European Research Studies Journal
Volume XXV, Issue 2B, 2022

pp. 184-193

The Influence of Managerial, Digital, Relational and Behavioural Skills on the Perception of Barriers and Drivers of Implementing Digital Intelligent and Sustainable Logistics

Submitted 12/05/22, 1st revision 23/06/22, 2nd revision 12/07/22, accepted 30/07/22

T. Bartosz Kalinowski[1], Marta Raźniewska[2], Jakub Brzeziński[3], Michal Adamczak[4]

Abstract:

Purpose: *The purpose of the paper is to investigate the influence of different skills (managerial, digital, relational, behavioural) on the perception of barriers and drivers of implementing Digital Intelligent and Sustainable Logistics (DISL) in companies.*
Design/Methodology/Approach: *To determine the impact of the level of skills on the perception of barriers and drivers of implementation of DISL, a survey was carried out among randomly selected logistics and production companies operating in Poland. Further, to test the research model and proposed hypothesis, this study applies Partial Least Squares Path Modelling (PLS), a variance-based structural equation modelling technique (SEM).*
Findings: *The results of the conducted research allow us to conclude that there is a statistically significant relationship between the identified level of skills in a company and the perception of the significance level of barriers and drivers of DISL implementation (higher level of behavioural skills causes a stronger perception of barriers and drivers).*
Practical Implications: *The findings can be used in decision making process on developing different skills in order to improve the perception of barriers and drivers and further support the implementation of DISL related solution in companies.*
Originality/Value: *The paper contributes to the newest trends in literature on supply chain management (covering digitalization and smart and sustainable logistics) and specifically highlights the relation of skills with barriers and drivers on the implementation of DISL.*

Keywords: *Skills, barriers, drivers, Digital Intelligent and Sustainable Logistics (DISL), PLS.*

JEL codes: *J24, R40, M10, M11, M12.*

Paper Type: *Research paper.*

Acknowledgement: *The research presented in this paper was performed as a result of the NEXTLOG project (supported by the EU Erasmus + Programme 2019-1-PL01-KA203-065731).*

[1]*University of Lodz, Poland, ORCID: 0000-0001-6713-9574, tbkalinowski@uni.lodz.pl;*
[2]*University of Lodz, Poland, ORCID: 0000-0002-2438-7137, marta.razniewska@uni.lodz.pl;*
[3]*University of Lodz, Poland, ORCID: 0000-0001-5353-8777, jakub.brzezinski@uni.lodz.pl;*
[4]*Poznan School of Logistics, Poland, ORCID: 0000-0003-4183-7264, michal.adamczak@wsl.com.pl;*

1. Introduction

In recent years the logistics market experienced rapid development and has been subject to substantive pressures and changes. Digital transformation of supply chains (Burroughs and Burroughs, 2020), rising complexity of transportation routes, uncertainties in collection and delivery times (Sanchez-Rodrigues *et al.,* 2010), growing interest in Industry 4.0, specifically autonomous logistics, self-organising logistics, intelligent transportation systems, intelligent integration of external and internal transportation, deep learning approach towards inventory optimisation and demand forecasting processes (Fan *et al.,* 2020; Ren *et al.,* 2020) emerged into intelligent (smart) supply chains (Liu *et al.,* 2021).

Furthermore, due to resource scarcity (Genovese *et al.,* 2017), the companies were looking for "green" solutions to integrate with their supply chains (Kersten *et al.,* 2017). With the observed changes, the global supply chains are currently rapidly progressing towards digital, intelligent and sustainable logistics (DISL). DISL is necessary to increase safety, tackle growing emissions and congestion problems, make processes within supply chains more efficient and sustainable, and enable the proper integration of today's society in the next-generation Industry 4.0 context.

Nevertheless, to successfully implement any concept, a specific skillset is required (Derwik *et al.,* 2016; Shou and Wang, 2017) and within the conducted research, we analysed next-generation competencies of logistics and supply chain managers that would be required to implement DISL. The purpose of the paper is to investigate the influence of different skills (managerial, digital, relational, behavioural) on the perception of barriers and drivers of implementing DISL in companies.

