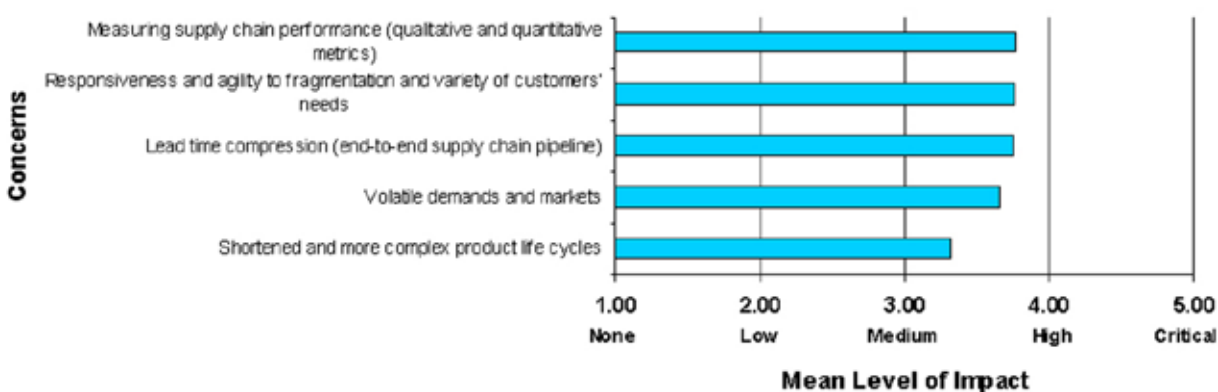


Figure 17 (f): Supply Chain Responsiveness/Agility



# Key Findings

## 4.5.7 FUTURE CHALLENGES FOR SUPPLY CHAINS VS SMALL/MEDIUM/LARGE ENTERPRISES

Another level of analysis reveals that there are significant differences between small and large organisations in their perception of future challenges for supply chains. Concerns related to closed-loop supply chain, integrating organisational functions through supply chain processes, greater visibility requirements of supply chain and skills shortage and aging population were identified by large organisations to have a significantly higher impact on the future of supply chains as compared to small organisations.

Similarly there were noticeable differences between wholly domestically owned and wholly foreign owned companies in their perception of future challenges for supply chains, especially with regard to global supply and distribution channels and volatile demands and markets.

## 4.5.8 FUTURE CHALLENGES FOR SUPPLY CHAINS – COMPARISON WITH EARLIER RESEARCH

A study conducted in 1995 by Gilmour et al. revealed that logistics managers in Australia perceived two main areas, namely: 1) The impact of technology on supply chain activities and relationships and 2) the impact of environmental regulations and requirements as two key future concerns for logistics management. Other areas such as global orientation and interorganisational relationships were given lesser weightage. However, today the domain of concern has moved away from the internal operations of logistics and now focuses on the importance of strategic potential of logistics.

As businesses continue to operate in a global economic environment, pursue outsourcing and expand their international operations, Ballou (2007) envisaged major challenges that are likely to confront SCM in the future. He advised that a cost reduction strategy will be as important as a revenue generation strategy for the supply chain, to reduce costs and increase efficiency. Furthermore cross-boundary management will assume paramount importance since the supply chain is composed of multiple and vertically related but legally separate businesses. He also believed that supply chain education and training will need to incorporate additional managerial aspects like skills in psychology and organisational behaviour, in order to operate in the supply chain environment.

Intense global competition forces companies to focus on their core competencies, competition in the future will not be between individual companies but between competing supply chains. Businesses will have to be highly professional and reactive in order to stand above their competitors. As a result of dwindling natural resources and increasing pollution levels, there will be an increasing need for technology to assist in curtailing energy consumption and produce environmentally friendly products. In addition, maintaining a dynamic and collaborative relationship with partners will be some of the challenges for the management of supply chains for the future (Jain and Benyoucef 2008).



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# Conclusions



The results of this study highlight that supply chain professionals in Australia are focussed, for the larger part, on logistics and distribution-related activities. However, to stay ahead of the competition, the role of supply chain professionals need to progress from administration to strategic function.

Key competencies and skills perceived by supply chain professionals for the successful integration of different businesses along the supply chain are communication and teamwork skills. The results also suggest that supply chain professionals require knowledge of a broad range of technologies, both intra-company and inter-company technologies, to realise the strategic importance of supply chain management in the long-term success of organisations. In addition, respondents identified operational performance measures as more important than strategic performance measures which could be because of a lack of linkage between organisational strategies and supply chain strategies.

Finally, the results on future challenges for supply chain indicate that environmental issues relating to the management of scarce resources have a significant impact on supply chain strategies. Supply chain professionals will need to possess a diverse set of skills to tackle the varied perceived challenges expected in the future.



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## Australia

Head Office  
Axxess Corporate Park  
Unit 100/45 Gilby Rd  
Mt Waverley VIC 3149  
Locked Bag 2  
Mt Waverley VIC 3149  
T +61 3 9558 9559  
F +61 3 9558 9551

---

Sydney Office  
Lakes Business Park  
Building 4B, 2-4 Lord St  
Botany NSW 2019  
Locked Bag 7002  
Botany NSW 1455  
T +61 2 9700 0933  
F +61 2 9700 0820

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National Number: 1300 366 033  
ABN: 67 005 529 920

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