**HOW SUSTAINABLE IS LOGISTICS EDUCATION: A RESEARCH AGENDA FOR EDUCATING LOGISTICIANS IN A.D. 2100**

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# Introduction

“In developing and updating the Key Knowledge Areas (KKA) it is important to ensure that the KKA do not date too quickly. They are written in a manner which can accommodate the rapid speed of change within the world of transport and logistics and the external factors which may impact on the profession…. The KKA must also reflect our global community and our international values”. (CILT, 2017, p.3)

This paper aims to question what sustainable logistics education might entail and to posit an agenda for research to identify and address issues that may influence strategies and policies to educate logisticians in A.D. 2100. Some conflicting views of current logistics education are reviewed, before presenting a positivist philosophy within which to postulate some possible future changes in logistics systems and educational requirements. The analysis proceeds by selecting a sample of the CILT Core Generic Areas and Specialist KKAs perhaps most likely to require adaptation, comparing them against possible future requirements, and noting some of the differences. Implications of the findings are noted including a need for ongoing research to explore not only likely changes in logistics processes, but also research to explore what implications these changes might have for developing logisticians’ personal skills to manage them. Social implications will require research to optimize responsibilities within the triple-helix of industry-university-government relationships (Yoon et al., 2015) concerning syllabus setting, educational provision and educational funding. The extent to which the analysis implies a need to revise KKAs, and when, remains a moot point. We conclude by noting that the clients of future logistics education will need to be engaged in defining and executing future research agendas to define the skills they will need and the future syllabi they will study.

# Logistics skills and their development

**Some views of logistics skills development**

The skills or competencies which successful logistics or supply chain (SC) managers need are relatively well researched (e.g. Dinwoodie, 2000; Thai et al., 2012; Barnes & Liao, 2012; Murphy & Poist 2007). Distinct schools of thought have emerged which classify the various competencies which future international managers may require.

Early this century, a popular Western “BLM” framework (Murphy and Poist, 2007) was identified to classify logistics skills, comprising competencies related to business, logistics and management. Within this framework, business skills span business know-how for example in manufacturing and purchasing. Logistics skills span inventory, transport, facility location and the like. Finally, management skills relate to either traditional skills such as planning, motivating and organising or non-traditional such as time management, or personal skills, such as integrity.

By contrast, working in Singapore, Thai et al. (2012) proposed several new skills and traits which logisticians would require. These included new business skills such as strategic planning with knowledge of risk management, multiculturalism and quality management. New logistics skills required knowledge of outsourcing, and knowledge of integrated logistics including multimodalism and green logistics. Finally, management skills included an ability to implement, to manage performance, and non-verbal communication skills. Traits of innovation and dynamism were also required.

Emphasising competencies, Barnes & Liao (2012) assessed linkages between individuals, network and inter-organizational competencies, involving investment in strategic partnership and firm performance in SCs. Individual competency in the form of organizational awareness, and organisation competency as a supply network competency, were both found to impact collaborative awareness. Finally, inter-organizational competencies are supported by collaborative awareness, which impacts investment in strategic planning.

The issue of dealing with other cultures is fundamental to trade and globalisation. Nardon and Steers (2008) explained that managers must learn **how** to learn to deal with other cultures and how to make sense of varied environments. This process involves learning cultural fluency, developing a global mind-set, and learning cultures “on the fly”. Cultural fluency involves learning the cultures and language of relevant countries though going on training programmes, learning to expect and cope with stress and anxiety and “culture shock” involves being immersed in a foreign culture. A “global mindset” involves “an ability to develop and interpret criteria for personal and business performance that are independent of the assumptions of a single country, culture, or context, and to implement those criteria appropriately in different countries, cultures, and contexts” (p.49). Managers develop knowledge structures which allow them to interpret situations using multiple cultural frameworks and then select the most appropriate action for each particular situation. Learning cultures on the fly is required when time is limited. All learning involves a cycle of concrete experience, abstract conceptualization, reflective observation and active experimentation. If you come from a culture which values direct communication, and ask a direct question to a person in a culture which values indirect communication, you may feel embarrassed or surprised. This is a concrete experience. Because what is happening does not match what you expected, you will then begin to observe very carefully how people act and react, and eventually you will reflect on what you are observing. You try to make sense of the situation by looking for explanations: perhaps the person did not hear you very clearly, or they do not speak English very well. When you think you have found a plausible explanation, where perhaps a person was embarrassed, you test your explanation perhaps re-phrasing the question in a different way to test the implications of your concept. Through a cycle of trial and error, you eventually learn to adopt successful strategies for communication.

