

INTERMODAL EDUCATION IN COMPARATIVE PERSPECTIVE

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The New Science of Intermodalism.

Intermodalism, in its simplest notion, involves the transport of both people and goods from origin to destination, be that within the same city or across the globe. Implicitly, however, it also involves the interface of multiple modes of transportation, and the interchange of people and goods between them. Some have come to refer to it as *multimodalism*. Yet, it is greater than *multi-*, it is *intermodalism*, involving the linkage and integration of existing transportation modes such that they become a seamless conveyance and distribution system from origin to destination. Such a system offers the potential of using each mode to its best advantage to generate -safe, physically secure, energy efficient, environmentally benign and economically sustainable mobility. There is no simple definition for intermodalism, nor sadly, is there a universally accepted one. We impute *intermodal* to subsume all of the foregoing aspects and characteristics.

While we see vestiges of intermodalism in antiquity, presently we are really only at the half-century mark in its global manifestation, for it has been some fifty years since the interstate highway system came into being in the United States, and almost fifty since Malcolm McLean's grand experiment in containerization. These two independent events heralded the age of intermodalism in the United States and thrust it onto the world stage.

If containerization be the hallmark of intermodalism, then beyond doubt we are well into the intermodal age in terms of freight movement. Every interstate highway is an endless ribbon of tractors pulling containers on trailers. Parallel to the roadways run railroads, which also transport considerable numbers of containers, the very same containers as on the trucks, which will later be offloaded and hauled to final destination by truck, or delivered to the quay. At any seaport in the world – be it Long Beach, Singapore, or a smaller one such as Port Klang or Bangkok – these containers are stacked ten high at the wharf, awaiting transfer into the hulls and onto the decks of ships.

In the realm of passenger transport, intermodal advances are less dramatic, but the infrastructure for connecting roads, rails, air and sea ports has steadily advanced. For example, today a traveler could leave the Loop in downtown Chicago, board the subway to O'Hare Airport, change to a non-stop airplane to Frankfurt-am-Main, pass through customs, and then have several easy options: within a short walking distance within the same terminus he could hail a taxi or board a bus, or board a train to downtown Frankfurt there connecting with the local metro, or he could board an inter-city express train for Hamburg or Berlin. Fifty years ago, this degree of connectivity was rare, where it existed at all.

Thus, intermodalism, as a process, is at work and appears to be working – certainly so among the more prosperous nations of the world. However, in less affluent areas of the world, the seeds of intermodalism have yet to germinate. With technology rapidly advancing, there is an ongoing calculus. The areas and economies of the world that lag in current intermodal skills and technology have an expensive game of catch-up that needs to be undertaken. In terms of global trade, if they do not catch up, they will remain in

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the world's economic "hinterland", with more expensive goods, less favorable trade and lower income. Now, such economies need not only catch up to the present, but even more they need to advance to the ever new and changing intermodalism, else the game is lost.

This is a tall order, even for a deep pocket in economic terms. Conceptually, it is even taller. It has been told that a scientist, once asked to define "electricity," replied, "I can't tell you exactly what it is, but I can tell you how it works." Fifty years later, the "new science of intermodalism" shares the same state of mind. This article explores the current state of intermodal education and suggests steps to advance the state of the discipline.

Overview of the Study.

In January 2000, the Asia Pacific Economic Cooperation (APEC) awarded a contract to researchers at the University of Denver and the University of Calgary, in Alberta, Canada, to identify needed intermodal skills, and to assess the degree to which educational and training programs supply such skills to the workforce within the APEC member economies.² The resulting study, of which this is a summary, was presented to the Transportation Working Group of APEC at its October 2000 meeting in Miyazaki, Japan. The study itself is a "case of first impression," for in reviewing the literature we found that no similar trails have been blazed before. There have been several efforts to identify and enumerate specific intermodal skills required of the industry workforce, and while there have been some efforts to identify courses, degree and training programs in individual national contexts, we found none to have undertaken to do so comparatively across national and economic boundaries.³

The study has two major foci, which we pursue broadly in the context of supply and demand. The first, the demand side, delves beneath the process of intermodalism, to identify whether there are any particular skills or knowledge needed of the intermodal workforce, and to *identify the skill sets involved*. The second is to *identify degree and training programs* that are in place, and which supply the skills identified.

The remainder of this paper will summarize the four major steps that we followed in prosecuting the study: (I) Literature Review, (II) Data Collection (Demand for Skills v. Supply of Training Programs), (III) an Analysis of Training Gaps Identified in Steps II and III, where supply and demand do not meet, and (IV) General Conclusions.

