Case Study

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Strategic Technology Management in Practice: Dynamic SAP-LAP Analysis of an Auto Component Manufacturing Firm in India

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Abstract

The key purpose of the paper is to examine reality of Strategic Technology Management (STM) in the Indian context. Despite considerable efforts at enhancing competitiveness through technology management, the scale-up remains low. Among several reasons, weak linkages between the technology strategy and business strategy leading to gaps in the technology capability and competitiveness seem to be the potential root causes. Leadership of firms should have deep understanding of strategic issues of technology management and they should have the drive to go beyond the first set of strategic alliances to enhance capabilities of STM across the journey. While there is considerable literature which emphasizes the importance of linking technology and strategy, reality of STM in Indian context is rarely examined, particularly in mid-size firms. This study examines the longitudinal technology development at an auto component manufacturer in India and analyses the linkage between STM and business performance using the dynamic SAP-LAP analysis. The paper also extends the dynamic SAP-LAP framework to include mapping of STM aspects on a flexibility continuum.

Keywords: auto component industry, competitiveness, dynamic SAP-LAP, learning issues, strategic technology management (STM), technology capability, technology strategy

Introduction

The automotive industry in India is operating in an era of deregulation and growth. The large volumes of investment including foreign direct investment in the automobile manufacturing ventures and technical collaboration are propelling a quantum jump in the growth of the industry. As per the Automotive Mission Plan (Government of India, 2006), the turnover of the industry is expected to increase to USD 145 billion by 2016 and exports is expected to touch USD 35 billion by that time .The increased production and capacity creation in the automobile sector specifically passenger cars is going to accelerate the continuous growth of the auto-component industry as well.

As per the industry statistics from Automotive Component Manufacturers Association of India, the auto component exports has risen from USD 760 million in 02-03 to USD 3,800 million in 2008-09, amounting to 20% of total output (ACMA 2009). At the same time, the auto component industry in India faces many challenges like greater competition in domestic as well as export markets, integration into the global supply chain, quality level, low over all technology level, WTO and FTA etc. The industry in India has responded to the challenges in a major way by going in for Technical Collaborations and Joint venture and upgrading the Quality systems and manufacturing processes. However, despite the above, competitiveness enhancement of firms from India remain quite slow in many organizations. One of the reasons attributed to this is the technology capability of the organization.

The emphasis on Technology has been one of the important factors for the growth of the industry. Historically, during the 1980's, strategic management scholars began to recognize technology as an important element of business definition and competitive strategy. Technology was identified as one of three principal dimensions of business definition, noting "technology adds a dynamic character to the task of business definition, as one technology may more or less rapidly displace another over time." As per Porter (1983), technology is among the most prominent factors that determine the rules of competition· Friar and Horwitch (1985) explain the growing prominence of technology as the result of historical forces; disenchantment with strategic planning, the success of high-technology firms in emerging

industries, the surge of Japanese competition, recognition of the competitive significance of manufacturing, and the emergence of an academic interest in technology management. As per Betz (1994), Technology strategy is realized in practice through various means like internal and external technology sourcing, deploying technology in product and process development and using technology in technical support activities. In turn, performing these activities provides change in the firm's technical competencies and capabilities.

However, strategic management of innovation and technology remains an area of neglect and misunderstanding for many Indian firms and may provide opportunities if managed properly. Surveys of the world's largest (R&D) performing companies (Roberts 2001) have been emphasizing that top management linkages of business and technology strategies are crucial for effective technology strategy. It is important to understand the reality of STM in emerging country contexts such as India. While there is considerable literature which emphasizes the importance of linking technology and strategy (Jones and Smith 1997; Momaya and Ajitabh 2005), reality of STM in Indian contexts is rarely examined, particularly in mid-size firms. This study attempts to contribute to this gap by taking the case of an auto component firm that has done considerable efforts to enhance its competitiveness through strategic technology management over a few years. Researchers have studied the competitiveness of medium scale Indian organizations (Singh and Deshmukh 2006); the current study concentrates on technology management aspect and its effects on the business performance of the organization.

Technology is the most prominent factor that gives a competitive edge to organizations. Competitiveness of auto component firms in India remains low, and that can be partly attributable to limited technical capability.