Other theories say that learning may be a social, interdependent process. The ability to negotiate at each stage includes negotiation of identity which involves engaging in concrete experiences; meaning, which requires an ability to reflect and observe together; new rules by developing new theories; and new behaviours which involve taking appropriate actions. Identity involves self-awareness of who I am and who the other person is relating to empathy and what the other person is feeling? We search for cultural explanations before judging a person, question for example whether it is acceptable for work to be late. Successful managers are open-minded and suspend judgement. To negotiate, you must be willing to inquire “how did I/you perceive the situation”, and then to advocate clearly what you want, and why. You must be able to gather information from what is said, body language and subtle cues. Individuals must be able to transform new information into action, and to negotiate new styles which requires flexibility in style.

Preparing logisticians to operate globally required a redefinition of the concept of leadership (Sanchez- Runde et al., 2011). Is leadership a universal global behaviour, a normative approach involving a global mind-set shaped by cultural intelligence, or a contingency approach enacted by acting only as a local manager?

Study in the UK has offered an excellent preparation for global logisticians, in a non-threatening environment within which to learn to develop personality traits; to enhance linguistic skills in English; to understand UK business and cultural environment; and to convince potential future employers that you can survive in an international business environment. More recently, preparation of logisticians for overseas assignments has focussed on understanding the meaning of leadership as a cultural construct and the variations in local expectations of leader behaviour. Apparent non-comital and indecision by Chinese managers can be conceived of as poor leadership by Western managers, simply because they do not understand the cultural constructs (ying and yang, create the conditions for success, let events come to you and so on). Success depends on analysing personal expectations, realising that success is very complex and difficult, and understanding the uniqueness of the local situation.

# Current benchmarking of logistics skills

Nearly two decades into the 21st century the Chartered Institute of Logistics and Transport (CILT) proposed “Driving knowledge, delivering quality” (DKDQ) as the benchmark for educating logisticians who will manage logistics systems perhaps until 2060. As such, KKA are explicitly designed to be resilient over time to rapid changes internally within the profession, and to external factors, and also to reflect a global community with international values (Table 1; CILTUK 2017). Within this paper, KKA are used as a base framework against which to compare possible changes engendered by logistics system developments and their implications for educating logisticians are considered.

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| Customer Centric and Continuous Improvement Principles | |
| Core Generic Areas | Specialist KKAs |
| A. Integrated strategic planning,  management and systems thinking | S1: Supply Chain Management |
| S2: Operations Management |
| B. Efficiency, quality and risk | S3: Procurement and Supplier Management |
| S4: Logistics Systems |
| C. Technology, analysis, adoption and  monitoring | S5: Transport Infrastructure and Network Planning |
| S6:Passenger movement |
| D. Society, sustainability, and the global  community | S7: Freight movement |
| S8: international Trade and Transport |

Table 1. Key Knowledge Areas Framework Source: “DKDQ”, CILTUK, 2017 p.3.

