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## High Technology Health Care Supply Chains: Issues in Collaboration

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### Abstract

Healthcare goods have witnessed an unprecedented growth in past few years, especially in developing countries. Being a prominent supply chain, it has drawn attention of the academia as well as the Industry. Cost cutting is one of the important issues in high technology healthcare goods such as heart stents, dental implants etc. Taking in view of the collaborating aspects in healthcare supply chain, we present the case of dental implants. From material procurement until the delivery end (patient) huge costs are involved which appear in different form from R & D to high technology manufacturing. Apart from the cost minimization, some sensitive areas seeking attention are core competency strength and degree of information transparency. In this paper; we present a few broad aspects of the entire supply chain for dental implants incorporating the prominent characteristics and issues. We also discuss how the collaboration and alliance formation helps in capturing value.

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### 1. Introduction

As companies operate globally; the supply chain network expands and so are the complexities encounter and require better enforcement of management tools.

Today, Healthcare industry is growing at a fast pace in India. Starting from the metropolitan cities to towns and then to rural areas, there is a huge demand of healthcare goods in this populous country. These goods and services have their different flows seeking the criticality of the situation. When dealing with the emergency situations it requires a

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fast response time from the entire supply chain e.g. in critical disease like cardiovascular diseases. The entire supply chain gives an untapped opportunity for the supply chain specialists and demands a lot of transformation in terms of developing tools, mechanisms so that the value can be delivered through the supply chain and correspondingly it should be beneficial for the healthcare organizations as well as patients at large. It is apparent that there is a huge unorganized sector involved in health care industry. Various big business houses outsource their part of business to different vendors. Hence, everyone wants to generate profit.

The high technology infers to the technology which is at the cutting edge and say most advanced technology. The industry which uses advanced methods and most modern equipment is called as “High technology industry” (<http://lexicon.ft.com/>) and these industries work in a cohesive manner with the supply networks in their specialities. With the high technology supply chains the issue always prevails is the growing pressure of the competitiveness and the up-keeping of the demand. Furthermore the speed to market of the high tech product is necessary.

Hence, the systems incorporated in high technology supply chains require a staged investment in the information systems at the point of sale so that the real time demand can be updated. This significantly reduces cost of logistics and efficient management of the inventory levels. Handling returns or service incurs huge costs and hence the same has to be efficiently handled. Further the high technology supply chains relate the issues relevant to a sub group like handling the logistics and inventory through the warehouse management; reverse logistics management involves the fully automated processes for the returns, sharing the data with the suppliers help in managing the inventory levels at the suppliers end and hence the production processes can be scheduled efficiently. Recently the high technology supply chains have suffered numerous service issues such as growing costs and inventories, lagging service levels, cost escalation or add ons later. Hence, in order to overcome such issues the companies incorporate changes in the production schedules which affects the entire supply chain network.

This paper aims to explore the issues and challenges in high technology healthcare supply chains. We come up with various issues pertinent in manufacturing, use of information technology and its impact. The remaining paper is as follows: section 2 sums up the previous research work in brief. Section 3 is about characterizing the high technology healthcare supply chains for dental implants. Section 4 deals shows collaboration as the important relationship to engage; section 5 talks about comprehensive framework for healthcare supply chains highlighting the need of high technology use. Section 6 is about some prominent issues in dental supply chains. Finally, section 7 presents concluding remarks.

## **2. Literature Review:**

The literature is examined keeping in view the high technology industry and the supply chains.

Apart from healthcare Industry; other high technology industries include space industry, arms industry, micro precision manufacturing of parts. Innovation and globalization have shaped these industries differently. This differentiation has been due to some of the happenings worldwide that made the industries incorporate changes. Cornell (2011) stated particularly about the high technology space industry in USA and happenings post-cold war: merging of the aerospace and defense (A&D) industry, acts related to arms regulation and control, collision of satellites and fresh space programs pushed the industry to go for such changes.

Wu, Yenyurt, Kim, & Cavusgil (2006) stated through a study that the investment in IT does not guarantee the better organizational performance. However, more investment in IT may be good for a particular Industry but this situation may not be scalable. From a resource based perspective he states about the supply chain capabilities as Information exchange, coordination, inter-firm activity integration and supply chain responsiveness. Lee, Palekar, & Qualls (2011) investigated about reducing the cost by implementing RFID in such a way that security and efficiency of the supply chain could be improved. Proper incentive mechanism are not available to deal with the challenge of incorporating the cost intensive technologies in a collaborative setup. Further, they observed that the tax benefits through some policy could motivate higher investment in technology. Felix & Valverde (2014) stated about the effect of using the RFID technology in the dental supply chain and compared the results with the existing dental supply chain taking a case of UK dental Industry. He stated that the RFID technology was helpful in eradicating

several issues and highlighted the characteristics of an IT enabled business process like building enforceability, easy monitoring and consistent.