2. Literature Review

The purpose of the article entailed the necessity of adopting an input set of skills subsequently verified in the research process. The set of supply chain competencies presented by Derwik and Hellström (2017) was taken as a starting point – it includes functional, relational, managerial and behavioural skills. We decided to modify the framework regarding functional skills. In the developed model, they were replaced with digital skills, which have become extremely important in organizations in recent years (especially during the pandemic). It is justified, as functional skills in Derwik and Hellström's model, include technique and technology knowledge related to digital skills. Moreover, the broad approach to the study area (DISL), focuses our attention on the universal skills of managers in logistics sector, regardless of the functional area of the supply chain.

Digital skills are intrinsically linked to DISL and relate to the use of the opportunities offered by modern information technology tools. As digital technologies radically change the conditions of supply chain management, skills in mastering and leveraging them are becoming critical for modern organizations

(Foroughi, 2021). Managers should be aware of this as they play a crucial role in driving the development of digital competencies in companies (Bi *et al.*, 2018). Digital skills are, on the one hand, related to data processing in order to obtain added value (Murawski and Bick, 2017) and, on the other hand, enable efficient communication and cooperation in a networked environment (García-Sánchez *et al.*, 2018). A detailed list of digital skills is presented in Table 1.

Table 1. *Digital skills – DISL perspective*

No.	Types of digital skills	Source
1.	Information processing	Bouri et al., 2018; Hecklau et al., 2016; Hummel et al., 2015; Kohl et al., 2019; Morgan et al., 2016
2.	Network and information security	
3.	Digital communication	
4.	Digital collaboration	
5.	eLearning	

Source: *Own study.*

Managers operating in DISL face many challenges due to the dynamics of the environment. In challenging environments, they must set goals, develop and implement long-term strategies (Sohal, 2013; Dotson *et al.*, 2015; Gammelgaard and Larson, 2001) while focusing on the operational level (Thai and Yeo, 2015). Among the managerial skills listed in Table 2, it is worth highlighting risk handling (Ellinger *et al.*, 2015) and the ability to acquire the appropriate people, technology, equipment and financial resources to meet customer expectations. These skills are of particular importance in DISL implementation, as they allow for the exploitation of emerging opportunities.

Table 2. *Managerial skills – DISL perspective*

No.	Types of managerial skills	Source
1.	Ability to develop and lead strategic business planning	Jayant et al., 2014; Paulraj, 2011; Ying et al., 2015
2.	Ability to manage cost-effectiveness of supply chain	
3.	Ability to develop and lead business transformation process	
4.	Ability to implement quality standards and initiatives	
5.	Ability to lead risk assessment and management	
6.	Ability to recognize, analyze, and solve a variety of problems	
7.	Ability to use KPIs for teams or supply chain management	
8.	Ability to supervise SC processes	
9.	Ability to acquire the appropriate people, technology, equipment and financial resources to meet customer expectations	
10.	Ability to understand financial statements	

Source: *Own study.*

Relational skills listed in Table 3 are the next area of importance for DISL. Proper communication within and outside the organization is key to sharing knowledge (Halley *et al.*, 2006) and understanding company goals and challenges. Intelligent and sustainable development requires cultural and cross-functional awareness that

comes from relational skills (Prajogo and Sohal, 2013; Sohal, 2013). Addressing challenges and completing major projects often becomes facilitated through market collaboration which also has an impact on increase in economic performance (Caputo *et al.*, 2019).

Table 3. *Relational skills – DISL perspective*

No.	Types of relational skills	Source
1.	Ability to communicate effectively within an organization	Cao et al., 2009; Cvetić et al., 2017; Gámez-Pérez et al., 2020; Heaslip et al., 2019; Vaičiūtė et al., 2017
2.	Ability to communicate effectively with vendors/suppliers	
3.	Ability to collaborate with cross-functional personnel	
4.	Ability to effectively work in teams and in matrix organisation structure	
5.	Ability to share knowledge between departments	

Source: *Own study.*

The last group described concerns the most individual - behavioral skills, identified as fundamental aspects of the modern supply chain (Derwik and Hellström, 2021). Skills such as time management, integrity, confidence, multitasking, and stress-resistance (Okongwu, 2007; Thai, 2012) characterize good managers, coping under all conditions. Creative, innovative thinking and problem-solving ability (Saha and Sharma, 2020) are skills that foster recognizing threats and turning them into opportunities. A summary of behavioral skills is presented in Table 4.