# Methodology

Adopting a positivist philosophy, we posit some possible changes in logistics systems to A.D. 2100 and consider their implications in terms of the DKDQ framework (CILTUK, 2017). By A.D. 2100 major changes are likely both internally and externally in logistics systems spanning, technology, economy and society. Some possible (and necessarily highly speculative) scenarios may include:

* Climate change which engenders Northern Sea routes through the Arctic; global warming that raise temperatures in the Sahara; inter-regional conflicts for water; significant sea level rises.
* Population rises (20B?) drive a desire for food, mineral and energy security which favour long term contracts and increased supply chain integration. Scarce resources suit a circular economy.
* Rising energy costs which favour local sourcing and pipeline development.
* Technological change shifts the units of motive power towards hydrogen based fuel cells; wind and solar powered vehicles; LNG; equipment with increasingly complex technical designs.
* New production processes drive 3-D printing and dematerialisation implies reducing material inputs per unit output.
* Autonomous vehicles and automated supply and fulfilment chains.
* Integrated digital payment and information exchange systems.
* Extra-terrestrial movements induce tough biosecurity controls.

The nature and location of production will change. Ships may already offer “floating warehouses” particularly with slow steaming, but on long inter-planetary missions, production will take place within the unit of carriage, or we will require systems in which inventory can evolve ad hoc in a circular fashion into other products as they are required.

Flows of information and money will be critical even if physical goods are not transported relating to for example production rights; construction, use and disposal regulations; template negotiation and exchange systems.

Perhaps trade and transport will become interplanetary, inter-stellar or inter galactic? This will still require physical components perhaps including “the way, the terminal, the unit of carriage and unit of motive power”; operations management; infrastructure; procurement and supplier management. The “time-related positioning of resource” may need to be revised if worm holes ever allow time travel but the basic principles of inter-animate relationships with whatever physical form new trading partners exhibit; efficiency, quality and risk; corporate social responsibility, “society” and inter-stellar responsibility, will remain.

A next step is to assess what changes (if any) may be needed to the CGA and KKA to prepare researchers to manage these shifts in logistics processes. Speculatively, “freight movement” and “international trade and transport” are selected as the KKAs most likely to require updates. Finally this work suggests a possible agenda of items which will require further research.

# Analysis

**How sustainable are CGAs to benchmark logistics education in 2100?**

By their nature, most CGAs are sufficiently generic to cover most eventualities. CGA C refers to selection of methods and techniques, data collection and analysis, setting of performance measurement, and applications of modelling and simulation and technology. Over time the techniques, measures and technologies will change, but aside from a criticism that perhaps skills in setting aims and objectives needs to be more explicit rather than implicit within performance measurement, the basic processes and skills will surely remain in 2100. Similarly CGA B, the principles of skills required to manage efficiency, quality and risk will change little. In CGA D, the nomenclature within which to frame society, sustainability and the “global community” will change if an extra- terrestrial or regionalised environment attains, but the frameworks set by responsibility, resilience, regulation, sustainability and integration will not.

Interestingly, CGA A, related to integrated strategic planning, management and systems thinking is perhaps the CGA likely to be least resilient to change. Only one aspect, namely “people development, leadership and strategic change management” really relates to softer people skills. Within complex geopolitical global environments, likely to include regionalisation, localisation or de-globalization, interpersonal skills involving diplomacy and intercultural competence need to be explicit and extend beyond “people development”. It is under two decades since successful logisticians depended on such skills, as business became international (Lu and Dinwoodie 2004; Pyne et al. 2007). Within extra- terrestrial logistical contexts survival extending far beyond simple trade may depend on an ability to display such skills at very high levels of competence with whatever life form is encountered in whatever environment, and should surely be prioritized in a logistics education. Within both the geopolitically hostile environment of regionalisation, and extra-terrestrial physically hostile environment, an ability to quickly and independently sense and develop business opportunities may also determine whether a business survives. Such entrepreneurial skills development surely goes beyond “leadership”, and should be explicit.