Methodology

A purposive sampling scheme was used for the purpose of the study. M/s Minda industries was selected as the case organization as Minda has adopted STM practices for enhancing their technical capability. A combination of case analysis, observation and interviewing was used as a methodology to comprehend the issue under study. Attributes such as Nature of industry, evolution of the organization, Collaborator(s), Corporate philosophy, Products, Customers and competitors, Technology strategy, Technological strengths and weaknesses, Integration of technology strategy with corporate strategy, Technology management practices and Business performance were studied. The graphical representation of methodology followed for case analysis is depicted in Figure 1.

Data on various aspects covered in the scope of the study was collected from concerned persons in the case organization. Semi-structured interviews were carried out with the people in various relevant functions and their profile is summarized in Table 1.

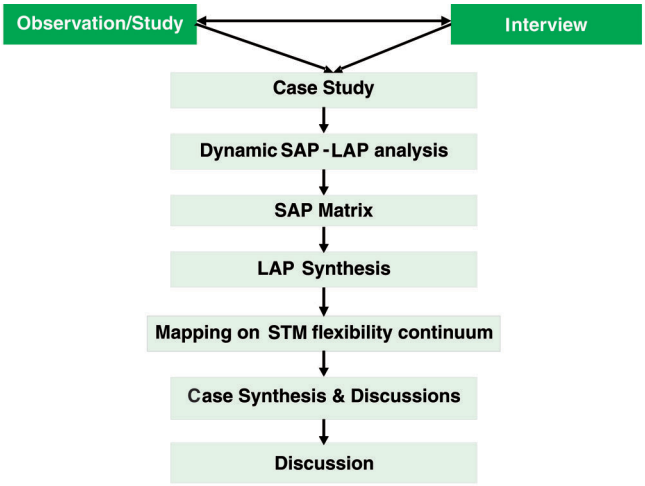

Figure 1: Methodology for Case Analysis

Table 1: Respondent Profile

Length of Experience	Number of Respondents	Functional Area	Number of Respondents
15 years & above	7	R&D/Engineering	6
10 to 15 years	4	Production / Process Engg	5
7 to 10 years	3	Corporate	3
Less than 7 years	2	Finance	1

Dynamic SAP-LAP Framework

The case has been analyzed using flexible system methodology based on SAP-LAP (Situation-Actor-Process, Learning – Action Performance) framework (Sushil 1994, 1997, 2001) to evolve the 'learning issues' regarding the actual practices and to bring out the 'suggested actions' for 'improvement in the performance'. Various researchers have used the SAP-LAP methodology (Sushil and Husain 1999; Husain et al 2002; Pramod and Banwet 2010; Sahoo et al.) for analyzing the dynamic situations being encountered in the industry. The methodology is applied in two steps comprising of SAP analysis and LAP synthesis. In SAP analysis, the case is described through three components that define the dynamic interplay of reality. These components are situation, actors and processes. These are definable within a context and interact flexibly on multiple planes in the ambiguous reality.

This study examines the longitudinal technology development at an auto component manufacturer in India and analyses the linkage between STM and business performance using the dynamic SAP-LAP analysis S*ituation* is the present status covering the environment, business opportunity including technological potential and technology management practices undertaken by the organization. *Actors* are the various people and parties including the employees, managers etc who influence the situation and alter it by their actions or inaction. *Processes*

are the procedural steps, including the technology management activity, taken by actors who alter the situation. Any dynamic behavior that alters the situation has the potential of being a process. Figure 2 shows the SAP –LAP model of inquiry and the interaction of situation, actor and process in the SAP-LAP paradigm.

The SAP matrix is formed on the basis of the internal and external actors for the organization. The internal actors include the employees of the organization; whereas the

