# LOGISTICS and SOCIO-ECONOMIC ISSUES IN GLOBAL TRADE

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**Key words: constraints, economic development, institutions, logistics, trade and transportation patterns**

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## Abstract

*This paper looks at logistics, international trends, and underlying trade constraints. It discusses global logistics issues in international trade and the structure of transaction networks by looking at the underlying constraints. This includes the varying physical and legal infrastructures that can result in changing flows and patterns in the world trading system. Structural change in the global economy has resulted in new information technologies that have provided the world's producers, service companies and agencies with a new model for global commerce. Technological advances in computer and communications hardware and software are reducing costs while providing a more "user-friendly" interface. These changes along with innovations in transportation technologies have allowed manufacturers to reduce inventories and to produce components in lower cost regions of the world. New markets for labor, goods, materials and services along with advances in electronic commerce, logistics, supply chain management and intermodalism is fostering an increase in global trade that is challenging many regions of the world.*

## Introduction

### *Globalization and Structural Change*

Over the last several decades, the world has seen tremendous global structural change take place. The emergence of new economies, political boundary changes, new trading blocks and trade organizations, along with advances in communications and computer technologies has been facilitating the growth of world trade at a rapid rate. The merger of these two technologies has taken us well into a new era of information technology that is helping to create new trade and transportation patterns. These technologies, the cell-phone, EDI, the Internet, and the World Wide Web are making the management of all forms of trade, both domestic and international, easier through improved logistics and supply-chain management practices as well as creating a new form of trade by means of "electronic commerce." This along with other new transportation technologies, GPS (global positioning systems) and ITS (intelligent transportation systems) is making it easier for firms to "out-source" and to have components and goods shipped from distant points on the globe, where costs are lower, to arrive "just-in-time" at assembly sites and distribution centers. This paper addresses how

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global commerce impacts different regions of the world in different ways and implies that new institutional arrangements are needed in order for regions to develop and be sustainable.

### *Production and Distribution*

The role of transportation, logistics, and supply chain management has become much more important as factories have been moving from vertical integration where most production operations used to take place in-house, to horizontal integration where those in-house operations are being sub-contracted or out-sourced due to innovations and improvement in technology. It used to be that the movement of goods and materials between production operations in a vertically integrated manufacturing facility took place on the factory floor by forklift. Now with horizontal integration those same movements of goods and materials are taking place on roads, airways, and over the sea, moving from one mode of transportation to another. Trucks, trains, airplanes, and container ships are now taking over the role of the forklift in the warehouse as goods and materials move globally putting more freight on region's roads causing congestion.

## Goods & Materials

This paper is about the movement of goods and materials by the shipping container. The shipping container has enabled the world to trade goods and materials on a scale that was unimaginable just a few decades ago and is growing rapidly with volumes expected to double in the next 15 years (see Figures 1 and 2 in the Appendix). Steamship companies employ special ships to transport containers between continents. In order for these marine carriers to cope with increasing volumes, they have moved toward economies of scale in vessel design resulting in larger ships calling on fewer ports. These emerging "hub" ports have had to make capital infrastructure improvements to accommodate the larger vessel's carrying capacity. These hub ports are also usually engines of economic growth for the regions they serve and are highly motivated to accommodate these larger ships.

Container shipping is mostly intermodal and is complex when considering the international shipments and modal shifts or transfers that frequently take place. Unfortunately these larger container vessels also put heavy demands on the region's landside intermodal connectors causing road and rail congestion and environmental problems during peak periods of loading and unloading containers.

## Geography of Global Commerce

### *Changes In Global Transportation Patterns*

As manufacturers move to lower labor cost regions as a result of out-sourcing or a product's life cycle maturing in one location, new trade and transportation routes often develop. Most recently there has been a shift in the location of manufacturing centers from East Asia to South East Asia (see Figure 1 in the Appendix) and now back again with China's ascension into the WTO. These shifts show the impact on transportation routes, regions, and ports throughout the world. Much of the trade that impacts the global economy and its transportation systems moves by various modes with its origin and destination in the Asia Pacific region as shown in Figure 2 in the Appendix. To better understand the flows and emerging patterns of global commerce, it requires looking at those elements that make

constitute the broader transportation system and its development. These include intermodalism, logistics, supply-chain management, and value-added facilities as well as communications, education, and transportation infrastructure. These are elements of a system that can foster economic development and growth. This global trading system may also induce regional problems.

### *Physical Constraints*

The commissioning of larger containerships is forcing port communities to deepen channels, devote more land to container operations, build on-dock rail connections and make other investments to remain competitive, especially if they want to become a hub port. The costs are staggering. Environmental and land use constraints are impinging on ports ability to make capital investments and the peak volumes of containers projected to move through ports on and off these mega containerships threaten to increase congestion, and even nullify the efficiencies that the shipping lines are attempting to achieve through these large capacity vessels.[1] It is predictable therefore, that the number of post-Panamax vessels (too large to pass the Panama Canal) calling at hub ports will increase but also smaller vessels needed for feeder services among small ports and serving hub ports will also increase which may provide logisticians and supply chain managers with alternate transportation choices.