# How sustainable are KKA’s to benchmark logistics education in 2100?

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| **Freight movement (FM)** | **Comment** |
| 1. Services types of operation and interoperability | Complex |
| 2. Intermodal integration and operations | Inter-chain |
| 3. Transport of dangerous, oversize and hazardous freight |  |
| 4. Freight transport, fleet operations, forward planning |  |
| 5. Scope, capability, and efficiency of urban freight transport operations | High density |
| 6. Freight forwarding and management of partners and subcontractors |  |
| 7. Local, national and international distribution network and regulations | Extra-terrestrial |
| 8. Models, modal choice and multimodal freight transport |  |
| 9. Transport scheduling, routing, back loading and optimisation models |  |
| 10. Reverse logistics | Circular logistics |
| **International trade and transport (ITT)** |  |
| 1. International modal choice, inter-modality and security | Extra-terrestrial |
| 2. Incoterms and contractual obligations | Inter-chain |
| 3. Customs tariffs, processes, procedures and insurance | Biosecurity |
| 4. Import, export, bonding and carnet procedures | Complex services |
| 5. Freight forwarding, contracts of carriage, documentation and  certification | Complex services |
| 6. Specialist requirements for the carriage of different types of cargo | Ambient conditions |
| 7. Insourcing, outsourcing, and offshoring | Off-planeting |
| 8. International trade facilitation, treaties, finance, and settlement | Inter-planetary |
| 9. Trade compliance, licensing and quotas | Inter-planetary |
| 10. Facilities (port, airport) operations | Tank farms |

Table 2: KKAs for freight movement and international trade and transport in A.D.2100

Table 2 outlines two KKAs which prima facie appear least sustainable, and adds commentary relating to whether skills affecting freight movements (FM) and international trade and transport (ITT) are likely to remain valid. Relatively few changes in kind are expected for most aspects of FM (including FM1, FM3, FM4, FM6, FM8 and FM9), excepting that the complexity of systems is likely to increase significantly. In particular, if extra-terrestrial systems develop, the type and range of services will increase, and thus problems of interoperability, freight with irregular characteristics, increasingly complex business relationships as specialist new functions emerge (such as designing and providing packaging for ambient zero gravity environments), and associated modelling and transport management issues.

Other aspects of FM pose interesting issues for future research. If the expected dramatic shifts in production methods and inventory management ensue, FM2 intermodal integration and operations are likely to shift to “inter-chain” systems embracing novel templates, data exchange systems and financing regimes. Within future mega cities, urban distribution centres may be replaced by district scale fulfilment centres, within which 3-D printing facilities operate to manufacture products to meet local demands. Whether suburban delivery systems will supplant final distribution involving private household vehicles is debateable. FM7 will require new nomenclature if extra-terrestrial systems develop perhaps engaging interplanetary, interstellar and intergalactic systems. On earth, if de- globalization and protectionism create regionalisation, then management of global systems involving “inter-regional” flows could involve major cultural and geopolitical dimensions, demanding that logisticians acquire skillsets which extend far beyond traditional logistics skills. Circular logistics are inevitable for extra-terrestrial movements, and indeed, as populations increase and available land reduces, pressures to implement a circular economy will redefine FM10.

Similar issues are likely to impact ITT. If extra-terrestrial systems develop, new nomenclature for ITT1 might engender concepts of inter-planetary and related movements; if regionalization ensues, inter- regional centres, inter-regional flow mode choice, intra-regional-modality may become significant. The principles of ITT2 will remain, but again if vertical supply chain integration increases to counter supply chain risks, “inter-chain” obligations will require a complete new nomenclature. ITT3 will become much tougher but extra-terrestrial systems will require specialist biosecurity and quarantine arrangements. The complexity of ITT4 and ITT5 will increase significantly as the range of specialist services and functions burgeons, as will ITT6 as the increased range of ambient temperatures create more challenging environments for storage, and handling. ITT7 may spawn phrases like “off- planeting”, “in-chaining” or “out-chaining”. Similarly, ITT8 and ITT9 may also become inter-planetary, inter-chain or inter-regional within which specialist processes may also evolve. Within ITT10, assuming that gravity can be harnessed to enhance motive power, mandatory skills for terminal operators might include tank firm management, perhaps as increasing proportions of liquid flows engage pipelines rather than movement by various tankers.