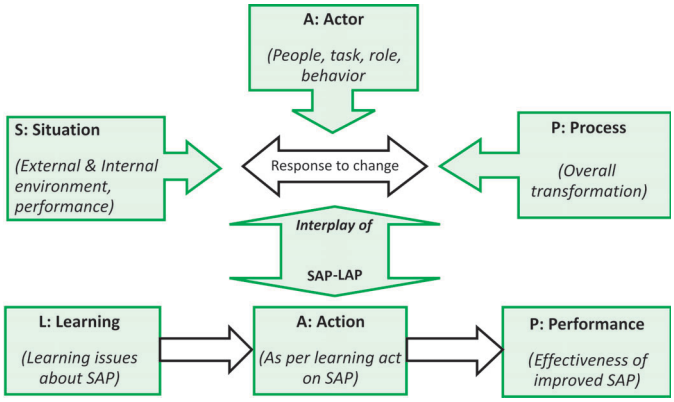

Figure 2: SAP-LAP Model

external actors include the external partners and suppliers. SAP matrix explains the two situations in terms of before and after implementation of STM initiatives within the organization. SAP synthesis lead to the second phase, which is called LAP synthesis, having three components i.e. learning issues, actions and performance. Learning issues emphasize the typicality as well as some features of its uniqueness. In the context of STM, it covers the outcome of the practices and policies. Learning issues lead to action, which when taken would lead to improved performance.

The dynamic SAP-LAP framework was used to understand the external and internal environmental changes with respect to time (Bhardwaj et al 2005). Dynamic SAP analysis gives the analysis of the situation, actors and processes with respect to time. This dynamic SAP analysis is with reference to internal and external environment and helps to understand the situation before and after STM practices were taken up. The inquiry schedule, described in Table 2, identifies the critical questions in each element like Situation, actors, process and learning. The schedule provides a structured framework for directing the initial questions to the respondents during the discussions; however, it does not limit the further queries emanating from the replies by the respondents.

This study examines the longitudinal technology development at an auto component manufacturer in India and analyses the linkage between STM and business performance using the dynamic SAP-LAP analysis.

Table 2: SAP-LAP Inquiry Schedule

Situation
– What are the core competencies of the organization?
– What is the nature of the competition that the organization is facing?
– Where the organization is placed on the technological road map vis-à-vis the competition?
– What are the factors driving the organization towards framing a Technology strategy?
– What are the initiatives taken by the organization to manage the technology effectively?
– What are the actions taken by the organization to relate the technology management to the business goals?
Actors
– Who are the main actors that play a lead role in managing the technology strategy of the organization?
– What are the roles of the actors in pursuing the integration of technology & business strategy?
– What is the significance of the role played by the lead actors in the context of organizational decision making?
Process
– What are the formal processes for tracking the manufacturing & technology developments?
– What is the process of Technology development being followed in the organization?
– How are the plans for manufacturing & technology capability made and implemented?
– What is the process of Technological know-how documentation & management for ensuring a learning curve?
– How are the Technology & business strategy integrated at the organization level

Case Study

Introduction to Minda Group

M/s Minda Industries Limited is the flagship company of the Minda group. Minda Group was founded in 1958 by Sri S.L. Minda and made a humble beginning by making switches for the automotive industry. The setting up of Maruti Udyog Limited in 1982 (now known as Maruti Suzuki India Limited), the joint venture company between Government of India and Suzuki Motor Corporation, Japan, really set the path for the growth of the auto component industry in India including the Minda group. The traditionally family owned business was gradually taken over by the two sons of Mr. S.L. Minda namely Mr. Nirmal Minda and Mr. Ashok Minda.

Minda's first technical alliance with M/S Tokai Rika, Japan was the stepping stone towards JVs. TA/ JVs are seen as enablers to gain access to latest technology in auto component industry.

With the opening up of automobile Industry in India in 1991, the auto component sector started looking up to cater to the demands of global auto major entering India. This was the time when the group started looking outside and identified "Technology" as a key factor in order to achieve faster growth. The group started a green-field project with

technical alliance with M/s Tokai Rika, Japan to manufacture 4-wheeler switches in 1992. The same was later converted into a joint venture Company named "Minda Rika Private Limited") in 1995. This was the first group company to be set up exclusively to serve the customer's need of import substitution of parts. The venture was a huge success both in terms of Technology management and business results. This led to a strong belief within the group about having strong technical collaborations/ JV's in order to get access to the latest technology and products to meet the needs of OEM's. Subsequently, the group has formed joint ventures and got into technical agreements with suitable partners for different product categories including Lamps, Horns, Batteries and alternate fuel kits. All the group companies of the Minda group are certified for TS 16949, the latest standard in Quality Systems Management.

Minda Industries Limited – Company Profile

Minda Industries has a turnover of Rs 4500 million and employs over 4000 persons in 17 plants. Minda industries have seen enormous success due to growing demand as well as its management of the company in an effective manner. This is the earliest of the group companies and has a long history associated with it. The company has been growing steadily over the years. The representative organization structure of Minda Industries is shown in Figure 3. A brief description about the major divisions of the company is explained subsequently.