Table 4. *Behavioural skills – DISL perspective*

No.	Types of behavioural skills	Source
1.	Ability to embrace innovative and creative thinking	Cao et al., 2009; Chhetri et al., 2018; Heaslip et al., 2019; Jäger et al., 2014; Ližbetinová, 2017
2.	Self-driven; taking initiative; work without supervision	
3.	Ability to think strategically	
4.	Willingness to experiment with new digital technology	
5.	Ability to present oneself with confidence	
6.	Ability to empathize with others	
7.	Ability to handle job-related stress	

Source: *Own study.*

The level of the above skills determines how managers operate within the organization. Specialization within particular skills can lead to specific perceptions of business direction, including DISL. The implementation of DISL solutions, depends on various factors that can be antagonized as barriers and drivers. The key ones identified by Kalinowski *et al.* (in press) are presented in Table 5.

The considerations of the relationship between skill sets and the ability to perceive the mentioned determinants of DISL implementation were addressed in the following research questions:

RQ1: Does the level of skills in a company influence the perception of the significance level of barriers and inhibitors of DISL solutions implementation?
RQ2: Which skills are most important for the perception of the significance level of barriers and drivers of DISL implementation in companies?

Table 5. *Barriers and drivers set of DISL implementation to companies*

Barrier	Drivers
1. Implementation cost	1. Pressure from the local community
2. Lack of intellectual capital	2. Pressure from shareholders / investors
3. No technological support	3. More stringent regulations and legal conditions
4. Time needed to implement DISL	4. Global environmental challenges
5. Poor commitment of the top management	5. Market pressure from local customers
6. Insufficient market pressure	6. Market pressure from international customers
7. Resistance of employees to changes	7. The potential of digital transformation
8. Lack of standardization in the implementation of DISL solutions	8. Financial pressure to reduce costs
9. No short-term benefits	9. Improving the business benefits of the organization
10. There is no single framework to regulate implementation	10. Increased competition
	11. More effective tracking and timely delivery

Source: *Own study.*

3. Research Methodology

To determine the impact of the level of skills on the perception of barriers and drivers of implementation of DISL, a survey was carried out among randomly selected logistics and production companies operating in Poland. It was requested that the questionnaire be answered by the company representative responsible for logistics and/or supply chain management, i.e., CEO - Chief Executive Officer - 14% of responders, Chief Management Officer (CMO) - 18% of responders, middle management level (i.e., branch and department heads) - 50% of responders and others responsible for logistics affairs - 18% of responders.

Most of the respondents were over 26 (98%), including 26-35 years old - 30% of the respondents, 36-50 years old - 50%, 51-65 years old - 18%. All representatives of enterprises participating in the study had at least higher education and 6% of them had a doctoral degree. Participants were assured of absolute confidentiality and anonymity. A total of 50 valid questionnaires were collected between December 2020 and February 2021.

The survey questionnaire was developed based on the results of the conducted literature research. It was built in two parts. The first one contained questions about the barriers and drivers of DISL implementation. The second part concerned the self-assessment of the level of skills (managerial, digital, relational, behavioural) held by

the company. The respondents assessed the significance of the barrier or driver and the levels of skills on a seven-point Likert scale, where 1 meant low significance/no skill, and 7 - high significance/high level of skill.

4. Survey Study

To test the research model and proposed hypothesis, this study applies Partial Least Squares Path Modelling (PLS), a variance-based structural equation modelling technique (SEM) that aims to maximise the explained variance of the dependent latent constructs (Hair *et al.,* 2017). SmartPLS version 3 was used to analyze the data in this study following a two-step analysis approach. Due to the characteristics of the studied variables, it was necessary to check them for internal consistency, indicator reliability, convergent validity, and discriminant validity. Composite reliability (CR), Cronbach's alpha (α), and Dijkstra-Henseler's rho (rho_A) were used to measure construct reliability. Heterotrait- monotrait-HTMT criteria were used to assess discriminant validity. *Construct reliability and validity* assessment is presented in Table 6.

