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Re-Engineering the Global Supply Chain Network for Importing Knitwear Capital Goods in India

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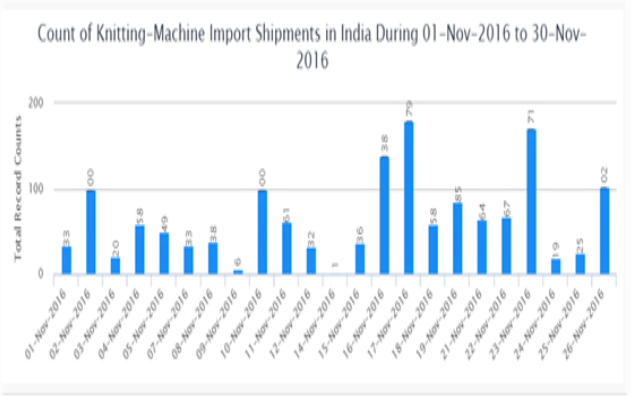
Abstract
Due to increase in the exports of Knitted garments, the Knitting exporting units decided to re-engineer the capital goods. The domestic suppliers are unable to satisfy the demand of the capital goods in time and the import of machinery from other countries are cheaper. In this context, the research has motivated to find out the supply chain reference model required to upgrade the technology in Knitting units. The study is conducted among 121 Export oriented units located in Tirupur, which is considered as the hub for knitwear units in India. The result indicates that technology upgradation is the main factor in deciding capital goods. Hence, the Supply chain reference model has been designed based on the technology upgradation mapping system..
Keywords: *EOU, TUFS.*

1. Introduction

The global textile industries business is witnessing mushrooming growth. To meet the requirement, the demand for capital goods in textile machinery is also increasing. Global textile machinery sourcing is growing at 14% on year to year basis (Textile value chain, 2016). The Indian textile machinery requirements has been doubled within seven years. The changes in technology also fuels the growth of textile machineries. Indian textile machinery industries imports of capital goods increase by six times within two years. Nearly two fifth of the demand for capital goods has been imported from other countries. It is also estimated that Indian textile exports will be around one lakh crores by 2020 (Vipin,2016). Hence, investment on textile machineries increased. India's apparel sector is highly fragmented and is characterized by low levels of technology us. The textile industry is grappling with the inability of replacing its old and worn out machinery as there is a dearth of domestic machinery manufacturers. The paucity of domestic producers of shuttleless looms and spindles is greatly affecting the industry with the waiting time per order being 2 to 3 years. Hence, the Indian textile units are importing the capital goods from US, UK, China, Germany, Switzerland, Taiwan, Japan, France, Italy and South Korea. Imports of knitting machines from China grew by 143 per cent whereas our total import of knitting machines from the world grew by 49 per cent in two years period ending on 2015 (Money control-2015). Exhibit -1 shows the knitting machine imports made in the November, 2016.

Exhibit -1



(Source: DGFT, Data base, GOI)

The imports are jeopardized by fluctuations in currency and articulation of using exact technology. Government of India restricted the importing of Second-hand machinery. Even then, the import of knitting machines is increasing. The competition among the global sourcing units is also increasing. In this context, this research has been motivated to find-out the Supply chain reference model that decrease the risk in Sourcing of Capital goods in Knitwear industries.

2. Objectives of the Study

The primary objective of the research aims to identify the successful global sourcing pattern for Textile Industries. The facilitating objectives are listed as follows.

To find out the technology resource flow in EOUs in sourcing the technology

To detect the global sourcing pattern of technology inflow

To portray the matching components of export of knitwear and import of machinery

3. Methodology of the Study

The study is conducted in Export Oriented Knitting Units in Tirupur, which is considered as the hub of knitting units in India. The study was organized in six stages. In first stage, secondary data about 121 export oriented units(EOU) were collected from the exporters association. In second stage discriminant Analysis was carried out to

identify the discriminant factor that differentiates among the affected and unaffected units in terms of productivity. In third stage, 121 technology imports from the four EOUs were analyzed to portray the technology resource flow. In fourth stage, based upon sourcing activities made by the four units, global supply chain pattern was established. In fifth stage, Supply Chain Operations Reference Model was created by the primary data collected through the interviews.

4. Global Sourcing of Machineries in Indian Knitted Industries

The most of the Indian in-house knitting industry is characterized by small scale units which lack of adequate facilities for dyeing, processing and finishing. The industry is clustered together in Tirupur (Tamilnadu) and Ludhiana (Punjab). Tirupur produces 60 percent of the country's total knitwear exports. Knitted garments account for almost 32 percent of all exported garments.