Switch Division

Switch division is one of the earliest divisions of the company. The company started with 2-wheeler switches for aftermarket and later spread its wings to OE business of Tractors, 2-wheelers and 2-wheelers. The company faced quite a few market problems with the 4-wheeler switches due to the stringent quality requirements. The company looked for a suitable technology partner and formed a JV with M/s Tokai Rika of Japan. This JV took over the 4-wheeler switch business and reduced the quality issues drastically. The 2-wheeler switch business continues with Minda Industries. Minda Industries already enjoys more than 70% market share in the 2/3 wheeler segment in India and is amongst the top few globally. It is already making inroads into the ASEAN market and aims to become the favored vendor for 2/3 wheeler switches globally. Minda Industries Limited has established 8 state of the art facilities spread across country and one in the ASEAN region.

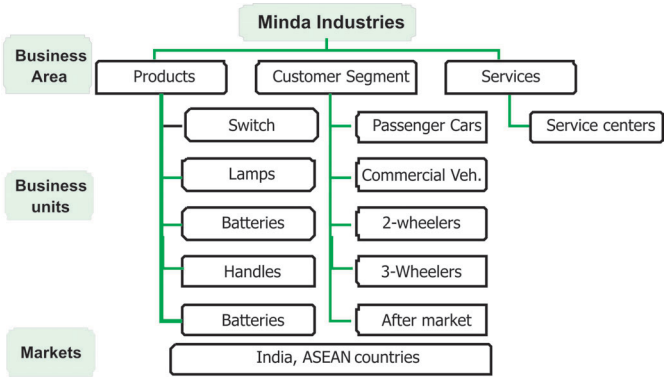

Figure 3: Representative Organization of Minda Industries

(Source: Developed based on Information from Minda Industries)

Lighting Division

Minda has a structured strategic business planning process. Technology forms an integral part of the business strategy.

The lighting Division of Minda Industries was conceived way back in 1980 and started with the supply of small lamps to the TVS group in 1984. It took gradual steps to increase the product portfolio and customer base. The company set up in-house facilities and developed capabilities for small lamps manufacturing. The process adopted was primarily "reverse engineering". Gradually, Minda took up the design and development of small lamps for 4-wheelers also. With customers in India were looking for a company with better technical capabilities and development of components with shorter lead times. This led to the search of an appropriate technology partner in the lighting area and Minda tied up with TYC in 2003. Minda Industries Ltd and TYC Brothers of Taiwan announced a Technical alliance with a view to convert it into a future joint venture for the design and manufacture of automotive lighting equipment in India.

Minda's first technical alliance with M/S Tokai Rika, Japan was the stepping stone towards JVs. TA/ JVs are seen as enablers to gain access to latest technology in auto component industry.

Minda lighting division manufactures a range of lighting system parts for supplying to OEM's and after market. With support from TYC, it has gradually developed capabilities for bigger lamps for 4 wheelers also. The current range of products includes Head Lamps, Rear Combination Lamps, Fog Lamps, High mount stop lamps, Side Turn signal lamps and License Lamps. It has manufacturing plants located in Sonepat and Manesar, Haryana and Pune, Maharashtra. In all the plants, manufacturing concepts like TPS and Kanban are employed to bring in flexibility in manufacturing.

Battery Division

The company has also set up a Battery division in technical collaboration with M/s FIAMM of Italy with plant to produce automotive Batteries. After successful development of 2-wheeler batteries, the product range has been expanded to 4-wheeler batteries. The manufacturing plant is located at Pant Nagar, Uttaranchal.

After a few successful JVs, Minda realized the importance of building its own technical competency by leveraging upon the technical know-how of partners as well by its own efforts.

As per the outlined vision, Minda Industries aspires to become a preferred supplier of OEMs for switching and lighting system solutions. The major customers of Minda TYC are Bajaj Auto Ltd, Yamaha Motors India (P) Ltd, TVS Motor Co. Ltd., Maruti Suzuki India Ltd, Tata Motors, Mahindra and Mahindra, Hindustan Motor, Ford India, GM

India, Toyota Kirloskar, and Volkswagen. Some of the major competitors of Minda lighting are Lumax, India Japan Lighting, Alpha Toyo, Exide Batteries, Hella etc. Minda Industries makes an interesting case study in the area of "Strategic Technology Management".

