MIT SCALE RESEARCH REPORT

The MIT Global Supply Chain and Logistics Excellence (SCALE) Network is an international alliance of leading-edge research and education centers, dedicated to the development and dissemination of global innovation in supply chain and logistics.

The Global SCALE Network allows faculty, researchers, students, and affiliated companies from all six centers around the world to pool their expertise and collaborate on projects that will create supply chain and logistics innovations with global applications.

This reprint is intended to communicate research results of innovative supply chain research completed by faculty, researchers, and students of the Global SCALE Network, thereby contributing to the greater public knowledge about supply chains.

For more information, contact
MIT Global SCALE Network

Postal Address:
Massachusetts Institute of Technology 77
Massachusetts Avenue, Cambridge, MA 02139 (USA)

Location:
Building E40, Room 267
1 Amherst St.

Access:
Tel: +1 617-253-5320
Fax: +1 617-253-4560

Email: *scale@mit.edu*
Website: *scale.mit.edu*

Research Report: ZLC-2005-3
Outsource/Offshore of Supply Chain Analytics
Nitin Salvio D'souza

For Full Thesis Version Please Contact:

Marta Romero
ZLOG Director
Zaragoza Logistics Center (ZLC) Edificio
Náyade 5, C/Bari 55 – PLAZA 50197
Zaragoza, SPAIN
Email: mromero@zlc.edu.es
Telephone: +34 976 077 605

Outsource/Offshore of Supply Chain Analytics

By
Nitin Salvio D'souza
MS in Logistics and Supply Chain Management.
Massachusetts Institute of Technology –Zaragoza International Logistics Program.
Zaragoza

Executive Summary

A new field termed analytics has emerged to analyze the terabytes of data that are being captured across supply chains. It uses tools ranging from the traditional statistical tools to operations research and from decision analysis to tools such as machine learning and artificial intelligence.

This thesis deals with analytics in supply chains and answers three questions: What is Supply Chain Analytics, what are its delivery models and should it be outsourced/ offshored? This thesis has four main contributions to the academia and the industry. The first, identifying the components of Supply Chain Analytics, a field which is still in its nascent stage. The second, creation of the Supply Chain X Matrix with the use of six processes of supply chains; Plan, Source,Make,Deliver,Serve,Return and four organizational pillars; Goods, Information ,Finance and People. The third is the mapping of the different Supply Chain Analytics services. The fourth, is the formulation of the Spatial Fixity Factor and Location Sensitivity factor which can be used as a guide in outsourcing by executives.

Overview of Analytics:

Analytics is used heavily in finance for financial modeling, risk analysis and forensic accounting. It is used to analyze the risk mortgage and auto loan applicants and also to determine the optimal lending rate. Insurance firms use analytics to decide the premium for its policyholders. Analytics is also used in checking credit card frauds and in collections of dues by credit card companies using the transaction history and delinquency behavior.

Analytics is used extensively in marketing to design and execute suitable cross sell, up sell, deep sell and retention strategies. It is used on Point of sales data (POS) which capture customer characteristics like age, income etc and utilize history of prior offers and responsiveness of customers to cluster customers and understand their behaviors. Analytics is used to understand the links between promotions and the increase in sales in each category of products. It is also utilized extensively to understand store layouts, placement of products and their impact on revenues.

Supply Chain Analytics:

Through the information gathered from literature reviews and the interviews**,** I conclude that the term Supply Chains Analytics is used to denote high end data intensive analysis through the use of tools such as classical statistics, artificial intelligence, machine learning, operational research, decision analysis, with complex models jointly created by mathematicians, domain experts and business analysts.

To map the different tools that are currently being used in supply chains a mapping tool is created. The mapping tool uses the five level 1 SCOR processes Plan, Source, Make, Deliver, Return and a new process that I have added to fill the gap in the SCOR model. The new process is termed as Serve and deals with all activities with the customer during and after the transfer of goods into the hands of the customer until the product has been returned.

The matrix uses the six supply chain processes and the well accepted four pillars of business; Goods, Information, Finance and People. It is named as Supply Chain X Matrix and it can be used to map processes across the supply chains.

	Plan	Source	Make	Deliver	Serve	Return
Goods						
Information						
Finance						
People						

Table 1. Supply Chain X Matrix © Nitin Salvio D'souza.