The segmented supply side of the Indian textile industry has led to highly uneven responses to openness. Choices that firms are themselves making—and have made historically—with respect to technology, product definition and market served, have led to an odd juxtaposition of a large un-dynamic old-guard still holding on to the 'large-volumes, low-margins' mindset of the protectionist era, and a small emergent segment of the industry that is swiftly modernizing. The weakest firms were primarily focused on the low end of the spinning, weaving and apparel markets, producing the coarsest (cotton) counts of yarn and/or grey cloth for old, price-sensitive constituencies that crouch down their margins.

Historical evidence with respect to thriving industrial trajectories has shown time and again that the most robust regions are those that have been able to nurture a strong, locally-rooted and diversified industrial base capable of change and renovate as exogenous and endogenous pressures change. Many garment companies have not been using specifications and have ineffective communication with their suppliers of textile engineering machines. Numerous tribulations have been noted in the handling of unworkable materials and of producing unserviceable garments. The properties of raw material affect not only its handling characteristics during production, but also the eminence of final product as well.

Therefore, aggressiveness and daring efforts taken by the mid-sized firms who have so far competed on the basis of low labour costs are considering relocation strategies as an imperative part of their growth plans, is very striking. The form that this type of reposition is taking resembles the recent experience of countries like Taiwan, Hong Kong and Korea. Just as many Taiwan and Hong Kong based firms have, in recent years, shifted to a strategy of 'Triangle manufacturing' (Gereffi, 1994, 2000) by moving labor-intensive assembly operations to lower-cost, quota-rich sites overseas, some textile and apparel firms in Tamil Nadu are also expanding outward. They are locating production and assembly in other parts of the world, notably in the Middle East and Latin America

Small and medium scale thwarts the achievement of specialised and effective internal division of labour that fosters cumulative improvements in productive capabilities and innovation. Because of the continuous and fierce struggle to preserve their narrow profit margins, small-scale entrepreneurs are often locked in their routine work and unable to institute innovative improvements to their products and processes and cannot look beyond the boundaries of their firms to grab hold of new market opportunities.

A lucrative knitwear unit manufactures around 2 million pieces of garments per year and its turnover is about U.S. $ 4.5 millions. Their factories are outfitted with the most up-to-date state of the art machinery imported from Germany, Japan, Singapore, Italy and also top quality indigenous machinery. A sophisticated state-of -the-art laboratory is available in-house to make sure that quality is always delivered at every stage of production. Fully equipped sampling department working parallel with the design studio, caters to the needs of the buyers round the year. Over the years they have integrated the core manufacturing facilities. Their knitting division has latest machines from Mayer & Cie, Falmac, Stoll and Jumberca. The unit can turn out cotton and blended fabrics like jerseys, fleece, ribs, piques, herringbone, engineering stripes, interlocks, jacquards, special edged collars. The knitting machines have Lycra attachment also. The stitching unit is equipped with Juki, Pegasus, Yamato and Kansai machines of latest origin. Computerized embroidery machines from Barudan, finishing equipment from Monti Antonio, Ramsons-veit, Stefab, Excel and much other related equipment are also installed. The design studio is manned by designers from National Institute of Fashion Technology (NIFT). The laboratory is outfitted with Launder meter, Crock meter, color matching cabinet, yarn testing equipment (that can check tensile strength, twist and counts), GSM cutters, electronic weighing, washing machines, tumble dryer etc.. Usters and Statex machines fill the laboratory. The sampling department works parallel with the design studio. LabMaster, a Germany-based Thies Textilmaschinen dying machine has been used to achieve high level reproducibility and portability in an extensive range of applications including research and development, quality assurance, laboratory trials. Knitting department is equipped with imported circular knitting machines, flat knitting machines and fully computerized jacquard machines. All are imported from leading international

manufacturers like Stoll, Falmac, Shima Seiki, Jumberca etc. Embroidery department is having multi-head computerized embroidery machines imported from Barudan, Japan. Production department (stitching) is geared up with all the normal and special purpose machines required for making contemporary fashion knitwear. These machines are imported from Japan and few of them from European countries. Finishing department has Italian make fully computerized continuous belt ironing machines, steam irons, normal ironing and packing equipment. Finishing department also has stain removing stations to remove all type of stains and the eco-friendly Italian make dry-to-dry cleaning machine to give all garments the final neat look and image. This particular machine recycles 99% of the effluents. They have pervasive arrangements for dyeing in Jet dyeing machines, soft-flow dyeing machines or closed winches as needed with reactive dyes. All colours are possible with the new machines used for washing and shrinkage. Production is carried out according to the specifications desired by their customers. Shrinkage control is done with all modern processes like compacting, tumble drying, relax drying etc. The quality policy of the firm gives importance to following the managerial excellence activities.

Adapt and improve upon internationally renowned quality assurance system.

Upgrade the machines, systems, techniques and processes to meet the ever changing demands of excellence and cost.

Plan and execute to ensure timely delivery of products.