Technology Development

Minda Industries is an established organization that started with switches division and has been adding on the various new business lines subsequently. It set up in 1970's a modern plant for switches. It further set up the Lighting Division for development of small lamps and started supplies of lamps to TVS in 1984. In order to manufacture a range of lamps, plant was set up in Haryana in 1990 as a green field project. The company started the supplies to India's leading passenger car manufacturer Maruti Suzuki in 1994. It entered into a strategic TA with Siema, Italy in the year 1999 and the supplies to Fiat started soon after this. With focus being turned to technology, search started for a technology partner as there was hardly any support from Siema, Italy. Meanwhile, the company developed in house facilities for tool design and development. This helped in the company developing High mount stop lamps for passenger car manufacturers, which was required as a part of Jan 2003 regulation. The longitudinal study of technology development at Minda industries is shown in Annexure I.

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Technology Management

Minda has a pool of qualified engineers for product and tool design and development. It has CAD/CAM/CAE system for component and tool design and manufacturing. Minda also took up the manufacturing capability up gradation by constructing high class tool development facilities. It has also developed test facilities for testing and evaluation of components. Minda Industries started by adopting the reverse engineering techniques for developing products initially. Subsequently, it developed in-house capabilities for design and development. Current emphasis is to acquire new technologies with the support of the JV partners and to upgrade the design and development capabilities of the entire group for becoming a competitive lighting system supplier.

Minda Industries employs the cross-functional team structure for new projects. In this the concerned Customer Account Head is responsible for all the major activities in a new project and is accountable to the customer. As part of the Minda group, it has structured process for strategic business planning. The industry Minda operates being technology intensive, technology forms a part of the strategic plan. Both medium term and long term technology plans are prepared for product, process and businesses.

Specific targets for parameters such as Revenue, Quality improvement productivity improvement etc is fixed up on yearly basis. Periodic reviews take place to review the performance. Technology management process (Hardware, Software and Brain ware) followed at Minda Industries is summarized below;

- **Product technology:** In-house development; By transfer of drawings, components, raw materials etc from collaborators
- **Process technology:** By transfer of drawings, equipments, production line etc. from collaborators / technology partners, suppliers of equipments
- **Management technology:** By training people in different areas in Collaborators plants; Team working– Teams for new product development

The Business Head is primarily responsible for technology management function. He reports to the corporate head. He is responsible for technology planning, initiating new ventures, product up gradation and improvements and new product developments. Divisional Head (Marketing and Engineering) looks after Engg and marketing functions. This helps to have better understanding of customer requirements.

Business Performance

The business performance of Minda Industries is given in Figure 4.

With focused in-house development and the experience, Minda has been able to develop products such as Switches, HMSL and Fog Lamps with relatively shorter lead times. The productivity has increased after the single piece flow concept was introduced by Minda. Besides the above, Minda employs measures such as quality improvement and rejection rates to judge the effectiveness of technological improvements. Exports performance of Minda grew at a CAGR of over 50%, which reflects the focus of the management on exports and the design and manufacturing quality of its products.

Though it is apparent from the above that Minda has been doing technology management from the beginning, however, on a closer look, it is noticed that there have been

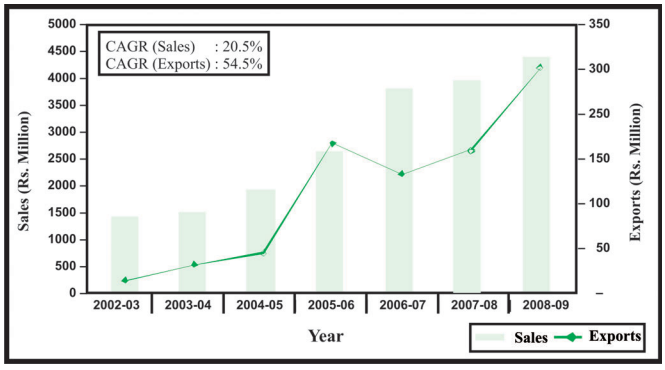

Figure 4: Business Performance of Minda Industries
(Source: Developed based on Information from Minda Industries)

certain transition points where Minda management started practicing STM. Dynamic SAP-LAP analysis is a suitable tool to understand and synthesize such situations. The dynamic SAP-LAP analysis conducted for Minda Industries is explained below.