I. Literature Review.

The study began with an extensive survey of all the existing activities relating to intermodal education ranging from workshops and conferences to published reports and articles. These could be divided into four general groups – those dealing explicitly with intermodal education, those dealing with logistics education, those focusing on intelligent transportation systems, and those concerned with transportation education in general.

² APEC was established in 1989, in response to the growing interdependence among Asia-Pacific economies, and has since become the primary regional vehicle for promoting open trade and practical economic cooperation [<http://www.apecsec.org.sg>]. The current member economies of APEC, in alphabetical order, are as follows: Australia, Brunei Darussalam, Canada, Chile, People's Republic of China, Hong Kong, China, Indonesia, Japan, Republic of Korea, Malaysia, Mexico, New Zealand, Papua New Guinea, Peru, Republic of the Philippines, Russia, Singapore, Chinese Taipei, Thailand, United States and Vietnam.

³ Throughout this report, the term "economy" is used. For our purposes, it is interchangeable in meaning and content with the term "nation," or "country." For political and diplomatic reasons, APEC – the organization commissioning this study – refers to its constituent members as "economies." We necessarily follow.

IA. Intermodal Education

The first category -- dealing with intermodal education directly -- was very limited, and of quite recent vintage. A search of the literature revealed just five publications, only one of which -- the 1998 Transportation Research Board (TRB) Report discussed below -- was less than 15 years old and directly relevant to our concerns. This report summarized the results of a workshop that we had attended. It was the fifth in a series sponsored by the TRB focusing on intermodalism explicitly and the only one that dealt directly with issues of education and training. The proceedings were published as "Intermodal Transportation Education and Training, TRB Conference Proceedings #17, 1998." The Workshop concluded the following:

- Many transportation professionals are not graduates of university transportation programs.
- Existing core business curricula do not adequately incorporate logistics and intermodal transportation courses.
- Given the nature of the intermodal industry, educators must become familiar with real life experiences.
- Education must include the articulation and dissemination of an "intermodal vision."
- Intermodal education and training requires participation by the public and private sectors.
- Continuing education and lifelong learning are essential elements.
- Professionals must learn to manage technology and innovation.

Of all the papers presented, the most germane to our concerns was the report by L. Pignataro and L. Hoel entitled "*College and University Transportation and Logistics Programs*, (pp. 60-63), focusing on the extent to which intermodalism had been incorporated into transportation education. The authors concluded that most programs were located in engineering departments, that interdisciplinary cooperation was not always adequate, and that administrative support for interdisciplinary programs was "sporadic." Altogether, 28% of the institutions surveyed stated that they had "always incorporated" intermodalism in their program, another 43% had recently made course additions, and 29% had made no changes at all. This study may well have overestimated the degree to which intermodalism has been incorporated into educational programs, because the authors assumed that courses dealing with subjects such as "systems," "policy," "management," and "logistics" reflected an intermodal focus.

Two recent surveys of intermodal education are also relevant. The first was carried out by the United States Merchant Marine Academy, in order to assess the industry's perspective on intermodal education and training needs. In their sample of 43 respondent organizations, responses were tabulated with the following results:

- Existing academic programs were not viewed as providing the kind of education that an intermodal work force requires. When asked to rank the programs' performance on a scale of one to five (very poorly to very well), the responses placed the existing programs below the midpoint, at 2.1.
- The most important subjects identified for entry-level personnel (obtained at the undergraduate level) were logistics (13%), modal/intermodal operations (%), financial and characteristics (9%), and financial management, marketing, business management, with 5-6% each.
- Mid level personnel also required advanced (graduate level) training in logistics (15%), financial management and information technology (9% each), followed by labor relations, modal/intermodal characteristics and operations, and terminal operations.
- The two areas of training of most interest to the responding firms were logistics and modal/intermodal characteristics and operations (10% each), intermodal marketing (8%), and such topics as transportation economics, information technology, software applications, and international transportation (6% each).

The Intermodal Transportation Institute, University of Denver, carried out the second major study of intermodal education needs in preparation for its new Master of Science in Intermodal Transportation Studies. The members of its Board of Directors, drawn primarily from industry, were asked to identify the specific skills that the program should provide to its students. The leading indicators were marketing and financial/economic analyses (14% each), followed by logistics and intermodal operations (10% each). Also emphasized were legal and regulatory issues (including liability, preventing loss and damage), negotiating, planning, knowledge of information and other technologies, and the ability to carry out forecasts. An important point made by the respondents was the need for individuals in the intermodal industry to have some knowledge of the operational capabilities of different modes.