Table 6. *Construct reliability and validity.*

Constructs	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
Barriers	0.768	0.818	0.848	0.584
Behavioural skills	0.903	0.925	0.921	0.628
Digital skills	0.888	0.911	0.915	0.684
Drivers	0.852	0.871	0.894	0.628
Managerial skills	0.923	0.932	0.938	0.685
Relational skills	0.883	0.914	0.913	0.678

Source: *Own study.*

When evaluating construct reliability and validity, it should be noted that the Cronbach's Alpha value for each construct is greater than 0.7 (Hair et al., 2017). It can be argued that the results demonstrate internal consistency reliability. The average variance extracted (AVE) is above the recommended threshold of 0.5 (Hair *et al.,* 2017), demonstrating an acceptable level of convergent validity. HTMT for discriminant validity assessment is presented in Table 7.

Table 7. *HTMT for discriminant validity*

Constructs	Barriers	Behavioural skills	Digital skills	Drivers	Managerial skills
Behavioural skills	0.370				
Digital skills	0.202	0.829			
Drivers	0.408	0.530	0.397		
Managerial skills	0.176	0.735	0.743	0.418	
Relational skills	0.378	0.785	0.593	0.441	0.754

Source: *Own study.*

The Heterotrait-monotrait (HTMT) ratio of correlations is smaller than the suggested threshold of 0.85 for all constructs (Henseler *et al.*, 2015). To conclude, the measurement model has been correctly assessed.

Before proceeding with the assessment of the structural model, the coefficient of determination R^2 was calculated for each endogenous latent variable. This coefficient determines the predictive power of the model and must be greater than 0.1 (Falk and Miller, 1992). R2 values for the developed model were, for Barriers - 0.246 and for Drivers - 0.251. Results of the significance tests for the path coefficients of the structural model are presented in Table 8.

Table 8. *Hypothesis testing results*

Constructs	Barriers	p	Drivers	p
Behavioural skills	0.545	0.032*	0.407	0.072**
Digital skills	-0.454	0.048*	-0.033	0.402
Managerial skills	-0.096	0.334	0.092	0.347
Relational skills	0.249	0.142	0.064	0.448

Notes: **significant at the 0,05 level; ** significant at the 0,1 level.*
Source: *Own study.*

5. Conclusions and Future Research

The results of the conducted research allow us to conclude that there is a statistically significant relationship between the identified level of skills in a company and the perception of the significance level of barriers and drivers of DISL solutions implementation. The results show that a higher level of behavioural skills causes a stronger perception of both barriers and drivers. The explanation for this phenomenon should be sought in the characteristics of employees characterized by a higher level of behavioral skills (Saha and Sharma, 2020). These are usually people with a holistic view (not only on the implementation of DISL). They can combine more facts and define wider fields of influence.

Hence the assessment of the significance of barriers and drivers in these organizations is higher. On the other hand, a higher level of digital skills results in a weaker perception of the barriers to implementing DISL solutions. This clearly shows that knowledge of DISL solutions (e.g., IT related) results in fewer barriers.

The presented research has limitations in two dimensions: a questionnaire study (mainly a research sample) and an analysis of the results. The survey was conducted only among enterprises operating on the Polish market. Their number cannot be considered representative either. In the analysis of the results, no inference was made using mediation. Subsequently, the team of authors intends to expand the research model with mediation. Searching for dependencies using mediation allows for the extension of the research perspective and the analysis of much more complex

relationships between the level of competencies in the company and the perception of barriers and drivers of implementing DISL solutions.

References:

Bi, R., Davison, R., Smyrnios, K. 2019. The role of top management participation and IT capability in developing SMEs' competitive process capabilities. Journal of Small Business Management, 57(3), 1008-1026.

Bouri, M., Chraibi, L., Sefiani, N. 2018. On the assessment of the individual competence level for an environmental manager: Case of logistics sector. 2018 International Colloquium on Logistics and Supply Chain Management (Logistiqua).

Burroughs, B., Burroughs, W.J. 2020. Digital logistics: Enchantment in distribution channels. Technology in society, 62, 101277.

Cao, M., Vonderembse, M.A., Zhang, Q., Ragu-Nathan, T.S. 2009. Supply chain collaboration: conceptualisation and instrument development. International Journal of Production Research, 48(22), 6613-6635.

Caputo, F., Cillo, V., Candelo, E., Liu, Y. 2019. Innovating through digital revolution: The role of soft skills and Big Data in increasing firm performance. Management Decision, 57(8), 2032-2051.

Chhetri, P., Gekara, V., Manzoni, A., Montague, A. 2018. Productivity benefits of employer-sponsored training: A study of the Australia transport and logistics industry, Education + Training, 60(9), 1009-1025.