### *Site and Situation*

Geographers have used the concepts of site and situation for many decades in their studies of cities, seaports and airports. These concepts, along with that of growth centers, and technological change, provide a useful systemic framework for looking at why some regions are able to have sustainable growth while others are unable to do so.[2] A site is defined as the absolute location of a place or activity and is described by local relief, landform, and other physical (or sometimes cultural) characteristics.[3] It is the ground or area upon which a town, factory, dwelling, etc. has been built or on which an activity takes place as seen in Figure 7 of the Appendix.[4]

Situation refers to the relative location of a place or activity with respect to the physical and cultural elements of the larger regional or other spatial system of which it is a part.[5] Situation is 'horizontal' and functional, referring to regional interdependencies such as accessibility to factors of production, to markets, or strategic location relative to both inputs and markets. The location of intermodal transportation systems (infrastructure and operations); education centers (including intellectual infrastructure); and value-added as well as distribution and logistics facilities are some examples of situational phenomena. Figure 7 in the Appendix illustrates the levels of resources in a region and their relationship to site at the

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[1] Browning, Jess (Ed.), "The Jumbo Barge Carrier: An Ocean Transportation System for the Twenty-First Century," A monograph and working paper, (July 2003) that was compiled in part from discussions with Tornqvist who patented the system in March 1998.

[2]. Fleming, Douglas K. "A Geographical Perspective of the Transhipment Function". IJME, 2000, Volume II, Number 3, 163-176

[3]. Fellman, Jerome, Arthur Getis & Judith Getis. Human Geography: Landscapes of Human Activity. Dubuque, IA: Wm. C. Brown Publishers, 1990.

[4]. Goodall, Brian. The Penguin Dictionary of Human Geography. New York: Viking Penguin, Inc., 1987.

[5]. Fellman, Jerome, Arthur Getis & Judith Getis. Human Geography: Landscapes of Human Activity. Dubuque, IA: Wm. C. Brown Publishers, 1990.

micro level and its situation at a given point in time. The macro level is the region's relationship to other regions and to the global economy by various modes of transportation and methods of communications. Figure 7 also shows the relationships of site and situation showing factor flows, product flows, and inputs and outputs (imports and exports) in the regional system. In order to bring these resource elements, market flows, and technological change into perspective a conceptual framework is helpful, but first it is helpful to examine some examples of what is being done to improve a site's situation in promoting regional development.

## Economic Development and Impacts

Changes in transportation infrastructure have always shaped commercial location and regional development. With regard to the 5 waves of technological evolution related to transportation that have taken place over the last 250 years, Kasarda states that the first wave involved seaports; the second river and canal-based development; the third railroads; the fourth highways; and the fifth airports. He states that the fifth wave basic drivers are large, high-speed jet airplanes; advanced telecommunications; globalization; new supply-chain management systems; time-based competition; production flexibility and mass customization; perishability (economic as well as physical); and survival of the fastest and most agile.[6]

### *Efforts to Create Logistical "One Stop Shopping"*

Freight transportation centers usually have evolved for the purpose of integrating multiple modes of transportation with the goal of increasing logistical efficiency in trade. They are designed and created to minimize the affects of today's complex international logistics systems. Value added facilities are and important element in these "one-stop-shops." They are designed to modify in some way a product that is in transit traveling from a point of origin in one location to a destination at some other location. A value-added facility is usually located either in or nearby a transportation center in order to take advantage of several of transportation choices.

### *Linked Business Clusters*

In promoting regional economic development activities, business clusters may be linked to a mix of multimodal facilities including freight forwarding and third-party logistics; e-commerce fulfillment centers; transformation (or value-added such as kit-making, subassembly, sequencing) and flow-through facilities; just-in-time manufacturing; perishables and refrigerated facilities; high-technology industries; business services; and regional headquarters offices.[7] A large-scale example of this kind of effort may be seen in Korea. The Korean Government wants their country to become the business and logistics hub of Northeast Asia. As part of this long-range goal, the Incheon region is developing the pentaport concept, which consists of, five ports in one: Incheon International Airport, Incheon seaport, plus a leisure port, a tele-port, and a business port. Incheon International Airport has been designed to be a hub airport of Asia; the Port of Incheon, serves as the gate to the Metropolitan area from the Yellow Sea. The region is developing a coastal industrial park, a

[6] Kasarda, John D. Director, "THE AEROTROPOLIS: Airport-Driven Commercial Development", The Kenan Institute of Private Enterprise, Urban Land Institute (ULI) Europe Summer Conference, Airport and Rail Centres: Emerging Property Development Opportunities 20 June 2002, Amsterdam, The Netherlands.
[7] . Ibid

customs free zone locating a logistics park, and a new area which is destined to be the future silicon valley of Korea. Its universities will provide the academic and educational infrastructure to meet its development needs.[8]

Clustering such as this enables a region to grow as developments progress in the creation and or improvement of logistics, value-added, distribution, and education facilities along with improved intermodal linkages to enable passengers and freight to move seamlessly from one mode to another as well as improved communications and information networks. It also requires giving support to foreign companies and foreign investors that want to do business in the region. Providing education and training facilities is also important. For example, fundamental economics, an understanding of modes of transportation, geography and cultural learning, data transfer and e-commerce, government regulations and customs, distribution and delivery to customers, costing and pricing, forecasting the business, and supply chain dimensions are elements that should be in curriculum for the education and training of logistics managers. All of these efforts require consideration of involvement by various institutions, both formal and informal.