IB. Logistics Education

Given the importance attributed to logistics, it was deemed useful to examine the literature dealing with logistics education. Fortunately, the rapid changes that are taking place in transportation have resulted in major studies of logistics education. The most important and detailed of these was carried out by the Canadian Professional Logistics Institute. A report of the study was authored by Alan Law, "*Canadian Logistics Labour Market Information Study*," *Canadian Logistic Journal*, Vol. 4, pp. 1-88. The study involved interviews with almost 600 logistics professionals, a survey of over 100 logistics employees, and five focus groups with 33 logistics practitioners in order to identify skills, knowledge, and aptitudes required by the logistics professional, as well as educational needs. Three key sets of skills were identified:

- Information Technology
- Business Management
- Planning, Developing and Implementing Strategies

Detailed modules for introductory, intermediate, and advanced level courses for all aspects of logistics were developed including one for transportation. Each module specified skills and specific objectives. These were published as "National Curricular Standards in Logistics," and Canadian Professional Logistics Institute, 1995.

IC. Intelligent Transportation Systems (ITS)

The effort to harness technology to improve existing transportation systems inevitably involves education. Accordingly, a number of studies have been carried out seeking to identify the nature of the skills required and the degree to which existing educational programs provide them. These studies are particularly relevant, because they are analogous to intermodalism along several different dimensions – both require a concern with (1) systems issues, (2) physical infrastructure, (3) technological innovation, and (4) customer relations.

One typical study, "Building Professional Capacity in ITS: An Assessment of ITS Training and Educational Needs, the Transit Perspective," U.S. Department of Transportation (USDOT), ITS Joint Program Office, April 1999, conducted 70 interviews and identified the following critical skill areas:

- Technological Options
- Creating Organizational Change
- Communications
- Systems Integration

Planning and knowledge required for intermodalism and the degree to which these are being met by educational and training programs, requires a consideration of their context. Accordingly, we studied the state of transportation education generally.

There has been a growing awareness that the rapid changes taking place demand changes in transportation education. The TRB sponsored a number of conferences on this topic. In the "Proceedings of the First

Annual Forum on Transportation Education and Training: Responding to the Changing Needs of the Profession,” TRB Circular # 495, January 2000, the Forum sought answers to the following questions: (1) What factors are affecting transportation and changing education needs? (2) What actions are being taken to respond to the changing environment? And, (3) What do tomorrow’s professionals need to know? The Forum concluded:

- Needs are diverse, include many levels and careers, and are changing rapidly.
- Graduate degree programs for entry-level professionals should consist of a core and electives.
- Graduate certification programs should be developed for mid-level professionals.
- Skills can roughly be divided into technical and non-technical categories.

A follow-up workshop, in which we also participated, was held in the summer of 1999 at the University of Minnesota in cooperation with the Council of University Transportation Centers. Various presentations were made, the most important of which -- from our perspective -- involved a report of the top needs based on 200 interviews. These were essentially the ones identified by the ITS research and included Systems Integration, Organization/Institutional Change, Systems Analysis and Design Applications, Managing Contractors, Financing, Communications (including Wiring Specifications), Planning and Integrating Regional Systems, Coalition Building, Data Analysis and Management.

Notably, the Groups also concluded that: (1) professional degrees, such as MBAs and MPAs are available, but they are not adequately oriented towards transportation needs, and (2) mid-career training is deficient. In short, there is an urgent need to expand peoples’ horizons.

Another important conference we attended was held at the University of Washington, July 15-16, 1999. Entitled “Educating the 21st Century Transportation Professional,” the focus was on using technologies in transportation education.⁴

The Second Annual Forum on Transportation Education and Training was held in conjunction with the January 2000 TRB meeting. A number of experts gave reports on various aspects of the topic. On the basis of our participation, we found the following points to be particularly relevant:

- It is essential to consider that people will be dealing with very different systems than those that exist today. They will be more complex and diverse, and will require different managerial and people skills.
- Education should be differentiated from training in that the incumbent pays for the former and the employer pays for the latter.
- New approaches, such as course modules and web-based learning are essential.
- Industry today is at a real crossroads and the actions taken now will shape developments for the next 20 years.
- Management skills must expand beyond traditional “business” to include ethics, customer service, and strategic partnerships.
- Transportation management, organizational structures, and institutional arrangements need to be revamped.
- Faculties still teach the “Old Transportation.” New textbooks and curricula materials are required, as well as the integration of new disciplines and topics such as technology transfer.
- There are two general categories – professional staff and operating staff – each with its own skill requirements. There is also a need for visionaries – people who understand the “Big Picture”-- and the nature and rate of change that is impacting transportation.

ID. Other Relevant Publications.

⁴ The report is available at the following website: <http://www.depts.wash.edu/transnow>.

