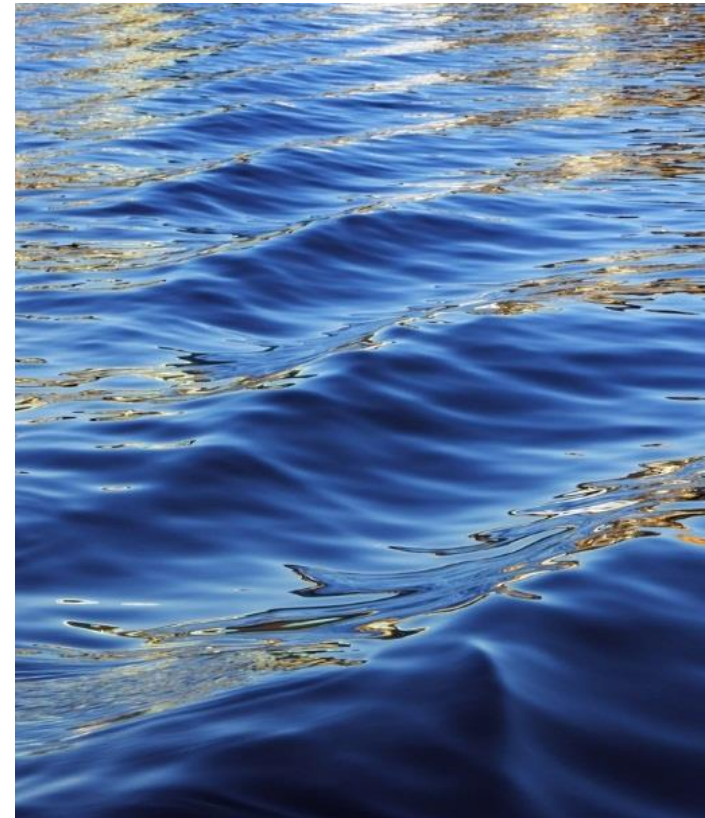


Adaptive Logistics for Flexible Resilient Supply Chains



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Need for Adaptive Logistics



1. Need for Adaptive Logistics

As highlighted by headlines such as “Supply Chains Must Become Less Efficient”

<https://www.forbes.com/sites/suzytaherian/2020/05/12/covid-shortages-supply-chains-must-become-less-efficient/>

it is becoming increasingly evident that focusing on efficiency can lead to supply chains being vulnerable to changes in the environments in which they operate.

Hence, supply chains need to be flexible and resilient to be able to adapt to changing environments

1. Need for Adaptive Logistics

Flexible

“Flexible supply chains are able to adapt effectively to disruptions in supply and changes in demand whilst maintaining customer service levels”

Stevenson, M. and Spring, M. (2007) Flexibility from a supply chain perspective: definition and review. International journal of operations & production management, 27(7), .685-713.

Resilient

“The adaptive capability of a supply chain to prepare for and/or respond to disruptions, to make a timely and cost-effective recovery, and therefore progress to a post-disruption state of operations – ideally, a better state than prior to disruption”.

Tukamuhabwa, B.R., Stevenson, M., Busby, J., and Zorzini, M. 2015. “Supply Chain Resilience: Definition, Review and Theoretical Foundations for Further Study.” International Journal of Production Research 53(18), 5592–623

1. Need for Adaptive Logistics

“Logistics is that part of the supply chain process that plans, implements, and controls the efficient, effective flow and storage of goods, services, and related information from point of origin to point of consumption in order to meet customers’ requirements”.

Council of Logistics Management 1998, cited in Rutner, S.M. and Langley, C.J. (2000) Logistics value: definition, process and measurement. *The International Journal of Logistics Management*, 11(2), 73-82.

Logistics enables the operation of supply chains. Hence, supply chains cannot be flexible and resilient unless logistics is flexible and resilient by being adaptive.



Adaptive Logistics Fundamental Characteristics



2. Adaptive Logistics Characteristics

To survive, logistics processes need to adapt with changing environments and at the same time need to maintain internal stability.

This is because too little adaptation can undermine resilience to changes in the environment but too much adaptation can undermine internal stability.

Adapting with changing environments enables logistics processes to have intended effects, while maintaining internal stability enables logistics to be efficient in their activities.

2. Adaptive Logistics Characteristics

Balancing adaptability and stability depends upon having reciprocal exchanges of learning and development between logistics processes and environment.

This can be described in terms of rhythmogenesis. That is the generation of rhythms found in most of the coupled physical, chemical, and biological systems in which underlying coupling acts as a feedback factor

Balancing adaptability and stability requires having multifunctional capabilities that can evolve to perform new activities as environments change, and some spare capabilities to compensate for capabilities that can be lost because of environmental change.



Adaptive Logistics Biosocial-Technical Options



3. Adaptive Logistics Biosocial-Technical Options

There are at least nine categories of biosocial-technical options to be considered for adaptive logistics processes.

They are as follows: ground, vehicles, energy sources, addressing, communication, location finding, repair resources, security, weather monitoring.

Short discussions of each are provided in the following slides. Each discussion spans from biosocial option to high-tech option.