Work towards establishing translucent management information system.

Train and motivate all the personnel to work as a team towards producing enhanced results.

5. Global Sourcing Attributes

The Aberdeen group studies focal point was on the information shared with significant suppliers on a worldwide basis. According to that study, supplier delivery performance, supplier quality performance and supplier responsiveness are mostly mutual with the buyers. Whereas technology plans, investment plans and physical environment compliance are not shared with the buyers. From the pilot study conducted, supplier quality performance, supplier delivery performance and physical environmental compliance are significantly shared by the suppliers and the respondents. Hence these attributes are incorporated in the final study.

There are few countries boasting the indispensable elements of textile tradition, know-how and professional skills, which construct excellence in the production of textile machines. Based upon the secondary sources collected from the 121 units, global suppliers from ten countries were identified for the study. Out of 121machinary imports made by the EOUs during the research period, 13 are from United States of America, 7 from Italy, 18 from Japan, 21 from China, 8 from South Korea, 6 from Taiwan, 12 from Germany, 11 from Switzerland, 10 from United Kingdom and 15 from France.

Five imported technologies widely used by the Tirupur EOUs are identified from the pilot study. They are as follows-

CAD (Computer Aided design)-Any design activity that engross the effective utilize of computers for drawing and designing parts or products for analysis and testing of designed parts and products. One of the machines which uses this technology is Genius CAD System .

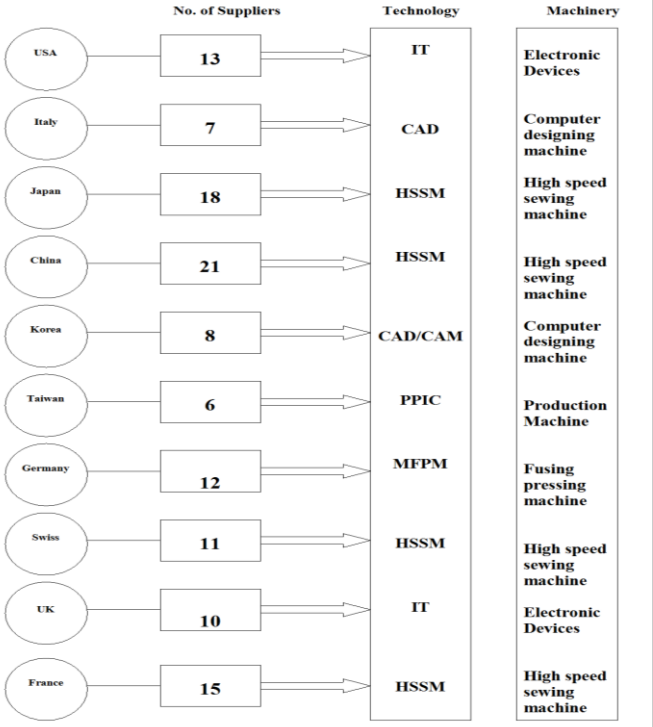
PPIC (Production Planning Inventory Control Devices) -A computerized production planning and inventory management system that masters production software scheduling, material requirements planning and capacity planning.

HSSM (High Speed Sewing Machine)-Sewing machines run on high speed with Machine fully/semi automated operation, digital panel and control systems. It is an inbuilt technology in Juki and Brother Machines.

MFPM (Modern Fusing Pressing Machine)-Contemporary machines are employed to fuse the materials pressing machine which runs on controlled temperature.

IT Related Products- The hardware and software used for electronic data processing and communication.

Exhibit 2
Taxonomies of Resource Flow



Conjoint analysis is used to determine how textile machinery importers make trade-offs between several of attributes while acquiring a machine from a particular manufacturer in a country. The attribute level selected are based upon the pilot study and past research. The attributes identified are skill of the exporters, technology, machine characteristics, sharing the resources and contractual obligations provided by the exporters. The dependent variable is intention to import. These ratings were obtained using a five point Likert scale.(1 = no intention to import, 5 = high intention to import). The sample respondents are 82 EOUs only. In running a regression analysis on the data, an R2 of 0.94382 was obtained, indicating a good fit. The preference ratings were correlated with the input rating for these profiles obtained from the respondent. The correlation co-efficient was 0.9361, indicating good predictive ability. This correlation coefficient is significant at 0.05 level. The path-worth or utility functions estimated for each attribute, as well as the relative importance of the attributes are given in Table1.