A number of other publications also deserve mention. “Innovative Practices for Multimodal Transportation Planning for Freight and Passengers,” NCHRP Report #404, 1998, provides a useful survey of innovative approaches to planning that suggest that new skills will be required by intermodal planners. These include systems management, measurement ability, financing, and public engagement. Descriptions of various educational programs and projects are also to be found in the Jan/Feb 1999 issue of TR News (#200), entitled “Preparing Tomorrow’s Transportation Workforce.” Finally, “National Transportation Science and Technology Strategy,” National Science and Technology Council, April 1999, further emphasized the following points:

- The need to understand technology and technological developments.
- The importance of organizational transformation.
- The impact of globalization on transportation.

Of additional interest are the “Millennium Reports,” prepared by the numerous TRB Committees. Although many mention education, three are particularly significant: (1) “Urban Freight Movement,” by R. Czerniak, J. Lahsene and A. Chatterjee, emphasizing the importance of developing not only new skills, but also new attitudes – if the problems of urban freight are to be resolved; (2) “Intermodal Freight Transportation,” by W. DeWitt and J. Clinger, emphasizing the importance of understanding intermodal operations and procedures, and of technological innovations, especially in the area of information and communication; and (3) *The Report*, by P. Manning, “Transportation Education,” is, of course, the most germane. It makes the following points:

- A shift towards policy areas, away from purely technical areas, is underway.
- Transportation education is a lifelong learning process.
- New technologies are bringing about fundamental changes in teaching methods and delivery systems.
- Globalization is forcing an international orientation.
- Future transportation professionals will need such non-traditional skills as the ability to identify and measure impacts in such areas as the environment, energy and community, and the ability to apply technologies in infrastructure, communications, and product design in a global setting.

Although the authors of *The Report* note that intermodalism represents “another important change,” they do not discuss this issue in any detail – merely remarking that “the needs of the profession in this area offer challenges for transportation education.”

IIA. Data Collection – Industry Demand for Intermodal Skills

Beyond the review of existing literature, data collection involved interviews with leading industry experts, interviews with several intermodal (hereafter, “IM”) stakeholders located in Australia, Malaysia and Japan, and an email survey of transportation professionals. We also undertook two further activities. First, we conducted an analysis of job descriptions in the transportation industry. This was accomplished through a search of job openings posted on company web sites. Several airlines and trucking companies were researched, together with several key intermodal companies, such as FedEx and UPS. In all, 204 jobs were analyzed.

Second, We organized two workshop focus groups, one held in Long Beach CA and the other in Singapore. Some 30-50 persons participated in each, representing government, industry and stakeholders. Participants were asked to define specific IM job descriptions, delineate the tasks to be performed in these jobs, and then enumerate the skills that would be required of an incumbent in those jobs. Combining the output of these workgroups with the prior data collection efforts, we defined a nine-point set of core competencies, required by the IM specialist:

- Understanding Ethical Principles
- Systems Analysis Skills
- Managerial Skills
- Environmental Analysis
- Knowledge of Computer Applications
- Knowledge of Technologies
- Communications Skills
- Knowledge of Different Modes of Transportation
- Knowledge of Planning

These competencies group into four separate categories of skills: Foundational, Analytical, Technical and Interpersonal, and within these categories of competency, a total of 32 separate skills were identified.⁵ In the research methodology, these 32 skills constituted the industry skill demand, against which the supply of educational and training programs would be measured.

IIB. Data Collection – Inventory of Supply of Educational and Training Programs.

We inventoried educational programs offered by universities and training institutions, both in North America and in Asia. Criteria of selection were that the training program be a recurring program of instruction, that it have identifiable intermodal content, and that it be listed and described on an internet web page in the English language, the official language of APEC. For those courses and programs that appeared on our “scopes,” we ascertained the level of study (undergraduate/MA/PhD/diploma or certificate program), the program course requirements, and identification of any intermodal courses. Courses identified in the latter two categories were matched against the 32 skill requirements, to determine on an aggregate and regional basis, the degree to which available programs met identified industry skill needs.

We noted that, in North America, some 13 educational institutions provide training in some fashion, 10% offering certificate programs, 30% bachelor’s degree programs, 40% master’s programs, and 20% doctoral programs. While many of the courses are offered within the context of a larger transportation program, few actually provide course work dealing with IM skills.

No programs were identified within the Latin American economies. That is not to suggest that none exist, but rather that we could not detect them among the information networks that yielded curricular information on all other APEC regions. Among the Asian economies, we identified 101 separate programs of instruction: 10% short courses, 12% certificate programs, 26% bachelor’s degree programs, 27% master’s programs, and 9% doctoral programs. Two-thirds of these program opportunities were offered in only three economies: Australia (34%), Singapore (19%) and Hong Kong (14%).