Bales, Maull, & Radnor (2004) advocated about the inter-organizational supply chain management and from his empirical research considering a case on aerospace industry he states about another layer in supply chain organization structure as “supply chain integrator” so as to manage and coordinate the whole high technology supply chain. Further he illustrates about the scope and evolving structure of aerospace material supply chain.

Cornell (2011) further states about the consequences of merging A & D in terms of reduced R & D, downsizing of the industry and an environment which is difficult to compete against the essential characteristics of high technology industry development. The tight regulations also hampered the high technology industry to take advantage of the global supply chains. In another case, the new entrepreneurs used a fresh and innovative design platform (like of ‘SpaceX’) and succeeded intensively setting a landmark that how clean and innovation culture aligned with the collaborative development creates value.

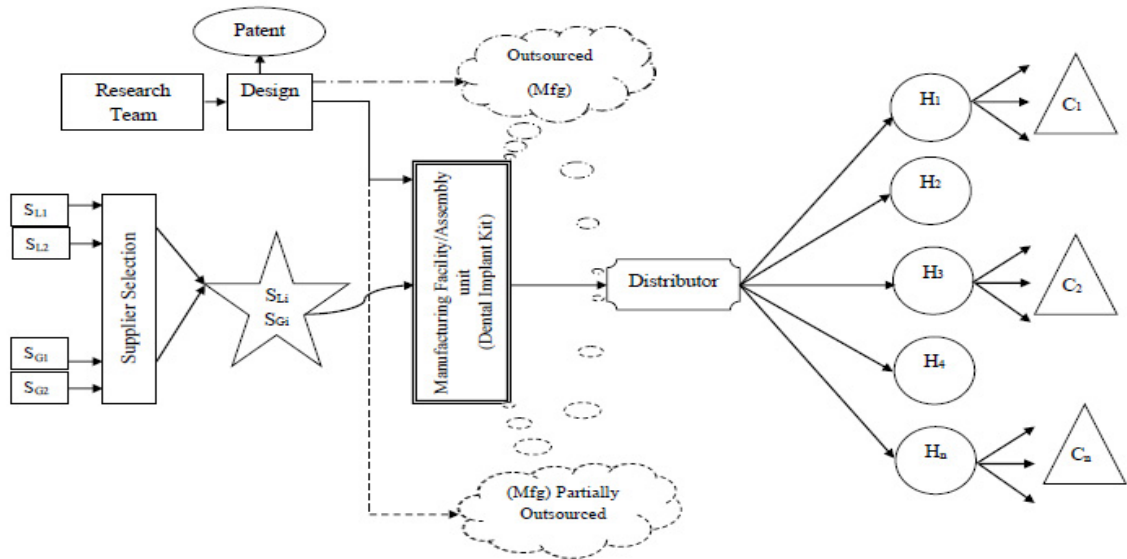
### **3. Characterizing the High technology Health care supply chain for Dental Implants**

Fig. 1 presents a process flow chain of a medical product (dental implant) where the process flow has been shown from the procurement of the raw material to the delivery end (patient). Dental implant is a medical operation used to restore the functions of damaged or missing teeth (Lee, Palekar, & Qualls, 2011). A dental supply chain operates on many critical parameters and demands a faster delivery. Some activities could be handled in a collaborative manner like outsourcing the activities in partially depending upon the uniqueness and the speciality of the potential partner.

Referring to Fig.1, raw material used in dental implants is Titanium, which is generally procured from different suppliers based in different countries. Basis for using the Titanium as a material for manufacturing dental implants is its bio-compatibility, high corrosive resistance and high specific strength. Now, the selected suppliers supply raw material at the manufacturer end where the manufacturer has developed its own processes to produce the final product (dental implant in this case). The manufacturing process used for the dental implants is highly automatic, precise and uses CAD/CAM technology. The research team prepares design incorporating the recommendations of the dentist.