### *Institutional Constraints*

Douglas North (Economics Nobel Prize winner 1992) states that institutions, both formal and informal provide the rules, enforcement characteristics of rules, and norms of behavior that structure repeated human interaction. Institutions are an element of the socio-institutional or *decision and organizational environment* shown in Figure 7 in the Appendix. They can facilitate or hinder market processes. He also states that institutions may foster productivity if they promote low transaction costs through the use of reasonable rules and norms of behavior. Conversely, they may limit productivity if they promote high transaction costs through the use of unreasonable rules and norms of behavior.[9] Information can be used to modify uncertainty to conditions of risk - that is, the more one knows the better chance he or she has of making the right decision. Partnerships are needed in the right kind of institutional framework to lower transaction costs - to make it easier for stakeholders in large projects of regional and/or national interest to come together on decisions that will benefit all parties. This is possible if the stakeholders use norms, rules, and behaviors that facilitate cooperation, along with risk sharing, and have sufficient information and decision-making capability available to select infrastructure projects that financiers will be willing to fund and that will promote regional economic growth. Transportation infrastructure is an important element in consideration of economic development.

[8] Browning, Jess, "Development of Logistics and Transportation Systems in Promoting Trade & Economic Growth: Comparing Incheon and Seattle Areas," Korean Observer, Autumn 2003. The author discusses Professor Fleming's geographical concepts of SITE and SITUATION and describes the Pentaport model as being able to enhance the Incheon's situation with regard to trade in North East Asia.

[9]. North, Douglas. *Institutions and Economic Growth: An Historical Introduction*. In World Development, vol. 17, No. 9, 1989. p.1321.

## Transport Modes: The Intermodal Transportation System

There are six basic modes in transportation - air, marine, rail, truck, pipeline, and lastly space. Freight and containers moving on these different modes, often switching between them is called "intermodalism". Figure 6 in the Appendix illustrates modal shifts in international trade. Intermodalism's growth goes back to the innovation and emergence of containers. An intermodal system has two broad categories: 1) Equipment (containers, vehicles, and terminals), and 2) Information and communication services. The intermodal transportation system is shaped by at least 3 forces: 1) new and emerging technologies, 2) fast changes in markets and trading patterns, and 3) deregulation and regulation. Other factors shaping the system are international boundaries and customs procedures, supporting infrastructure and the efficiency and effectiveness of labor. Logistics plays an important role in the transport and storage of goods and materials.

## Logistics

Logistic management can be defined as, "the science of balancing the storage (stocks) and movement (flows) of inputs and outputs to meet demand, and minimize total cost while delivering increased efficiencies,"[10] Logistics and value added facilities along with improved intermodal transportation systems can facilitate increased trade and economic growth within a given region. In today's global information economy, one needs to look at the broader system to understand how global structural change and new technologies are impacting regions. Economic, social, cultural and environmental considerations are very important. In the movement of things "just-in-time" and in the integration of corporate international operations, landside access and freight mobility is also important in considerations of logistics and supply-chain management. There are many elements in the delivery system that to be considered in understanding international logistics and supply chain management. Information is one good example. An illustration of the supply-chain in Figure 5 of the Appendix shows how lack of information amplifies demand and inventories at various points moving from the end customer or final destination back toward the origin in the supply chain.

Internet technology is speeding the flow of material through the supply chain, increasing response to consumer and business demand, and delivering new products to market faster than ever before. Dynamically linked via the Web, software enables one to quickly receive critical information, such as real-time freight quotations, most cost efficient modes of transportation, and confirmed shipping dates, ensuring that a supply chain functions smoothly and efficiently. Figure 6 in the Appendix illustrates how new information technology, the Internet, the Web and EC or electronic commerce tools can simplify, couple and improve operations as goods move from the origin to destination within the supply chain.

## A Systems Approach

Bringing a global perspective to a region's trade and transportation system offers challenges and opportunities to create facilities of strategic importance in the flow of goods, materials and people both locally and globally. In order for academics, planners, policy makers, and leaders to better understand the processes involved in creating such a facility, it is helpful to use a systems approach. One needs to consider the broader system and all its supporting

[10] DOTARS, "Freight Logistics in Australia: an agenda for action," June 2002, p5

elements such as logistics, intermodal operations and infrastructure, rail carriers, trucking, air carriers, marine carriers, new technologies, systems integration, supply chain management, information systems, electronic commerce, contracts, just-in-time delivery, and security and customs, as well as education and research, plus ancillary service and production facilities. One also needs to consider the driver in the system, the "customer's needs" which includes service reliability, cargo visibility, tracking and tracing, accurate documents, cargo consolidation, and business logistics services including supply chain management. It is important to have an understanding of the emerging global trade and transportation patterns. It is also useful to develop a conceptual framework that identifies the emergent forces that may come to bear on a region and its development.

## Conceptualizing Regional Development

Regional economic activity reflects the interplay of a wide variety of elements in firms and industries including but not limited to employment, investment in technology, use of innovations in products, and processes, internal economies, external economies, and diseconomies, access to factors of production and markets, multiplier effects, behavior of individuals and firms, external markets, and structural change over time and space. A conceptual framework can be used to make policy recommendations for logistics facilities development more explicit and meaningful. The conceptual framework shown in Figure 8 of the Appendix illustrates how possible interaction between economic theory, forces of influence, and policy decisions with the role of technological change may impact a region over time. In conceptualizing the development and growth of a region over time, it is helpful to consider the attributes of site and situation using a conceptual framework to conjecture what scenarios will play out as differently trained people make policy decisions, all the while, markets and technological change are impacting a region and affecting its ability to compete in the global economy.