IIC. Integration of IM Skills Demand and Educational Program Supply.

Several general observations stem from our analysis thus far. Integrating the demand for IM skills in the workforce and the supply of educational programs, the following points emerge:

- Persons applying for positions in the IM industry may develop a wide range of skills through a number of different avenues. Entry-level educational requirements range from secondary school or

⁵ *Foundational Knowledge*: Government Regulations & Policies, Available Transport Technology, Global Business Environment, General Business Environment, Labor Relations, Various Transportation Modes, How Modes Interface, Identification & Understanding of Legal Issues. *Analytical Skills*: Environmental Impact Analysis (Geographic and Human), Economic & Financial Analysis, Policy Analysis, Strategic Planning, Forecasting Skills, Futures Analysis, Systems Analysis, and Ethical Analysis. *Interpersonal Skills*: General Managerial Skills, Customer Service Skills, Communications Skills, Listening Skills, Sales Skills, Coalition Building Skills, Teambuilding Skills, Conflict Management and Negotiation Skills, Leadership Skills. *Technical Skills*: Computer Applications, Technology Management, Modeling Skills, Logistics and Supply Chain Processes, Data Gathering Analysis and Manipulation Skills, Marketing Skills, Transportation Experience.

equivalent or even job-specific skills – such as Aircraft & Powerplant license or a commercial driver’s license – to MBA or Master’s level skills. Skills expected of persons at lower or entry-level positions appear more specifically related to the skills required to perform specific operational tasks.

- However, as one moves up the industry ladder, a person moves from very specific modal tasks to tasks and duties that require more of an IM perspective. These IM skills may be acquired through various mechanisms and programs, job experience, and on-the-job training, on a full or part-time basis. Figure 1 depicts the various avenues of education and training available to the transportation industry in general.
- Entry-level IM skills then, are usually required in positions that are not necessarily “entry level” in the general sense. Most persons at the entry level of intermodal are in fact already established and have expertise in a particular mode. They then seek to augment that expertise with additional training and skill development that will apply to different modes and more complex IM problems.
- The complex interrelationship between skills, position level and type of training is depicted conceptually in Figure 1.

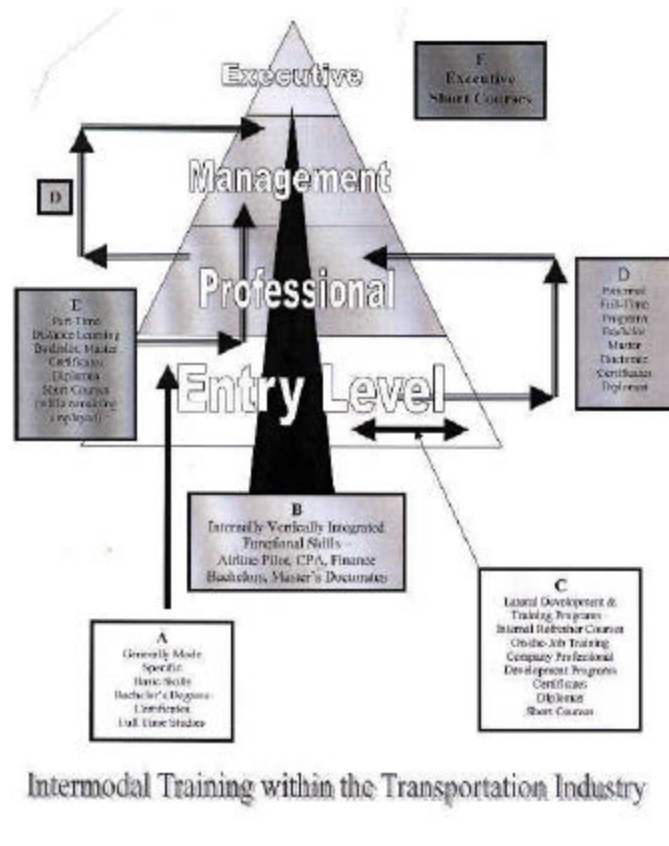


Figure 1

III. Analysis of Training Gaps.

It became apparent that the supply of programs did not meet the demand for skills in any comprehensive or meaningful manner. In short, there are gaps, which we next sought to identify and explore. An overview of these gaps appears below:

Intermodal Skill Categories	Widespread Opportunities	Limited Opportunities	Few Opportunities
<i>Foundational</i>		X	
<i>Analytical</i>		X	
<i>Technical</i>		X	
<i>Interpersonal</i>			X

Table 1

Acquisition of intermodal skills, in the aggregate, is at best limited. If the goal of intermodal skills development is to meet demand with supply, then integrated programs should be provided in locations where individuals have need of training. That is, workers should be able to learn without quitting their employment, and students should be able to gain a complete set of IM skills in one program or course of study in a single location. Unfortunately this condition exists only in a few places. The only locations where a person could probably get all the training needed, without relocating for an extended period of time would be New York, Charleston, Denver, Seattle, Hong Kong, Singapore, Sydney or New Zealand. In some of these locations, well-developed degree programs are complemented by industry-based and commercial training courses, designed to address specialized and often customized, skills development needs.