Production of dental implants can be made in-house depending upon the resources available or can be outsourced (partially or fully) to a collaborating partner. A complete kit for the dental implants is made and supplied to the hospitals via distributors. Finally the dentists provide the feedback about the issues related fixing etc. if arises. This feedback is the output of the shared decision making of the dentist and the patient.

Figure 1. Characterising the High Technology Health Care Supply Chain for Dental Implants.

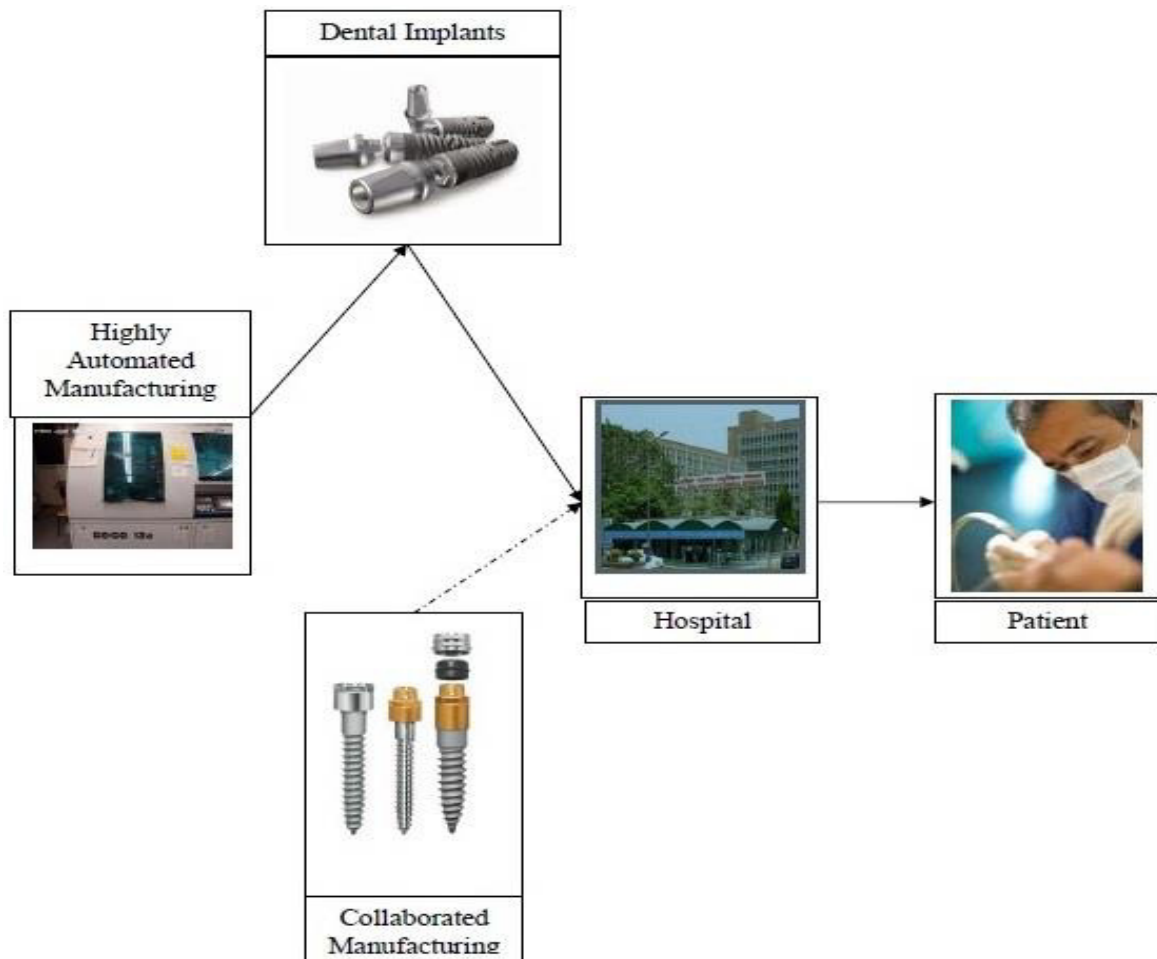


#### 4. Why alliance/collaboration is needed in this case?

Combination of the market forces making it important to access the real time data. Technology is changing fastly and the old business tools are not going to help in meeting the expectations of today.