Cvetić, B., Vasiljević, D., Danilović, M. 2017. Competence requirements for logistics managers in the Republic of Serbia. Management: Journal of Sustainable Business and Management Solutions in Emerging Economies, 22(2), 37-46.

Derwik, P., Hellström, D. 2021. How supply chain professionals learn at work: an investigation of learning mechanisms. International Journal of Physical Distribution and Logistics Management, 51(7), 738-763.

Derwik, P., Hellström, D. 2017. Competence in supply chain management: a systematic review. Supply Chain Management, 22(2), 200-218.

Derwik, P., Hellström, D., Karlsson, S. 2016. Manager competencies in logistics and supply chain practice. Journal of Business Research, 69(11), 4820-4825.

Dotson, M.J., Dave, D.S., Miller, S.E. 2015. Desired skills and competencies of prospective supply chain managers: An empirical investigation of US supply chain executives. International Journal of Logistics Systems and Management, 22(1), 55-66.

Ellinger, A.E. Chen, H., Tian, Y., Armstrong, C. 2015. Learning orientation, integration, and supply chain risk management in Chinese manufacturing firms. International Journal of Logistics Research and Applications, 18(6), 476-493.

Falk, R.F., Miller, N.B. 1992. A Primer for Soft Modeling. University of Akron Press: Akron, OH, USA.

Fan, T., Pan, Q., Pan, F., Zhou, W., Chen, J. 2020. Intelligent logistics integration of internal and external transportation with separation mode. Transportation Research Part E: Logistics and Transportation Review, 133, 101806.

Fornell, C., Larcker, D.F. 1981. Evaluating structural equation models with unobservable variables and measurement error. Journal of Marketing Research, 18(1), 39-50.

Foroughi, A. 2021. Supply chain workforce training: addressing the digital skills gap. Higher Education, Skills and Work-Based Learning, 11(3), 683-696.

Gámez-Pérez, K.M., Sarmiento, A.M., Garcia-Reyes, H., Velázquez-Martínez, J.C. 2020. An international university-industry collaboration model to develop supply chain

Competencies. Supply Chain Management: An International Journal, 25(4), 475-487.

Gammelgaard, B., Larson, P.D. 2001. Logistics Skills and Competencies for Supply Chain Management. Journal of Business Logistics, 22(2), 27-50.

García-Sánchez, E., Guerrero-Villegas, J., Aguilera-Caracuel, J. 2018. How Do Technological Skills Improve Reverse Logistics? The Moderating Role of Top Management Support in Information Technology Use and Innovativeness, Sustainability, 11(1), 58.

Genovese, A., Acquaye, A.A., Figueroa, A., Koh, S.L. 2017. Sustainable supply chain management and the transition towards a circular economy: Evidence and some applications. Omega, 66, 344-357.

Hair, J.F., Hult, G.T.M., Ringle, C.M., Sarstedt, M. 2017. Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM). Second Edition (SAGE Publications: Thousand Oaks, CA, USA.

Halley, A., Nollet, J., Hardy, G., Chiurciu, R.M. 2006. Power Relationships and Their Impact on Competency Development. Supply Chain Forum: An International Journal, 7(2), 4-14.

Heaslip, G., Vaillancourt, A., Tatham, P., Kovács, G., Blackman, D., Henry, M.C. 2019. Supply chain and logistics competencies in humanitarian aid. Disasters, 43(3), 686-708.

Hecklau, F., Galeitzke, M., Flachs, S., Kohl, H. 2016. Holistic Approach for Human Resource Management in Industry 4.0. Procedia CIRP, 54, 1-6.

Henseler, J., Ringle, C.M., Sarstedt, M. 2015. A new criterion for assessing discriminant validity in variance-based structural equation modeling. Journal of the academy of marketing science, 43(1), 115-135.

Hummel, V., Hyra, K., Ranz, F., Schuhmacher, J. 2015. Competence Development for the Holistic Design of Collaborative Work Systems in the Logistics Learning Factory. Procedia CIRP, 32, 76-81.

Jäger, A., Bauer, J., Hummel, V., Sihn, W. 2014. LOPEC - Logistics Personal Excellence by Continuous Self-assessment. Procedia CIRP, 25, 69-74.