Despite that, within these centers, even programs that focus explicitly on intermodalism vary in scope and content, and no single university or training program in any APEC economy provides all the necessary skills. While the Report itself considers these matters both on an aggregated and on a regional basis, for present purposes, aggregated data will make the point. Considering 10 of the APEC economies, we identified 121 training programs. The following table shows the availability of training programs by type within the APEC economies.

	PhD	MA	BS	Diploma	Certificate	Short Courses	Distance Learning	Total	%
U.S.	4	8	6	-	2	-	-	20	17%
Australia	1	8	1	9	11	2	2	34	27%
New Zealand	1	3	1	2	-	1	-	8	7%
Taipei	1	1	1	-	-	-	-	3	2%
Japan	1	1	1	-	-	-	-	3	2%
Korea	-	-	-	-	-	1	-	1	1%
Malaysia	2	3	2	-	-	-	-	7	6%
P.R. China	1	4	1	-	-	-	-	6	5%
Hong Kong	-	1	2	6	1	3	1	14	12%
Singapore	1	4	2	9	-	2	1	19	16%
Thailand	1	2	2	-	-	1	-	6	5%
Total	13	35	19	26	14	10	4	121	
%	11%	29%	16%	21%	12%	8%	3%	-	-

Table 2

Within the 121 training programs, we identified a total of 440 courses that had intermodal content – that is, the course title or description was such that we could ascribe it as addressing the 32 IM skills. The following table shows this relationship.

Skills	# of Courses	Skills	# of Courses
FOUNDATIONAL KNOWLEDGE:		INTERPERSONAL SKILLS:	
Government Regulations & Policies	22	General Managerial Skills	21
Available Transport Technology	22	Customer Service Skills	10
Global Business Environment	16	Communications Skills	9
General Business Environment	12	Listening Skills	1
Labor Relations	8	Sales Skills	4
Various Transportation Modes	29	Coalition Building Skills	1
How Modes Interface	24	Teambuilding Skills	4
Ident. & Understanding Legal Issues	15	Conflict Management & Negotiation	6
		Leadership Skills	4
ANALYTICAL SKILLS:		TECHNICAL SKILLS:	
Environ. Impact Analysis	20	Computer Applications	20
Economic & Financial Analysis	28	Technology Management	12
Policy Analysis	12	Modeling Skills	18
Strategic Planning	17	Logistics & Supply Chain Processes	31
Forecasting Skills	6	Data Gathering, Analysis & Manipulation	17
Futures Analysis	2	Marketing Skills	19
Systems Analysis	13	Transportation Experience	14
Ethical Analysis	3		
		TOTAL NO. OF COURSES:	440

Table 3

Overall, it appears that the largest gaps between needed skills and educational and training programs are in the following areas: Identification of Legal Issues, Ethical Analysis, Labor Relations, Intermodal Computer Applications, Intermodal Transportation Experience, Communications Skills, Listening and Coalition Building Skills, Forecasting and Futures Analysis, and Policy Analysis. These were the largest gaps identified. However, further inspection of the results also reveals that there is a shortage of courses dealing with important topics, and that these are often located in only a few member economies. For example, only 15 courses are available that deal with legal issues throughout all of APEC, and 6 of these are in the U.S. The same is true for courses in understanding the global business environment. Thus, it appears that there is a need to enrich existing education and training programs throughout the APEC region.

The foregoing discussion concerned itself with gaps in course offerings. There is another dimension to this gap, and that falls into the realm of educational program/course *availability*. That is, IM skills development courses need to be available to an individual when and where he/she needs it, in progressing up the industry ladder.

Table 2, which shows educational programs by individual APEC economy, is our starting point. While there is some suggestion that diploma courses are available to personnel at all levels of an organization, it is clear that *available* skills training and educational experiences are targeted towards individuals who (1) have already entered the work force in a specific modal area of transportation and are seeking additional training, or (2) individuals who are seeking a college level degree in order to enter the workforce at the professional level.