The Supply Chain X Matrix is adapted to map the current supply chain analytics processes. It is called as Supply Chain Analytics Matrix.

	Plan	**Source**	**Make**	**Deliver**	**Serve**	**Return**
Goods	-Design Analytics			-Inventory Analytics		-Disposition Analytics
Information	-Demand planning -Merchandising optimization	-Supplier Analytics	-Quality Analytics	- Routing Analytics	-Warranty Analytics	-Return Analytics
Finance	-Cash to Cash flow Analytics	-Spend data Analytics	-Activity – Based - Costing		- Fraud Analytics	

Table 2. Supply Chain Analytics Matrix © Nitin Salvio D'souza.

Cluster Analysis	Natural groupings of multidimensional objects or observations are searched according to their degree of similarity or distance.
Neural Networks	A complex nonlinear modeling Technique based on a model of a human neuron. A neural net is used to predict outputs from a set of inputs by first taking linear combinations of the inputs and then, the linear combinations are converted into nonlinear transformations using an activation function.
Pattern recognition	Large amounts of raw data are converted into manageable vector of features, via data compression and dimensionality reduction techniques.
Regression	A statistical method used to find the best-fitting relationship or function between a target variable and its predictor variables are modeled.

Table 3. Few tools used in Supply Chain Analytics.

Analytic uses hundreds of complex tools. A few of the tools used in analytics are show in table 3

Delivery Models:

Supply Chain Analytics is a data intensive process and uses information technology infrastructure. The delivery models of Supply Chain Analytics have been found to be the same as that of Information Technology. The different types of delivery models are a function of a geographical location.

In-house	**Outsource**
Onsite	Onsite
Offsite	Offsite
Near shore	Near shore
Offshore	Offshore
Onsite/Offshore	Onsite/Offshore
Offsite/Offshore	Offsite/Offshore
Global Delivery Model	Global Delivery Model

Table 4. Delivery Models.

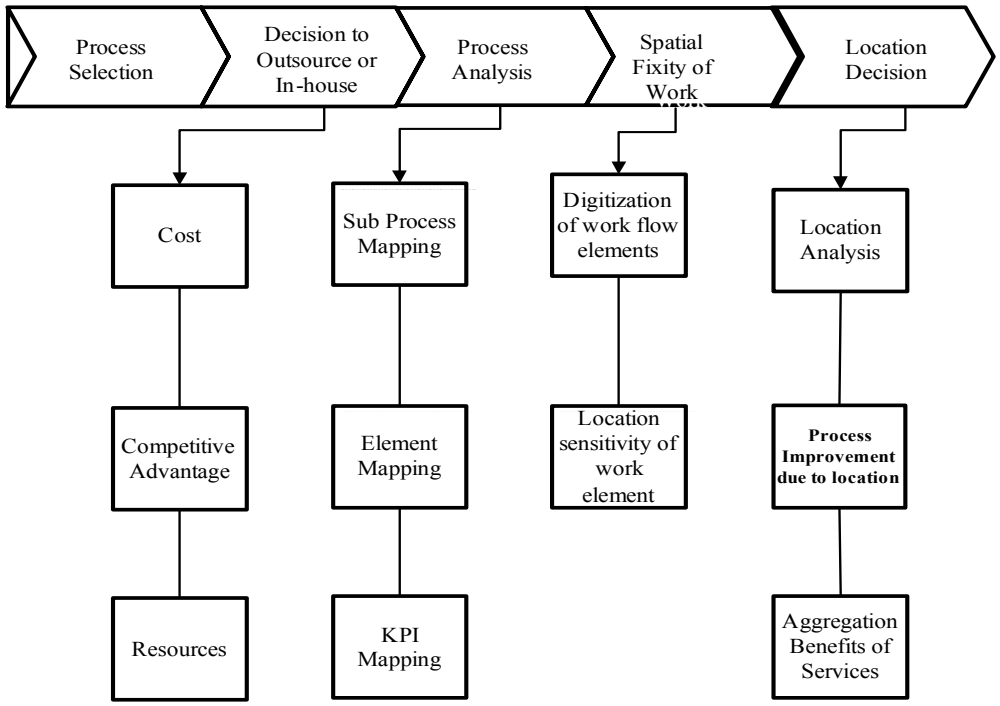
The terms used in the industry are explained as below:

Onsite is interchangeably used with in– house to mean that service is provided at the premise of the company. Offsite is used to mean that service is being provided at a place away from the point of requirement of service inside the country. Offshore is used to denote that the location of the service being provided is overseas. Near -shore is the location of services in a near- by country. From a United States perspective near shore would mean Canada and Mexico. Onsite-Offshore indicates that the service is being provided inside the company's premises and from an offshore location. Offsite-Offshore indicates that service is being provided at a place away from the point of requirement of service inside the country where the main operations are being conducted and

from an offshore location. Global delivery model is used to denote multiple delivery sites around the globe.