Table 1 Global Sourcing Pattern

Attribute	Relative Importance	Attribute Value	Utility
Skill	16.13	Technical Skill	0.648
		Commercial Skill	1.121
		Interpersonal Skill	-1.769
Technology	25.22	CAD/CAM	3.072
		PPIC	-2.123
		HSSM	0.943
		MFPM	-0.991
		I T	-0.901
Machine Characteristics	23.68	Cost	5.211
		Quality	3.452
		Performance	-4.245
		Up gradation	-2.408
		Design	-2.010
Sharing the Resources Technology	17.94	Delivery Performance	0.668
		Quality Performance	-0.323
		Physical Compliance	-0.345
Contractual Obligations	17.03	Shipment Terms	-1.243
		Legal documents	1.243

The most appropriate analytical tool for testing the country preference with the supplier attribute is Analysis of Covariance (ANCOVA) because it is used to measure the relationship between dependent and several independent variables. The data type was applied to both metric and category data. In this case, there is one dependent variable (country preferred), and five independent variables .The null hypothesis that 'the suppliers from United States, Japan, Taiwan, South Korea, Germany, Switzerland, Italy, United Kingdom, France and China does not differ in skill, technology, machine characteristics, sharing resources and contractual obligations' is established. The results are presented in Table-2.

One-Way ANCOVA: Effect of Attributes on Country

Case	Attributes (Independent Varaibles)	F Value	Significance
1	Suppliers' Skill	10.447	0.00
2	Technology	279.761	0.00
3	Machine Characteristics	401.171	0.00
4	Sharing the technology Know-how	129.625	0.00
5	Contractual Obligations	0.853	0.57

The null hypothesis is rejected in first four cases. It can be concluded that the attributes- suppliers' skill, technology, machines characteristics and sharing technical know-how differ in countries, whereas contractual obligations do not differ. Based upon the modal values, the country-wide specific attributes are listed in the table 3.

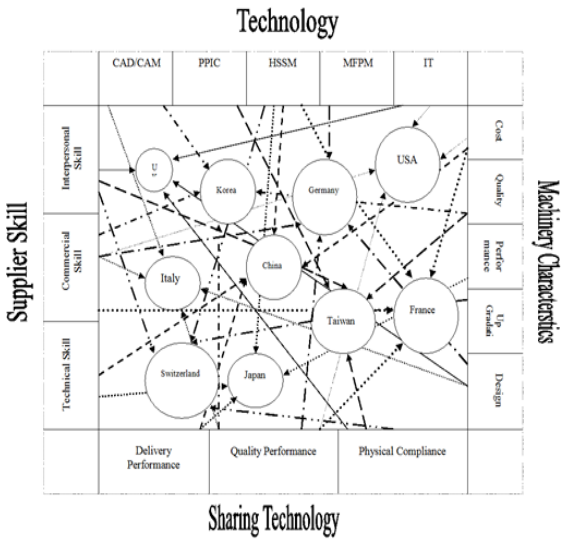
Table 3 Country-wide Sourcing Variables

Country	Skill	Technology	Machine Characteristics	Technology Know-how
United States	Commercial Skill	IT	Cost	Quality Performance
Italy	Commercial Skill	CAD	Design	Quality Performance
Japan	Technical Skill	HSSM	Performance	Delivery Performance
China	Technical Skill	HSSM	Cost	Delivery Performance
Korea	Commercial skill	CAD/CAM	Quality	Quality Performance
Taiwan	Inter-personal Skill	PPIC	Quality	Physical compliance
Germany	Commercial skill	MFPM	Design	Quality Performance
Switzerland	Inter-personal Skill	HSSM	Up gradation	Physical compliance
United Kingdom	Inter-personal Skill	IT	Design	Physical compliance
France	Commercial Skill	HSSM	Cost	Quality Performance

Most of the high speed sewing machines and Flexible bimetal high speed sewing machines are sourced from the suppliers located in Fujian, Guangdong, Jianjsu, Shangahai, Shandong and Zhejang in China. There are around 462 suppliers supplying high speed sewing machines from China, 15 from France and 21 from Japan. High speed

lockstitch Sewing machines, high speed zig zag sewing machine and high speed over lock sewing machine are sourced from Japan. Over lock machines are sourced from France(Quandrium). Modern fusing pressing machine are sourced from (KBA-metronic AG) Germany. There are around five suppliers supplying modern fusing pressing machines regularly from Germany. Computer aided design software and hardware are sourced from Italy (Europlanet Srl,CADline,. Milano Product development) and Korea(Cubicet). There are seven suppliers regularly supplying the CAD software from Italy and six from Korea. The most of the hardware and software networking devices are sourced from US (Techrainbow Inc) and UK.

Exhibit 3
Supply Chain Operations Reference Model



6, Findings and conclusion

The EOUs use sourcing of technology as one of the tools that used to get rid of the currency exposure risk in exporting. The resources are upgraded and able to process the fabric in limited time compared to previous years. While sourcing the textile machinery, more than quarter weight was given to the technology that fine tune the production in future with short span of time. The sourcing country evaluation depends upon the skills, technology provided, machine characteristics and technology know-how services provided by the suppliers.

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