After the short discussions, a summary diagram is shown that indicates the biosocial-technical options of a real logistics organization in 2023.

3. Adaptive Logistics Biosocial-Technical Options

Ground: natural ground conditions – fully paved road network

In many regions, environmental conditions are not compatible with maintaining a fully paved road network. Also, paved roads can be damaged by extreme weather. Hence, logistic processes in many regions need to be able to adapt to ground conditions where roads are not fully paved.

Vehicles: load carrying animals - multiple mechanical vehicle options

There are a few regions during some seasons where load carrying animals remain the most reliable option for carrying goods. There are many regions where having multiple vehicle options including 2-, 3-, 4-, 6-, 8-wheeled vehicles is necessary to be able to transport goods across a variety of changing ground conditions.

3. Adaptive Logistics Biosocial-Technical Options

Energy sources: natural sources – many fuel stations

Although some load carrying animals are evolved to function with minimal consumption of natural energy sources, natural energy sources do need to be available at regular intervals. For mechanical vehicles, there are many regions where there are few fixed fuel station buildings but some informal fuel sellers whose position can change daily. Logistic processes need to be able to adapt to varying energy availability and prices.

Location finding: natural landmarks – complete addressing system

There are many regions where wayfinding has to be informed by reference to natural landmarks, because there are no sign posts or more detailed addressing systems such as numbered buildings, named streets, etc. Thus, logistics processes in many regions needs to be able to adapt to there being limited addressing information.

3. Adaptive Logistics Biosocial-Technical Options

Communication: traditional – reliable Internet

There are some regions where traditional communication is the only option because there is insufficient technical infrastructure for even basic mobile phones. In many other regions, Internet access is not yet available, Internet has low bandwidth, or Internet is not reliable. Hence, logistics processes can need to encompass a variety of communication media.

Location finding: human skills – digital navigation technology

Where there is little or no addressing systems and little or no reliable Internet coverage, location finding depends upon human skills. Through digital addressing systems, digital navigation technologies can be used in some regions that do not have street names and building numbers. However, human navigation skills can be reduced by continual use of digital technology.

3. Adaptive Logistics Biosocial-Technical Options

Repair resources: human ingenuity – vehicle repair centres

There are many regions where there are few vehicle repair centres and where logistics vehicles can break down far from vehicle repair centres. Hence, repairs have to be carried out by the driver to prevent the vehicle and its load being immobile for many days. Hence, spare parts should be carried in the vehicles. Also, drivers and/or drivers' mates should be trained to carry out preventative maintenance and vehicle repairs.

Security: traditional social structures – automated systems

In regions with unreliable electricity supply and Internet access, security can depend upon traditional social structures, such as appointing a senior person in the local community, rather than on the implementation of advanced automated security systems.

3. Adaptive Logistics Biosocial-Technical Options

Weather monitoring: traditional – automated weather stations

Where weather patterns are less predictable and extreme weather events are more common, traditional human knowledge need to be supplemented by information from resources ranging from radio and Internet weather forecasts to local automated weather stations. Maintaining a wide range of sources for weather information is important in case high-tech sources cannot be accessed due to lack of energy supply and Internet access.

Combining options for adaptive fitness

Logistics processes need to be able to adapt with the environments that they operate in. The better the fit is with the environment, the less information uncertainty, the less physical disorder, and the less wasted energy there can be in logistics. Hence, options should be implemented that maximize fit with the operating environment.

3. Adaptive Logistics Biosocial-Technical Options

A summary is shown on the next slide of combined adaptive logistics biosocial-technical options.

The summary encompasses the nine categories described in the preceding slides, each of which spans from biosocial option to high-tech option.

The x marks in the summary show the options taken by a real logistics organization.

The second summary is blank for you to consider what would be the best options for logistic processes in your environment.

3. Adaptive Logistics Biosocial-Technical Options

Adaptive Logistics Biosocial-Technical Options								
HIGH TECH SYSTEMS								
fully paved road network	multiple vehicle options	many fuel stations	complete addressing systems	reliable Internet access	digital navigation tech	vehicle repair centres	automated security systems	automated weather stations
	X			X				
X		X	X		X		X	X
						X		
natural ground conditions	load carrying animals	natural energy sources	natural landmarks	traditional communication	human wayfinding skills	human ingenuity	traditional social structures	traditional responses to climate
BIOSOCIAL SYSTEMS								

3. Adaptive Logistics Biosocial-Technical Options

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HIGH TECH SYSTEMS								
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BIOSOCIAL SYSTEMS								



Four Related Courses



Four Related Courses

Improving evaluation and implementations of technological innovations

<https://community.digilogic.africa/course/technological-innovations/>

Moveable factories for combining production and logistics

https://community.digilogic.africa/course/moveable_factories/

Big data implementation guide

<https://community.digilogic.africa/course/big-data/>

Startup survival and growth planning and monitoring tool

<https://community.digilogic.africa/course/startup-fitness-tool/>

Development of market offerings methodology

<https://community.digilogic.africa/course/development-of-market-offerings/>



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