Outsourcing of Supply Chain Analytics:

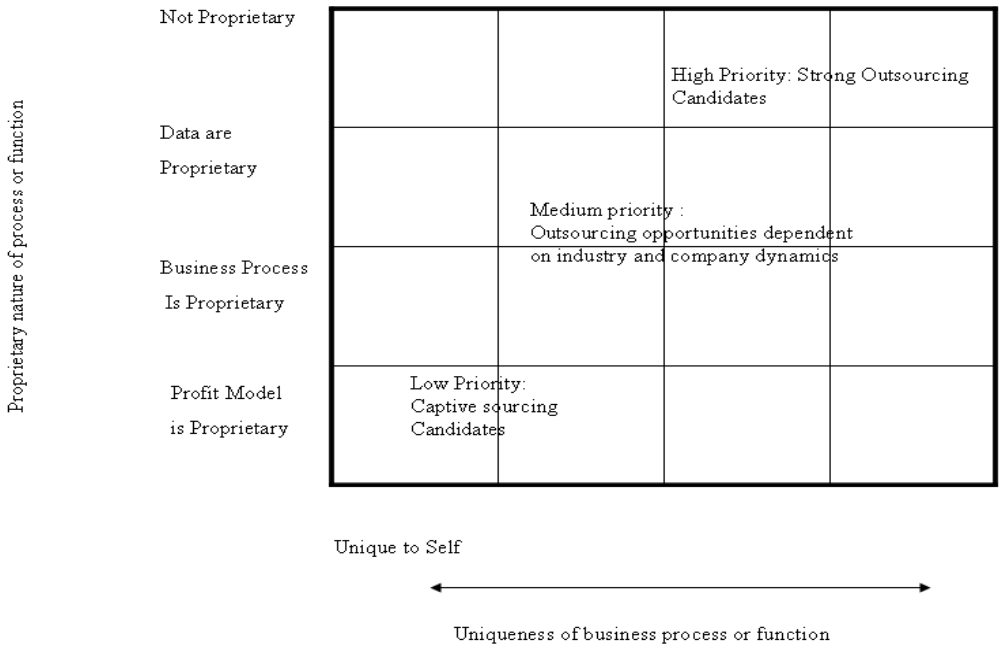
The tools used in Supply Chain Analytics are complex, the skill level required is very high and the technology required is expensive. Businesses wanting to implement analytics on their supply chain processes have to invest time, effort and finances to create the technology infrastructure, and hire a set of highly skilled and extremely talented people. Depending upon the need for analytics and the investment that is required, companies might want to set up in-house centers which deliver analytics or might want to outsource analytics. To guide in the decision an outsourcing decision process framework is created. It consists of five steps.



Decision framework for Outsourcing Analytics.

The first step is to select a process for outsourcing or in-house sourcing. The stimulus for selecting a process from the Supply Chain Analytics Matrix to outsource or develop an in-house sourcing might emerge from within the organization or from external business environment. The stimuli could be industry trends, vendor offerings, and competitive factors amongst others. Once the process has been selected for analysis then a preliminary research is conducted to check if the process could be executed by an external vendor or an internal business unit.

The second step is to decide whether the process be outsourced or be done in-house. The matrix provided by Gottfredson(2005) is suggested to be used as a guide.