This is a critical point in understanding one important training gap – namely, expanding the knowledge base for people who perform IM functions within the transportation system, and therefore require skills training beyond the simple entry level. This mismatch between skill upgrading needs and training opportunities for

IM transportation is distinct from the relationship between entry-level skill needs and training availability within the traditional modal transport sector.

Consequently, *in terms of intermodal careers*, there is still a training gap for skills needed at the *entry level of intermodal transportation* – that is, when people make the leap from traditional modal transportation work to IM operations, planning, management, etc. That set of “entry level” (or “foundational”) IM skills is still in shorter supply than some of the advanced IM skills development opportunities. This state of affairs is depicted below, in Figure 2.

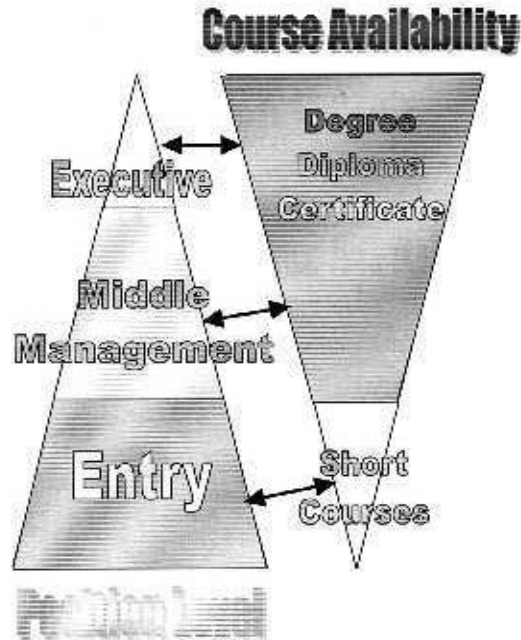


Figure 2

Additionally, Figure 2 illustrates that, while entry into the transportation industry comes through modal expertise originally, persons who are developing “entry level” IM skills generally begin receiving training through specific short courses or some type of on-the-job training. Additional training experiences are generally provided to middle and executive level personnel through college courses and degree programs.

Table 4 Availability of training experiences by degree level and by region

Degrees	Level	NA (US, Can)	LA (Mex)	Oceania (Aust NZ)	Asia-Developed (S, HK, T, J)	Asia - Developing (C, M, T, K)	TOT	%
BS and above	Exec	18		15	16	18	49	40%
Diploma	Middle			11	15	0	26	21%
Certificates	Entry	2	1	11	1	0	12	10%
Short Courses	Entry			3	5	2	10	8%

Distance Learning	Entry			2	2	0	4	3%
Total		20	1	42	39	20	122	
%		16%	1%	34%	32%	16%		

Inspection of Table 4 shows that in certain regions of APEC, there is greater availability of training programs for certain positions within organizations than with others. For example, 40% of the course offerings and programs containing those offerings are targeted towards persons who *already have an undergraduate degree*. In many economies this is the educational background required for a middle or upper level management position.

The foregoing analysis may be summarized succinctly: *It appears that the preponderance of intermodal skills training is targeted towards middle and upper middle management level, and not at the entry level professional.*

IV. Conclusions.

It should be kept in mind that the APEC member economies represent a cultural, educational, and socio-economic diversity, whereby there are no common solutions even to relatively identical problems as between economies. The best that can be offered are general guidelines that may be used in defining particular solutions within individual economies. Accordingly, the conclusions reached by the Report purport to be general guidelines, addressing both the skills needs in a complex and changing intermodal environment, and the form, format and content of programs to meet those needs.

IVa. Changing Skill Needs in the Intermodal Environment.

- General Competencies

The intermodalist is primarily concerned with integrating the dynamic process of transportation across time and space.

The general competencies required of the IM specialist are not dissimilar from those required in mode-specific jobs. However, because intermodal positions by definition include several modes, the intermodalist needs not only those general competencies, but also the ability to apply them in a more comprehensive setting.

The intermodalist integrates the dynamic process of transportation across time and space, which requires the application of managerial, analytical and interpersonal competencies in a variety of settings, with a variety of different constituencies, and at varying levels of responsibility. Hence, IM requires a wide range of both new and existing skills.

- Operations Management

New basic skills will be required to design, operate and manage the new and emerging intermodal system.

While many of today's managers are self trained at making the best links and throughput in a system that is based upon separate modes, future managers will need new skills to optimize the use of purpose-build intermodal infrastructure. Both now and in the future, the tasks of these individuals were seen as "defining constraints and devising solutions to those constraints." But, the nature of those constraints is very likely to shift from those internal to today's transportation system (e.g., poor air-rail-transit connectivity in intercity passenger transport, or poor ship-rail-truck

connectivity in freight) to external constraints in tomorrow's systems (e.g., energy costs/availability, greenhouse gas limits, social equity constraints on "externalities").