In global supply chains the strong requirement of incorporating the processes that create value and reduce the cost is perceived by the researchers. In case of the healthcare technologies huge amount of investment is required in R & D and every step adds cost. Further the material procurement from offshore suppliers increase the cost multi-fold. The collaboration has such strong potential of providing revenues in high technology healthcare supply chains. For the dental implants it is imperative to develop the technological processes for excellence and innovative means to reduce the cost. Current tendency in the enterprises is to cooperate more closely rather than maintaining a diverse skill base and resources and reducing the financial risk due to broad business portfolios (Bales, Maull,& Radnor,2004). Focussing more on limited and closely related tasks i.e. core functions; these provide competitive edge and global coverage capability and leaving/extending the non-core functions to the specialist organizations providing collaborative ties among the organizations. All such decisions are aligned with the business strategy. Figure 2 shows the pictorial view of the manufacturer-customer linkage part of the dental Implant supply chain.

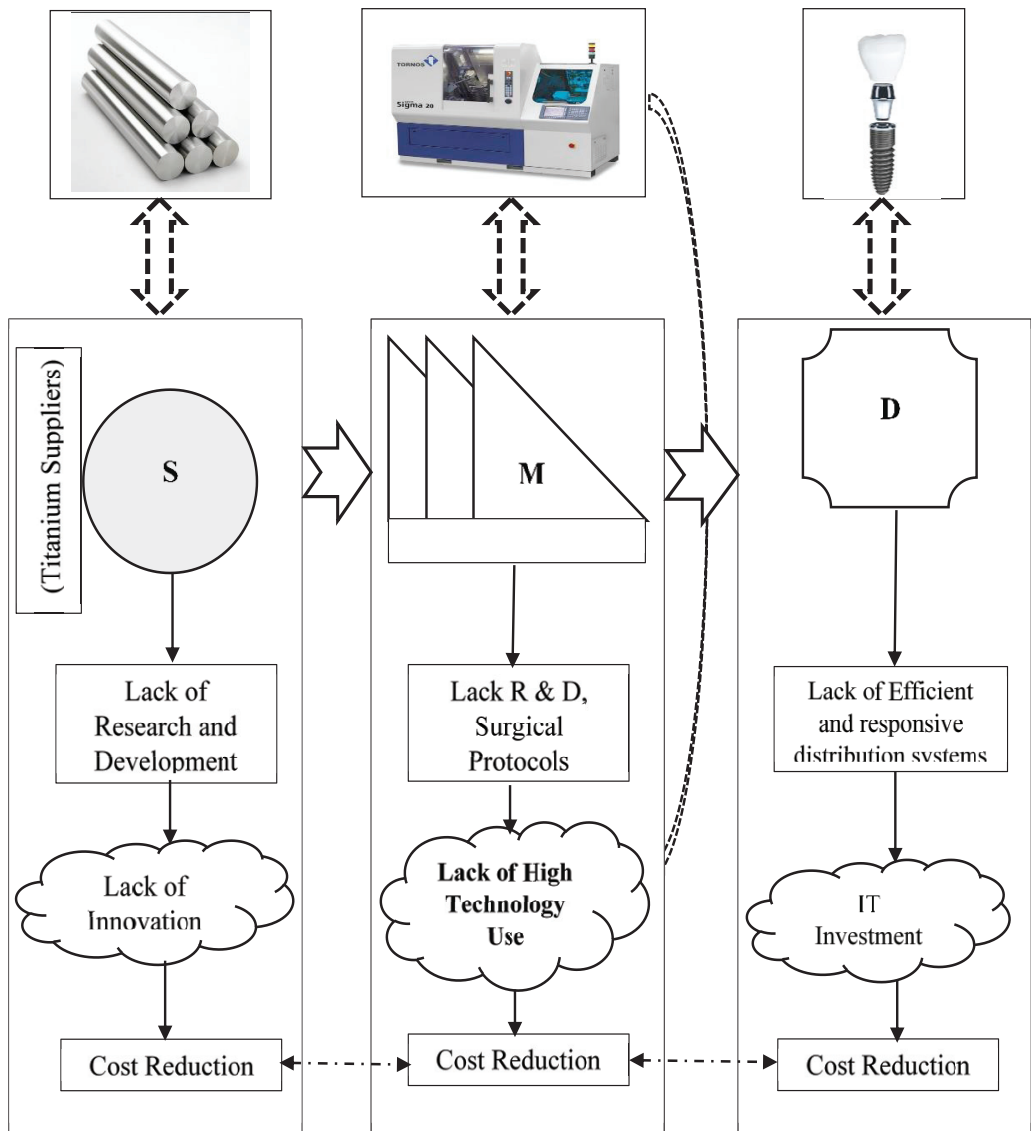
Figure 2. Pictorial Representation of basic Manufacturer-Customer Linkage (Dental implants).