## Summary

Structural change in the global economy has resulted in new information technologies that have provided the world's producers, service companies and agencies with a new model for global commerce. This model has brought with it a new management style that is being adopted at different rates by various organizations in regions all over the world. Information of all types can now be transmitted and authenticated rapidly over long distances. Technological advances in computer and communications hardware and software are reducing the cost per user while providing a more "user-friendly" interface and speeding up the adoption process. These changes along with innovations in transportation technologies have allowed manufacturers to reduce inventories and to produce components in lower cost regions of the world. Components, goods, materials, and people can be transported great distances at low costs on reliable schedules. Political changes and international investments in many regions of the world have opened up new markets for labor, goods, materials and services. This along with advances in electronic commerce, logistics, supply chain management and intermodalism has fostered an increase in global trade that is challenging many regions.

Huge investments in transportation infrastructure and related facilities are needed which also provides multiplier effects, increasing trade and exacerbating congestion problems until the infrastructure and operational improvements are completed. Individual governments and firms are generally unable to provide the funds needed for this kind of investment. As a

result, a new era of cooperation and partnership must emerge whether it is to create a regional logistics facility, a growth center or to solve regional transportation problems. In either case it requires new institutional arrangements. The principle stakeholders benefiting from regional infrastructure improvements need to be identified and made partners in the project. They should be as aware of their share of responsibility as well as their return (benefits) on investment. As partners, they will be committed to developing revenue sources for investment in transportation infrastructure projects to improve freight mobility. This is possible only if the stakeholders use norms, rules, and behaviors that facilitate cooperation, along with risk sharing, and have sufficient information and decision making capability available to select infrastructure projects that financiers will be willing to fund. It may be that a region cannot build enough infrastructure and facilities to achieve their goals and will need to look for management solutions and new technology to foster improvements in their existing system. In either case, the decision analysis must be done in the context of the larger system and in consideration of technological and structural change.

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DOTARS, "Freight Logistics in Australia: an agenda for action," June 2002, p5