Dynamic SAP Analysis

Dynamic SAP analysis gives the analysis of Situation, Actors and Processes in case of Minda Industries. This dynamic SAP analysis is carried out before and after STM initiative at Minda.

Opportunities

- In 2002-03, the automotive industry had recovered from the slowdown and recorded a growth of 13% over previous year. The large volumes of investment including foreign direct investment in the automobile manufacturing ventures and technical collaboration are propelling a quantum jump in up gradation of technology. With increased production and capacity creation in the passenger car sector, foreign countries may use India as an export hub. This tremendous growth is likewise triggering growth of the auto-component segment.
- Frequent changes in vehicles as part of minor / major changes by the automotive OEMs provide a huge opportunity for growth for switches and lighting products.

Minda started adopting STM practices consciously due to market opportunities (large FDI and industry growth), increased competition and stricter regulatory requirements.

Threats

- With the expected boom in the 2-wheeler and passenger car production, Industry, particularly, the auto component industry had become more competitive. Concentrated efforts were going on in India for inducting and absorbing the latest technology and upgrading the quality of products to an international level and a partner search mission was on by many of the component suppliers. Indian firms were on the lookout for Joint Ventures and technology alliances specializing in niche technology and to complement their range of products as well as bench marking with the world's latest and the best.
- The regulation regime in India was growing stricter as the year 2003 was going to witness a slew of regulations like Emission, Safety (Seat belts and High mount stop lamps, Horns), and Regulation of Ozone depleting substances. This essentially required technology upgradation at supplier end. Auto component manufacturers in India not only had to invest in manufacturing, but had to upgrade product technologies to remain future ready.

Both internal and external stakeholders have a role to play in the STM practices of Minda.

Main Actors

The main actors facilitating the STM are mentioned below:

- Managing Director and other directors of Minda Industries.
- Managers of Minda as the change agents.
- Collaborators as partners.
- Customers as opportunity providers.
- Competitors as source of inspiration.
- Govt. of India and various state government agencies.

Processes

The company worked to make a strong manufacturing base and low overheads have kept the company cost competitive.

- Emphasis on In-house capability development and on acquiring new technologies with the support of the technology partners.
- Upgradation of the design and development capabilities of the group for becoming a competitive Switching and lighting system supplier.
- In house R&D team works on new technologies with a futuristic outlook has helped the group in launching many innovative products.
- Management of product up gradation and new product developments in a structured manner through customer need identification.
- Minda Industries is a professionally managed company and has a Business Head who is responsible for technology management function including technology planning, initiating new ventures, product up gradation and new product developments.
- Focused in-house development leading to shortening of Time to market and thereby supporting the customers for a faster minor/full model change.
- Continuous education of its employees including the shop floor associates at its "Pathsala" (Minda Learning Centre).
- Systematic technical information exchange with technology partners by way of visit of its engineers to collaborator plant and design locations, frequent visit of collaborators to Minda plants, mail exchanges and regular teleconference.
- The company has experienced productivity enhancement by adoption of the single piece flow concept on their assembly line. They have employed Kan-ban, modular manufacturing system in all their business units.
- Supplier management has gained required focus in current years and Minda has taken up a cluster based approach for development of suppliers.
- Technology implementation has been given due focus and thrust and Minda has implemented a cross functional team approach for implementation of new technology projects.

- The company has initiated an objective judgment of technological improvements measures through monitoring of parameters like quality improvement and rejection rates. This has led to a lower rejection rate both on the company as well as the customer end.

The summary of Dynamic SAP analysis is presented in Annexure II.

SAP Matrix

The SAP matrix is based on three components of Situation, Actor and Process. The Y-axis consists of two different situations of technology management i.e. traditional technology management and STM. The X-axis mapped the two types of actors, internal and external. The processes are mapped based on different situations and different actors. The SAP matrix is shown in Figure 5.

The SAP matrix explains the situation with respect to before and after STM practices and their impact on internal actors such as employees and external actors such as partners, suppliers, customers of Minda Industries.