Jayant, A., Gupta, P., Garg, S.K., Khan, M. 2014. TOPSIS-AHP Based Approach for Selection of Reverse Logistics Service Provider: A Case Study of Mobile Phone Industry. Procedia Engineering, 97, 2147-2156.

Kalinowski, T.B., Raźniewska, M., Brzeziński, J., Toboła, A. 2022. Implementing Digital, Inteligent and Sustainable Logistics (DISL) to SMEs and large companies - identification and significance of barriers and drivers – in press.

Kersten, W., Seiter, M., von See, B., Hackius, N., Maurer, T. 2017. Chancen der digitalen Transformation: Trends und Strategien in Logistik und Supply Chain Management (DVV Media Group GmbH).

Kohl, M., Heimeldinger, C., Brieke, M., Fottner, J. 2019. Competency Model for Logistics Employees in Smart Factories, Karwowski, W., Trzcielinski, S., Mrugalska, B. (eds.), Advances in Manufacturing, Production Management and Process Control, AHFE 2019. Advances in Intelligent Systems and Computing, 971, Springer, Cham,133-145.

Liu, W., Shanthikumar, J.G., Lee, P.T.W., Li, X., Zhou, L. 2021. Special issue editorial: Smart supply chains and intelligent logistics services. Transportation Research Part E: Logistics and Transportation Review, 147, 102256.

Ližbetinová, L. 2017. Competencies of University Graduates in Field of Transport and

Logistics, in Khalid S. Soliman, Education Excellence and Innovation Managemenet through Vision 2020: From Regional Development Sustainability to Global Economic Growth (International Business Information Management Association (IBIMA), Vienna, Austria).

Morgan, T.R., Richey Jr.R.G., Autry, C.W. 2016. Developing a reverse logistics competency. International Journal of Physical Distribution and Logistics Management, 46(3), 293-315.

Murawski, M., Bick, M. 2017. Digital competencies of the workforce - a research topic? Business Process Management Journal, 23(3), 721-734.

Neradilova, H., Fedorko, G. 2017. Simulation of the Supply of Workplaces by the AGV in the Digital Factory. Procedia Engineering, 192, 638-643.

Okongwu, U. 2007. An Innovative Supply Chain Management Programme Structure: Broadening the SCM Skill Set. International Journal of Learning and Change, 2(2), 192-212.

Paulraj, A. 2011. Understanding the relationships between internal resources and capabilities, sustainable supply management and organisational sustainability. Journal of Supply Chain Management, 47(1), 19-37.

Prajogo, D., Sohal, A. 2013. Supply chain professionals: A study of competencies, use of technologies, and future challenges. International Journal of Operations and Production Management, 33(11/12), 1532-1554.

Ren, S., Choi, T.M., Lee, K.M., Lin, L. 2020. Intelligent service capacity allocation for cross-border-E-commerce related third-party-forwarding logistics operations: A deep learning approach. Transportation Research Part E: Logistics and Transportation Review, 134, 101834.

Saha, S., Sharma, R.R.K. 2020. The impact of leaders' cognitive style and creativity on organisational problem-solving. Benchmarking, 27(8), 2261-2281.

Sanchez-Rodrigues, V., Potter, A., Naim, M.M. 2010. Evaluating the causes of uncertainty in logistics operations. The International Journal of Logistics Management, 21(1), 45-64.

Shou, Y., Wang, W. 2017. Multidimensional competences of supply chain managers: an empirical study. Enterprise information systems, 11(1), 58-74.

Sohal, A.S. 2013. Developing competencies of supply chain professionals in Australia: Collaboration between businesses, universities and industry associations. Supply Chain Management: An International Journal, 18(4), 429-439.

Thai, V.V. 2012. Competency requirements for professionals in logistics and supply chain management. International Journal of Logistics Research and Applications, 15(2), 109-126.

Thai, V.V., Yeo, G.T. 2015. Perceived competencies required for container shipping logisticians in Singapore and South Korea. The International Journal of Logistics Management, 26(2), 334-355.

Vaičiūtė, K., Skirmantienė, J., Domanska, L. 2017. Assessment of Transport Specialists' Competencies in Transport/Logistics Companies. Procedia Engineering, 187, 628-634.

Ying, J.F., Tookey, J., Roberti, J. 2015. SCM competencies in construction: issues and challenges in New Zealand. Journal of Engineering, Design and Technology, 13(4), 522-538.