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## APPEDIX

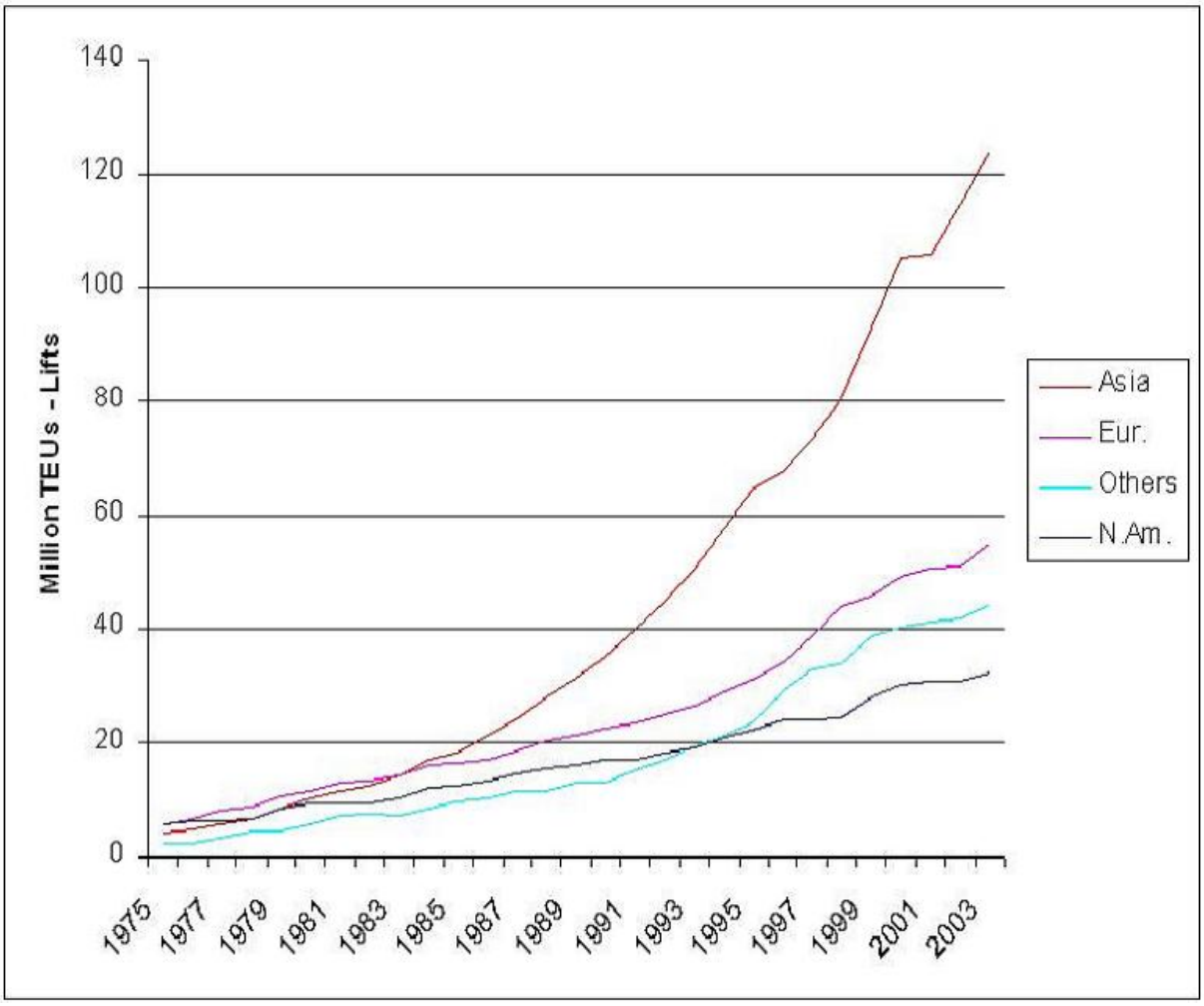



**FIGURE 1: World Container Volumes**

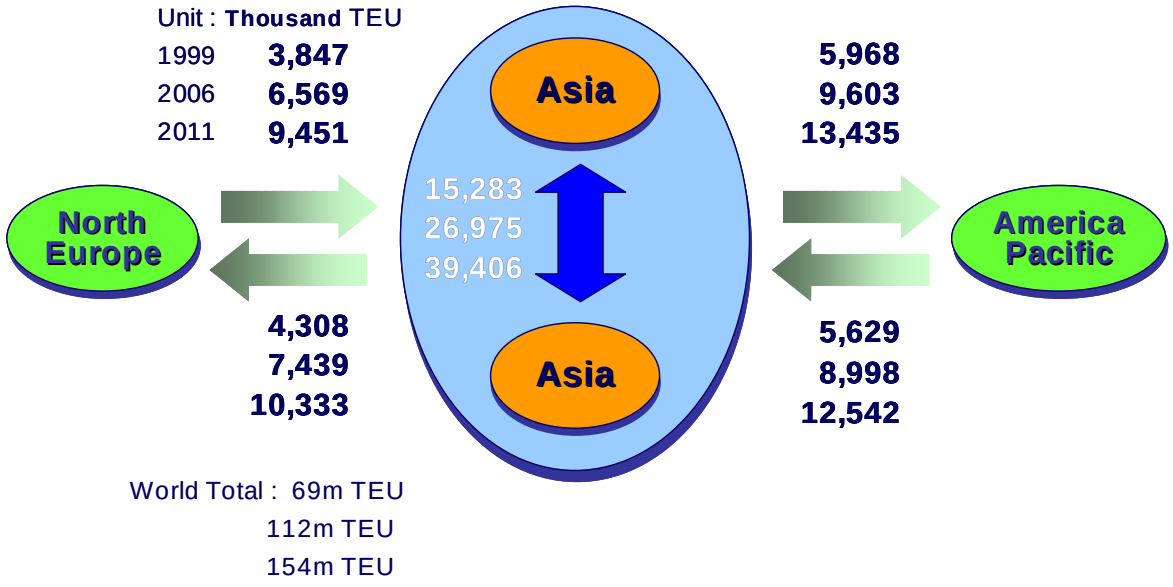



**FIGURE 2: World Container Flows**

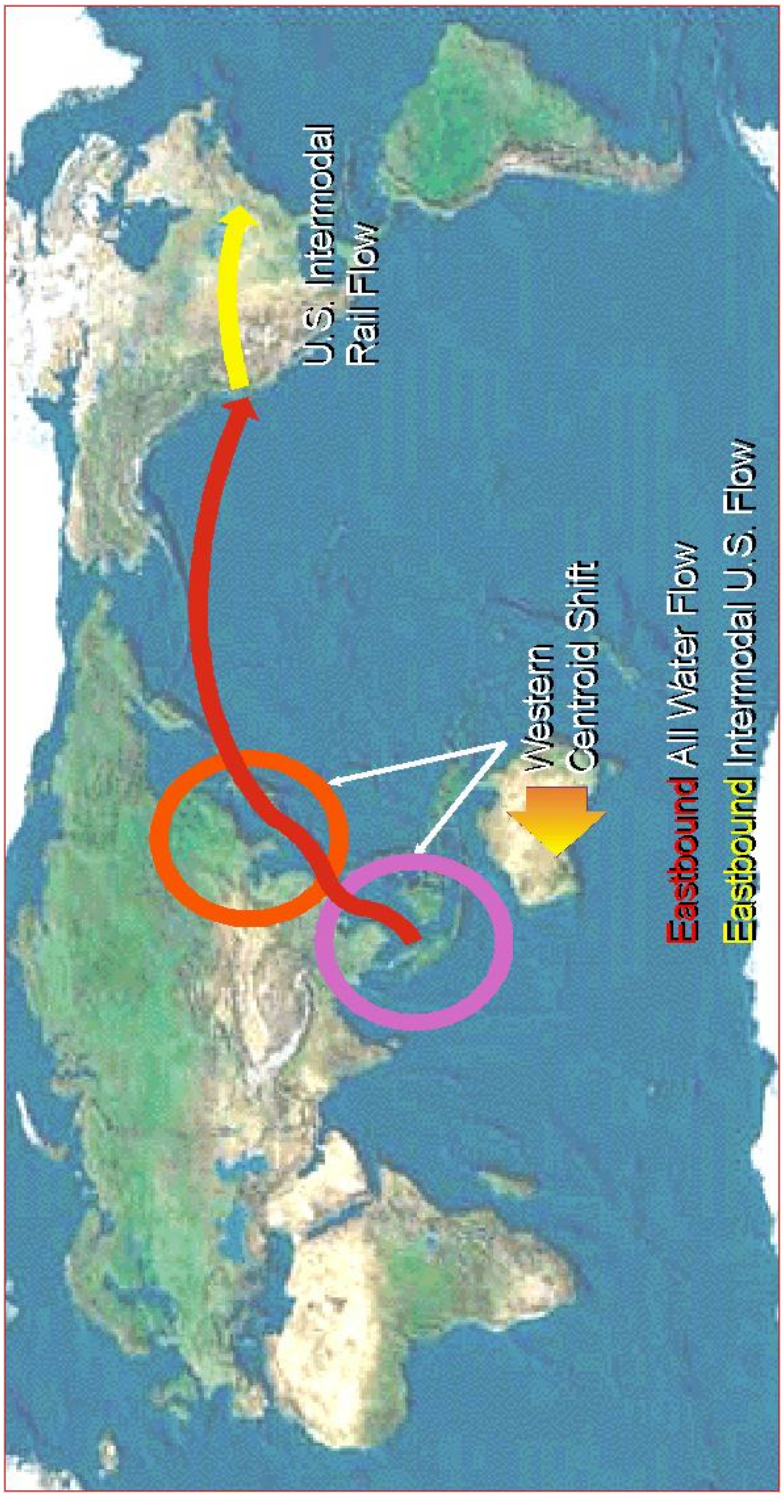



**FIGURE 3: Changes in Global Transportation Patterns**[11]

[11] Planet Earth by World Sat International Inc., 1998 and graphics by TranSystems Corportation.