LAP Synthesis

The LAP (Learning- Action-performance) synthesis is based on Dynamic SAP analysis. It gives the learning from the situation, action suggested for the actors and performance of the organization due to the implementation of various processes mentioned above:

- Formation of collaborations in different product areas has helped Minda TYC to bring in new technology and induce a new culture for betterment of the company.
- Formation of corporate R&D has resulted in introduction of many innovative products by the respective design divisions and has resulted in enhanced technology absorption capability of Minda Industries as a whole.

After STM practices	High level of product and technology planning • Corporate R & D providing requisite support to respective design divisions • Objective judgment for quality up gradation initiatives • Employee productivity enhancement	• Lesser quality issues for the customers· New customers coming into fold of Minda Industries • Improvement in business results
Before STM practices	• No formal process for technology planning • No structured methodology for product and process up gradation	• Quality issues being faced by customers • Longer lead time for product development at customer end
	Internal actors	**External actors**

Figure 5: SAP Matrix for Minda Industries

- A highly skilled and motivated workforce has contributed in a big way for success of Minda Industries.
- The product range that Minda Industries is dealing with has a lot of relevance to the changing customer preferences. Switches and Lighting being one of the systems which directly impacts the aesthetics and appeal of the vehicle requires the touch of sophistication in product development.
- Minda has seen a relatively good growth rate in last 5 years. Senior Management team at Minda attribute this to the result of sustained efforts put in for in-house developments.

Minda Industries needs to remain cost competitive in order to strengthen its presence in the highly competitive four wheeler lighting and electrical system area. However, in the new business areas Minda Industries needs to prove its credibility in terms of reliable performance of its products, which is key to sustained business growth in auto component industry.

Case Synthesis and Discussions

The study brings about some interesting observations regarding Strategic Technology Management practices and their impact on the organizations performance. Some of the important parameters concerning the effective technology management practices have been described on the technology management continuum before and after the implementation of STM practices in Figure 6. The analysis indicates that there has been a positive movement on the continuum in each case.

Minda started with in-house efforts to manufacture switches and lamps etc. It adopted the "reverse engineering techniques" to develop products on its own and gradually built the in-house facilities for design and development.

The case study brings out the importance of strategic technology management in auto component industry in India and shows why organizations need to develop technology capability for sustained business performance.

This process took quite a long time before Minda realized that technology support from a capable partner is required to grow in such technology intensive areas at the required speed. Therefore, it went for various JV's and TA's. The switch JV with Tokai Rika grew into a highly successful venture. However, TA with Siema, Italy for lamps did not work out well because of some differences and less interest from the collaborator side.

Subsequently, Minda entered into collaboration with TYC, Taiwan for providing the technology in this area. Minda brought in their design talent from various divisions to the lamp division for effective absorption of technology in the JV. The initial progress in the Lamps divisions has been encouraging as reflected in the business performance of the division.