Similar shifts in processes and nomenclature could be attempted for all KKAs, perhaps having particularly radical implications for supply chain and operations management and logistics systems. However, unless a scenario based model is built, in which assumptions about particular technology and process developments are made, an infinite variety of possible future systems and their combinations emerges which denies generalisations. The findings presented here have implications for future research in logistics, society and policy.

# Discussion

**Research implications**

As a benchmark to guide logistics education most aspects of DFDQ appear to be remarkably resilient, offering a sustainable basis for benchmarking logistics education. Ongoing future research will be required to test this resilience and to identify and address developing issues ad hoc as inputs to formulating strategies and policies to educate logisticians in A.D. 2100. It was noted earlier that CGA A requires explicit reference to a range of soft, “inter-animate” skills development, possibly to include non-human life forms. Within complex geopolitical global environments, regionalisation, localisation or de-globalization will demand interpersonal skills involving diplomacy and intercultural competence which need to be explicit and extend beyond “people development”. An ability to quickly and independently sense and develop business opportunities should explicitly include entrepreneurial skills development which extends beyond “leadership”. Extra-terrestrial logistics environments would demand both inter-animate and entrepreneurial skills.

Regarding KKAs, future research needs to extend beyond the engineering and economic aspects of de-materialisation, autonomous vehicles, off-globing, circular manufacturing, and dynamic supply chain processes. Ongoing research is essential relating to how educators can best foster personal adaptability, reliability, integrity and ingenuity to prepare logisticians to manage process change dynamically. Prima facie, the least sustainable KKAs were posited to be freight movements and international trade and transport, but even here most aspects appear robust aside from increasingly complex business relationships as specialist new functions emerge. More interesting issues for future research include training to design and manage “inter-(supply)-chain” systems embracing novel templates, data exchange systems and financing regimes; suburban district scale fulfilment centres and circular (economy) logistics. New nomenclature will be required to embrace extra-terrestrial systems or “inter-regional” rather than global or international systems. Regarding ITT, vertically integrated supply chains, “inter-chain” obligations, specialist biosecurity arrangements, and an increased range of ambient temperatures will create challenging environments within which to undertake storage, and handling. New nomenclature may include “off-planeting”, “in-chaining” or “out-chaining”. Scenario based planning will be required to handle specific combinations of system and process developments to pinpoint specific logistics skills issues.

# Social implications

In an increasingly over-populated and interdependent world, soft human skills are increasingly likely to drive the skills demanded of logisticians rather than hard technical skills. Extra-terrestrial developments will demand both soft and hard skills, and increasingly “logistics and transport” will become an overly narrow conception of the field within which key skills will be fostered. As supply chains under threat increasingly integrate vertically, logisticians will require practical communication and leadership skills, involving not only effective interactions with different nationalities, but also differing regional value-systems and even co-operation with unknown and complex life-forms. Ongoing research will be required to optimize responsibilities within the triple-helix of industry- university-government relationships which underpin syllabus setting, educational provision and educational funding to ensure effective and practical skills development for logisticians.

# Policy implications

The clients of future logistics education, given their long term career commitment (Dinwoodie et al., 2014) , will need to be engaged in both defining and executing future research agendas to define the skills they will need, future syllabi and the means which will be appropriate to shape their future educational experiences. However, future educational provision must reflect increasing trends towards circularity in which the same physical resources may constitute different products over time, trends towards chain management rather than management of particular processes such as logistics or transport, and 3D printing which reconfigures the traditional supply chain. Perhaps logisticians will select particular educational modules ad hoc, at different stages in their career, from a diverse set of management skills, which extend far beyond logistics and transport, to prepare them for their upcoming business role. Research will be required to identify precisely what skills each role will require, how many people will need to prepared to undertake each role, and to ensure a good fit between the requirements of each role and the aspirations of their incumbents.

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