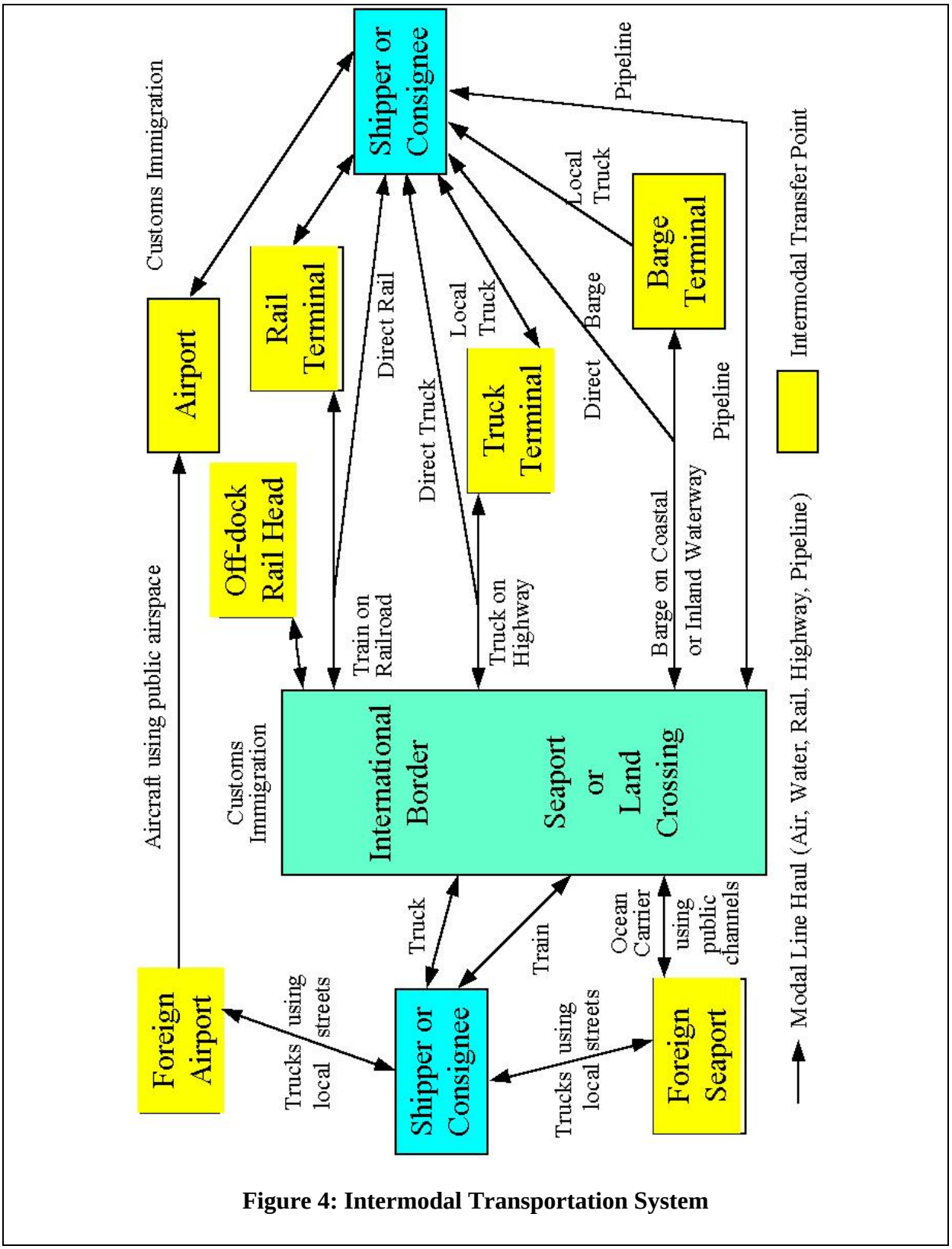



**Figure 4: Intermodal Transportation System**

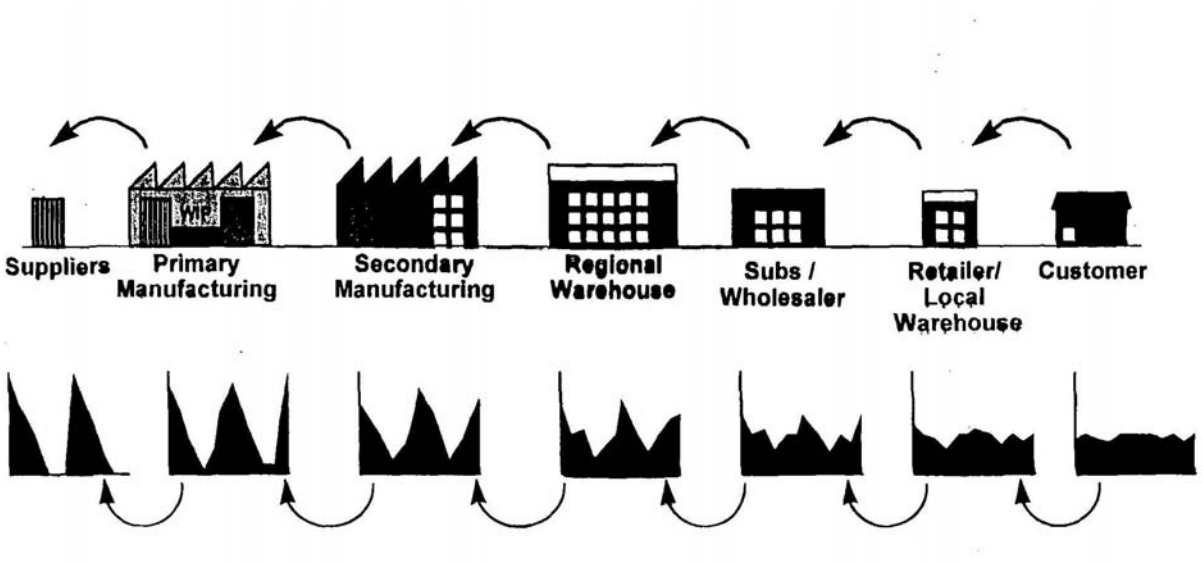



**FIGURE 5: DEMAND AMPLIFICATION**[12]

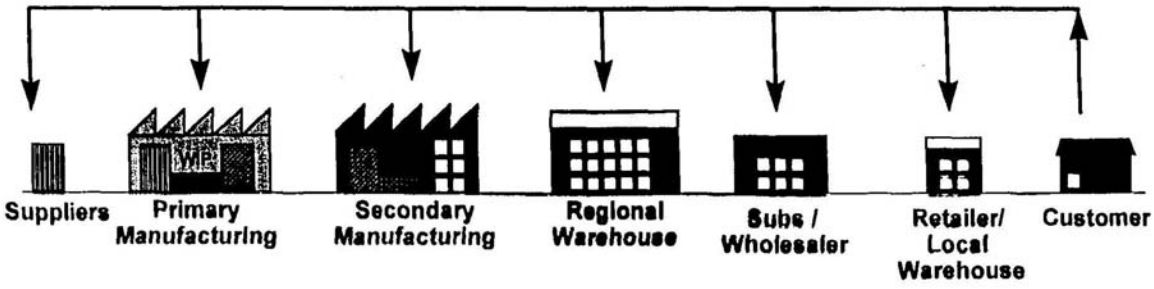