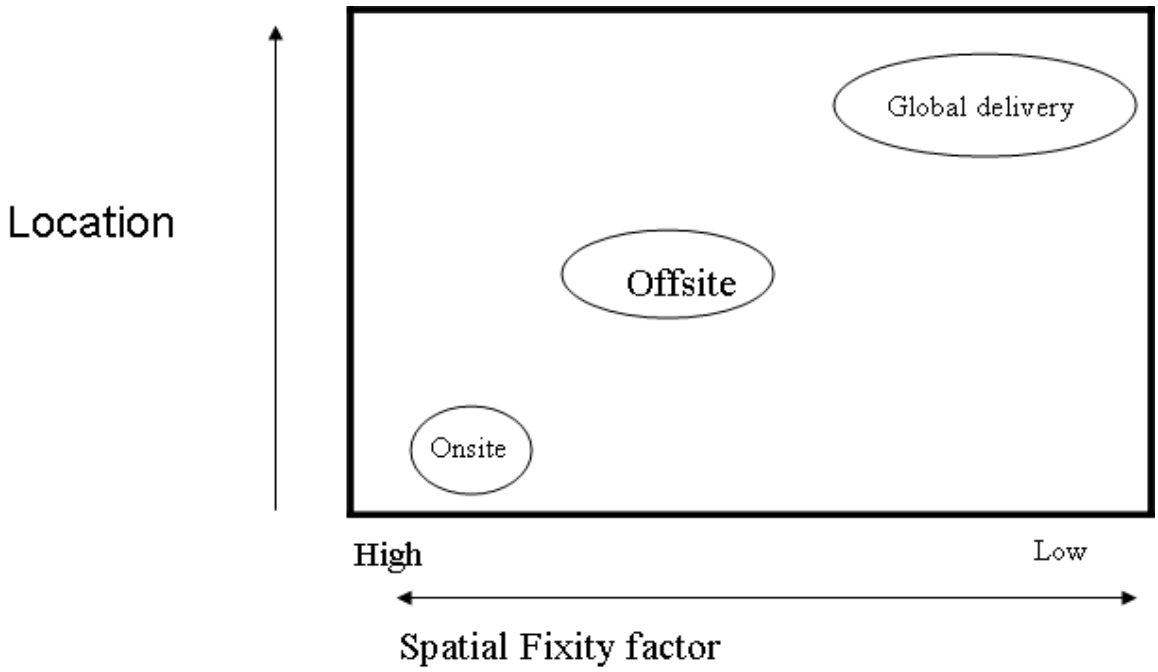


Gottfredson M, Puryear R, Phillips S, Strategic Sourcing From Periphery to the Core., *Harvard Business Review*, Feb2005, vol. 83 issue 2, p132.

The third step is to analyze and map the process, sub process and its elements.

The process under consideration is analyzed for all activities that are required, resources that are consumed and expertise that are required for the process to be performed. The sub process and the elements of the process are then mapped. The current key performance indicators (KPI) are captured. The next step would be to check for the spatial fixity of the elements. If an entire process is to be outsourced then the spatial fixity analysis can be overridden.

The fourth is to analyze the Spatial fixity of element analysis. Once elements in the process have been mapped, an analysis has to be undertaken to understand the spatial fixity of the element. Some processes need to be done in a particular location because of the availability of physical resources and tacit knowledge present at the location. A deeper analysis of the elements should be undertaken to understand whether elements could be further divided and whether parts of the element can be digitized or automated.



Spatial Fixity Factor=

$$\frac{\text{Number of elements of the work process that have to be done at the location under consideration}}{\text{Total number of elements in a work process}}$$

A Spatial Fixity Factor = 0 implies that the location does not impact the process. A Spatial fixity factor = 1 implies that the process has to executed at the location under consideration and cannot be done in any other location. The second factor that needs to be calculated is the *Location sensitivity*. It is the ratio of the productivity at new location to the productivity at the current location. Location sensitivity greater than 1 implies that the new location under consideration is a better choice.

The fifth step is to select the Delivery Location of Service. Based on the earlier analysis, the delivery process for the elements or the process as a whole is analyzed. The location is decided depending upon turnaround time, availability of knowledge workers, cost of unit production and cost of governance. The location decision is then fed back into the decision making flow, recursively, until there exists an acceptable solution. The delivery models chosen could be to

exclusively locate the service onsite, offsite, near- shore, offshore and global delivery models or a combination of the above.

In conclusion, this thesis has defined the boundaries of Supply Chain Analytics, created a mapping tool for supply chain processes, mapped the currently used analytics in supply chains, and created a decision frame work for outsourcing Supply Chain Analytics. To the best of my knowledge, this thesis is the first academic paper in this field and hence has aimed to be a starting point for future research in this field. The amount of data that is currently being captured in going to multiply with the advent of RFID and the richness in data quality will ensure that Supply Chain Analytics can provide insights into business processes hitherto impossible to obtain.