- Planning and Development

The effectiveness of future intermodal systems will depend upon the ways in which new participants become engaged in planning their design and operation.

If such engagement takes the form of partnership among stakeholders who share in the economic, environmental and social benefits generated by intermodalism, then IM systems will be poised to achieve their full potential. But, if future engagement takes the form of adversarial disputes over the degree and distribution of burdens and costs associated with intermodalism, then a formidable barrier will stand in the way of achieving intermodal systems' potential. Based upon available evidence, it appears that the skills needed to solve problems arising from the mismatch between today's IM needs and existing facilities and practices will not, in themselves, create a capacity to unlock the potential of future IM designs and operations. If, for example, tomorrow's e-modal architects, planners and managers lack key skills in developing innovative financing mechanisms, in nurturing productive partnerships between public agencies and private firms, and in solving environmental problems, then the future airports, ports and other modal interchange points will cost more and deliver less. The payoff from developing future IM skills is thus a high one.

- Future Skills Needs.

As intermodal transportation systems evolve, one must upgrade the level of intermodal skills, while attending to future skills needs. If this is not done, then the skills gap between APEC member economies will increase.

The competencies required of the IM specialist are influenced to a significant degree by the nature of the economy and the pattern of development of intermodalism in a particular society. The workshops demonstrated the importance of developing individual programs to meet the specific needs of the member economies. At the same time, one must pay attention not only to the skills required to upgrade the level of intermodalism in those economies where basic skills are still inadequate, but also to their future needs. If this is not done, then the gap between the member economies will increase as intermodal transportation systems are evolving rapidly with new technologies and globalization. Therefore, it is essential not only to focus upon enhancing the knowledge and skills of important IM actors in particular economies, but also to train individuals for tomorrow's skill needs. It follows that policy makers and senior managers must have a keen awareness of the role that IM plays today and its future potential.

IVb. Development of Training Programs and Curricula to Meet Future Skill Needs.

- Development of Training Programs.

Training programs should be developed that possess the following characteristics: basic skills and technical competencies at entry level, intermodal planning and organizational skills at management level, strategic design and development skills to top level administrators and officials, and key interpersonal skills at all levels. The level of skills training must be carefully designed in order to meet specific needs, as determined by the level of responsibility within an organization, the region of the world, and the level of development of the specific economy's transportation system.

- Educational Institutions

Even in economies with the largest number of training opportunities, few programs provide students with the integrated and coherent experience needed to develop the skills required.

Existing educational programs meet some of the above needs to a greater or lesser degree in almost all economies. Yet, the number of programs that focus upon intermodalism is quite limited even in the most advanced economies. There, numerous programs in engineering, logistics, business and transportation provide the basic skills. Further, policy makers are sensitive to the opportunities of intermodalism and its future development. Remarkably, even in those economies, few programs provide students with the integrated and coherent experience needed to develop the skills required by what has been called the “new science of intermodalism.”

Many of the disconnected sources for skills acquisition that are in place across many of the APEC member economies cannot generally offer IM knowledge and develop IM insights for all positions in the workforce. In a few rare cases, programs exist that go beyond the level of imparting specific technical, administrative or planning skills, and enabling their students to appreciate how the pieces of the IM puzzle fit together. Additionally, there are many international governmental and non-governmental agencies, as well as private sector organizations, that now play an important role in specific skills training. At the same time, it is clear that the provision of more advanced and integrated skills will require the development of domestic educational capabilities that do not presently exist in many APEC economies.

- Curriculum Development.

It is necessary to integrate a general conceptual understanding of the various modes with a practical understanding of their capabilities, strengths and weaknesses.

This involves a coherent stepwise skill development model that can be implemented through a range of educational activities, including short-term courses, workshops, work-study programs, practica and internship experiences, as well as traditional degree programs. To accomplish this, educational institutions will need to form partnerships with government and the transportation industry.

What is required is the development of a range of educational activities that include short-term courses, workshops and undergraduate and graduate programs, all incorporating practical application of the skills being transmitted. In addition to a sequential skill development program, there is also a need for a *coherent skill development model*, a template or master document endorsed by key groups. Therefore, it would seem appropriate that groups representing all the dimensions of intermodalism including logisticians, freight forwarders, marketing, operators, infrastructure providers, regulators, carrier, shippers and planners, be brought together with a group of academics, to discuss such a template. Such a meeting could be convened under AEC auspices.