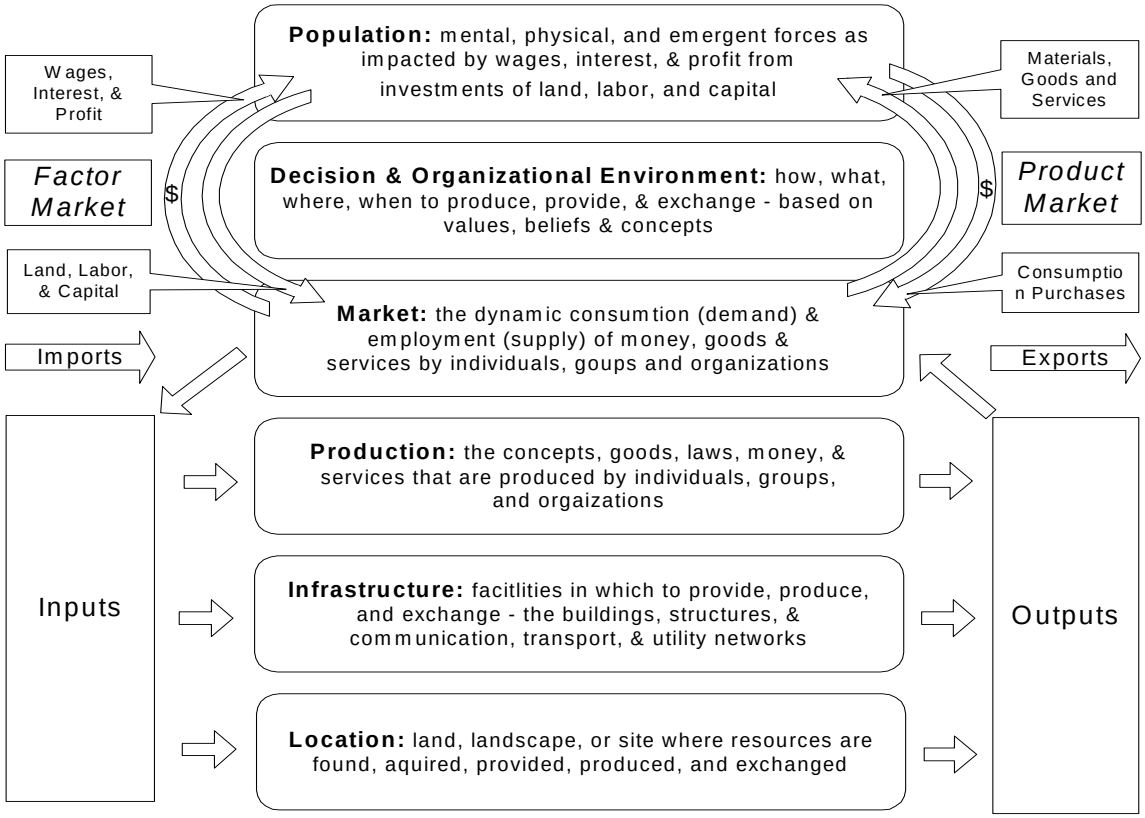



**FIGURE 6: SIMPLIFYING AND COUPLING THE SUPPLY CHAIN**[13]

[12] Schmitt and Bevers, Supply Chain Management, UofW Business School, 1998.