### 5. Comprehensive framework on Supply Chain for Dental Implants

For dental implants, the framework shown in Figure 3 provides an insight how the high technology differs from the conventional supply chain. Lacking areas are shown on a canvas from supplier to the distribution part of the supply chain. Some of the prominent lacking areas highlighted are lack of research and development activities, lack of high technology use (such as in conventional manufacturing) and highly skilled personnel, and lack of investment.

Fig. 3. Comprehensive Framework on supply chain for dental implants



Legends: S: Supplier, M: Manufacturer, D: Distributor

**6. Prominent Issues in High Technology Health Care Supply Chains:**

In the current study we are studying different supply chains as these are distributed and traded differently. Moreover, these vary in their cost, criticality factor in delivery of patient care, and impact on operations. They also differ in operational demands and the differences in type and scale of benefits. How can we reduce the cost in acquisition of different goods? How the coordination and collaboration can help achieve the reduced cost and

reduced lead time? (Vedpal, Jain, & Bhatnagar, 2012) What is the effect of collaboration at different levels on the performance of the supply chain? When should a healthcare partner go for coordination, collaboration and competition and what are the factors affecting them individually? Hence there are a couple of issues that are required to be overcome to make the healthcare supply chains more efficient.

### *6.1 Issues at the supplier end:*

More efforts should be deployed in research and developing materials which are more compatible with the surgical standards. Innovation is important front which provides the competitive advantage to the industry hence inputs in metallurgy and exploring new alloys that can be useful in making the dental implants provide the company new avenues for making profits.

It can be argued that investment in research & development and innovation can increase the cost in short term but in long term it provides a great advantage to the industry by reducing the cost at a massive scale and infact, it is important for sustaining the business.

### *6.2 Issues at manufacturer end:*

The dental implants do carry lot of challenges in development and hence the surgical protocols and standards must be followed before the product actually comes in commercial space. Use of CAD/CAM technology has made the production of dental implants according to the scientific standards set in consultation with the dentists.

The real time design change can be incorporated in manufacturing using the high technology machine tools capable of producing the dental implants with the quality meeting the international standards and saving time and money. The mass production of the dental implants can be made using these high technology machine tools.

### *6.3 Issues at distribution end:*

Distribution carries the huge part of the total cost in a supply chain network for the dental implants. It requires special kits to deliver the dental implants along with the accessories. Furthermore, for the correct forecasting of demand and real time information sharing it becomes imperative for the industries to invest in Information and communication technologies such as RFID technology.

In broad-light, the cost reduction is the major issue which needs to be addressed prominently so as to make the technology available to the masses and avail the health benefits.

Healthcare systems used in ICU's monitor the information on various parameters on-time and exchange the relevant information in an integrated way. In broader terms, seeking the high technology industry Information exchange refers to the ability of a firm to share knowledge with its supply chain partners in an effective and efficient manner (Wu, Yenyurt, Kim, & Cavusgil, 2006). Further the information exchange should be from a credible source and in adequate format. Trust issues come in to the picture. Furthermore, High technology companies are facing more service issues like: enormous cost over-runs, delayed new product rollouts, missed delivery dates, and disturbed production schedules. Enforcement of technology such as RFID help properly monitored processes in case of critical items in healthcare (e.g. stents).

## **7. Conclusion**

This paper concludes by identifying the need of collaboration and discussing the nature of healthcare supply chains particularly focussing on dental implant. Not enough literature is available on such high technology supply chains dealing with products like dental implants. We have characterized the dental supply chain and the basic process flow of the supply chain specifically for dental implants. We show the lacking areas which actually differentiate between the high technology supply chain and a conventional supply chain. In broad, we have come up with the issues in high technology healthcare supply chains.

How can we tackle such issues in high technology supply chains? Some of the things that could be laid down in

practice include aligning the high technology healthcare supply chains along the business strategy. A categorization of the products for example on the basis of criticality etc. can help drive the performance of the supply chains. To reduce the cost and speed up the service it is important to integrate the supply networks and enable electronic integration (Felix & Valverde, 2014) as the single supply chain driving the business mode lacks on many fronts like delivery, product innovation etc. Furthermore, it is important to be flexible to make collaborative ties and get the competitive advantage.

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