**SITE**




**SITUATION**

**Relative Location**: A region's location of place or activity with respect to the physical and cultural elements of the larger system

**External Relationships, Interconnection and Interdependencies**: A region's tributary hinterlands with overseas forelands and with other ports, both competitive and cooperative, etc.

**Accessibility:** A region's access to factors of production, or to its markets, or strategic location including its access to value-added as well as distribution and logistics facilities.

**Transportation linkages:** Intermodal transportation system including infrastructure, facilities and operations management.

**Institutional Linkages:** A region's education centers (including intellectual infrastructure)

**FIGURE 7: SITE AND SITUATION RELATIONSHIPS[14]**

[13] Ibid.
[14] Jess Browning, "Regional Development, Technological Paradigms and Policies," Seattle: University of Washington, June 1995.

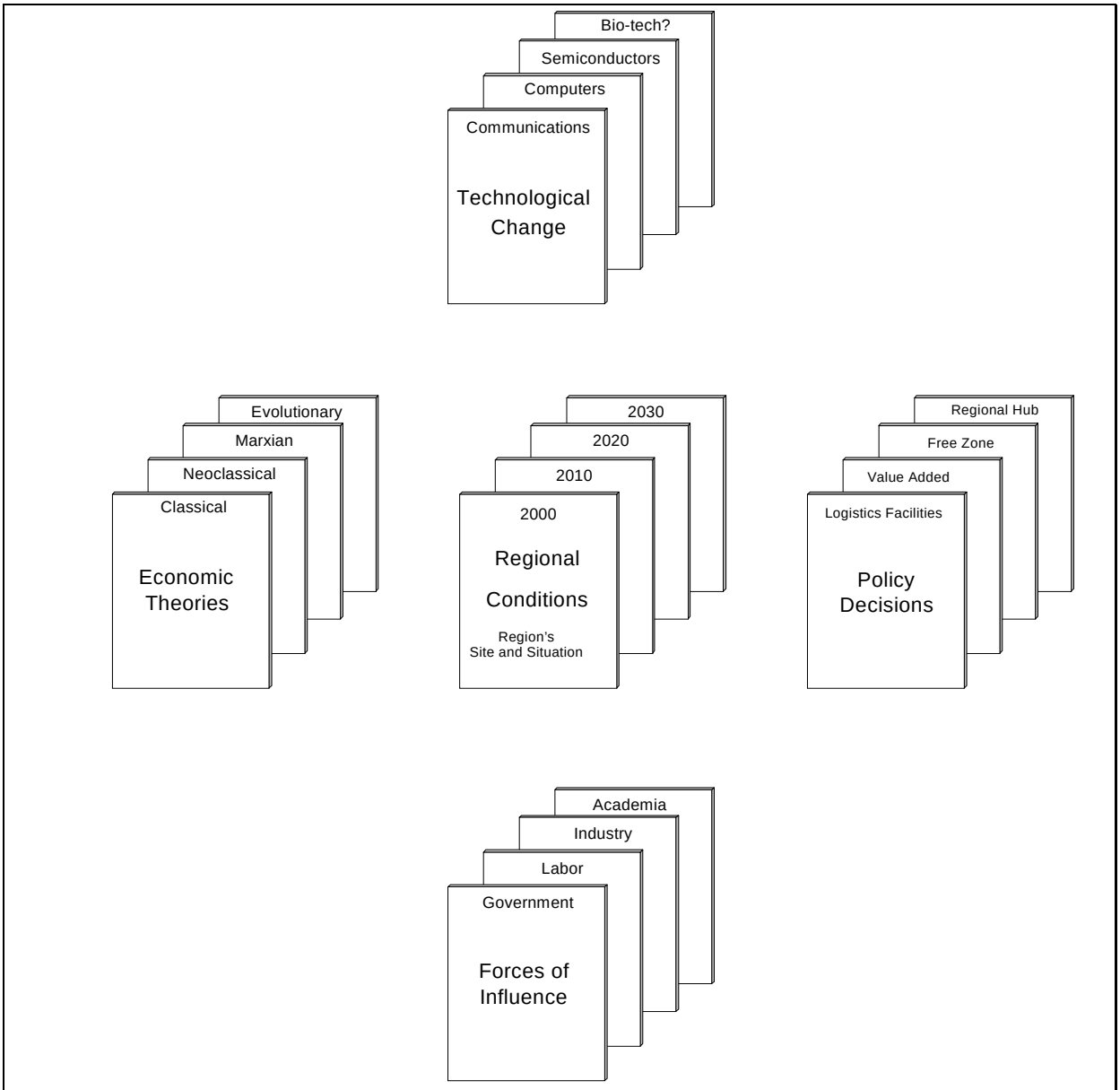



**Figure 8: A Framework for Conceptualizing Regional Processes**[15]

[15] Browning, Jesse H. "Regional Development, Technological Paradigms and Policies" Seattle: University of Washington, 1995