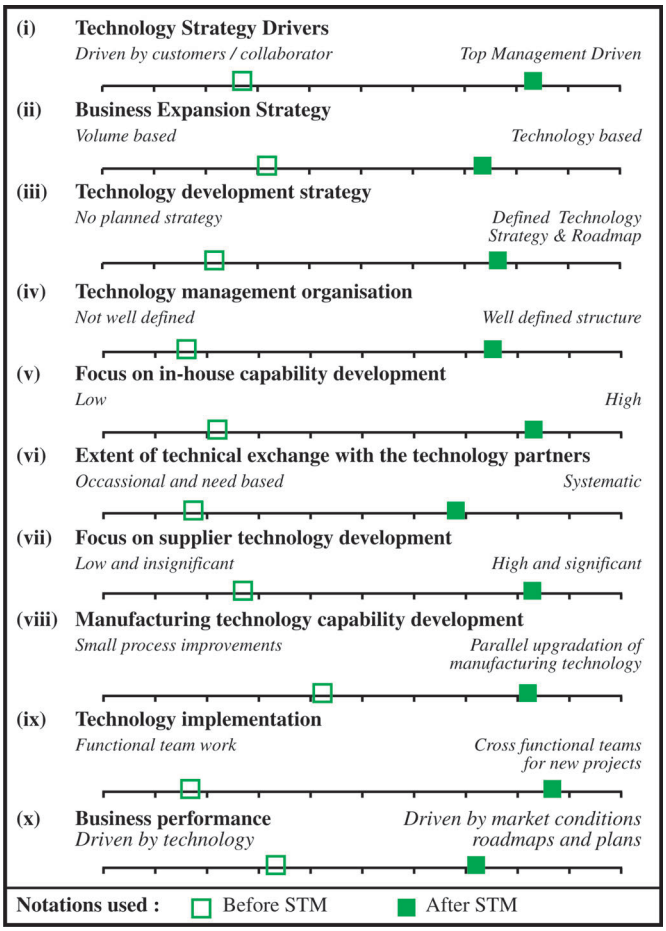

Figure 6: Positioning of Minda Industries on STM Flexibility Continuum

At the same time, Minda also realized the fact that despite going for various TA's, the long term capability up gradation can only be achieved through effective absorption of technology from the partners as well as by own efforts. Therefore, they have gone in for a corporate R&D that works in the various future technology areas and supports the various divisions in introducing contemporary technologies in the products.

The case study brings out the importance of strategic technology management in auto component industry in India and shows why organizations need to develop technology capability for sustained business performance.

The strategic approach adopted by Minda Industries for technology management has started showing results and Minda has been able to enhance its technical capability and improve its business performance.

Conclusion

This case study clearly brings out the need for STM in auto component industry in India and demonstrates how organizations can benefit by adopting STM practices. Organizations need to have a strategic intent and are required to put in efforts for building technological development capabilities. Both active technology development and technology transfer play a key role in developing the organization's technological capabilities. Organisation may not be able to develop technological capability for sustained business growth unless the organizations develop technology absorption capability and capacity. The benefits of technical collaborations can be drawn to the best extent only with the parallel up gradation of the local manpower and design and evaluation capabilities. The organizations need to absorb and further build upon the technical know-how to attain a long term technological edge.

Business results of the organizations depend on the appropriate integration of technology strategy and business strategy. The case of Minda Industries demonstrates an organization that has been successful in enhancing their technical capabilities through in-house efforts as well as leverage the know-how absorbed from the partner. Therefore, they could effectively link their technology strategy to their business strategy. Finally, organizations need to have an appropriate framework for "Strategic Technology Management" and need to chart out their own road map for long-term success and growth.

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References

ACMA (2009). Industry Statistics, Automotive Component Manufacturers Association of India, Delhi (www.acmainfo.com, accessed 09 September 2009)

Betz F (1994). *Strategic Technology Management*, McGraw-Hill, New York

Friar J. and Horwitch M. (1985). The Emergence of Technology Strategy: A New Dimension of Strategic Management, *Technology in Society*, 7, 143-78

Government of India (2006). Automotive Mission Plan 2006-16, Ministry of Heavy Industries and Public Enterprises, Government of India, New Delhi.

Husain Z., Sushil and Pathak R.D. (2002). A Technology Management Perspective on Collaborations in the Indian Automobile Industry: A Case Study, *Journal of Engineering and Technology Management*, 19(2):167-201.

Jones O. and Smith D. (1997). Strategic Technology Management in a Mid-Corporate Firm: The Case of Otter Controls, *Journal of Management Studies*, 34(4):511-536.

Momaya K. and Ajitabh A. (2005). Technology Management and Competitiveness: Is There Any Relationship, *International Journal of Technology Transfer and Commercialization*, 4(4):518-24.

Porter M.E. (1983) The Technological Dimension of Competitive Strategy, *Research on Technological Innovation, Management, and Policy*, 1, 1-33.

Pramod V.R., Banwet D.K. (2010). System Modeling of Telecom Service Sector Supply Chain, *International Journal of Business Excellence*, 3(1):38-64.

Roberts E.B. (2001) Benchmarking Global Strategic Management of Technology, *Research Technology Management* 44(2):25-36.

Sahoo T., Banwet D.K. and Momaya K., Strategic Technology Management in Auto Component Industry in India: A Case Study of Select Organizations, *Journal of Advances in Management Research,* 8(1), Forthcoming issue.

SIAM (2009). Industry Statistics, Society of Indian Automotive Manufacturers, Delhi (www.siamindia.com, accessed 09 September 2009)

Singh R.K., Garg S.K. and Deshmukh S.G. (2006). Competitiveness Analysis of a Medium Scale Organization in India : A Case, *International Journal of Global Business and Competitiveness,* 2(1):27-40.

Sushil (1994). Flexible Systems Methodology, *Systems Practice*, 7(6): 633-652.

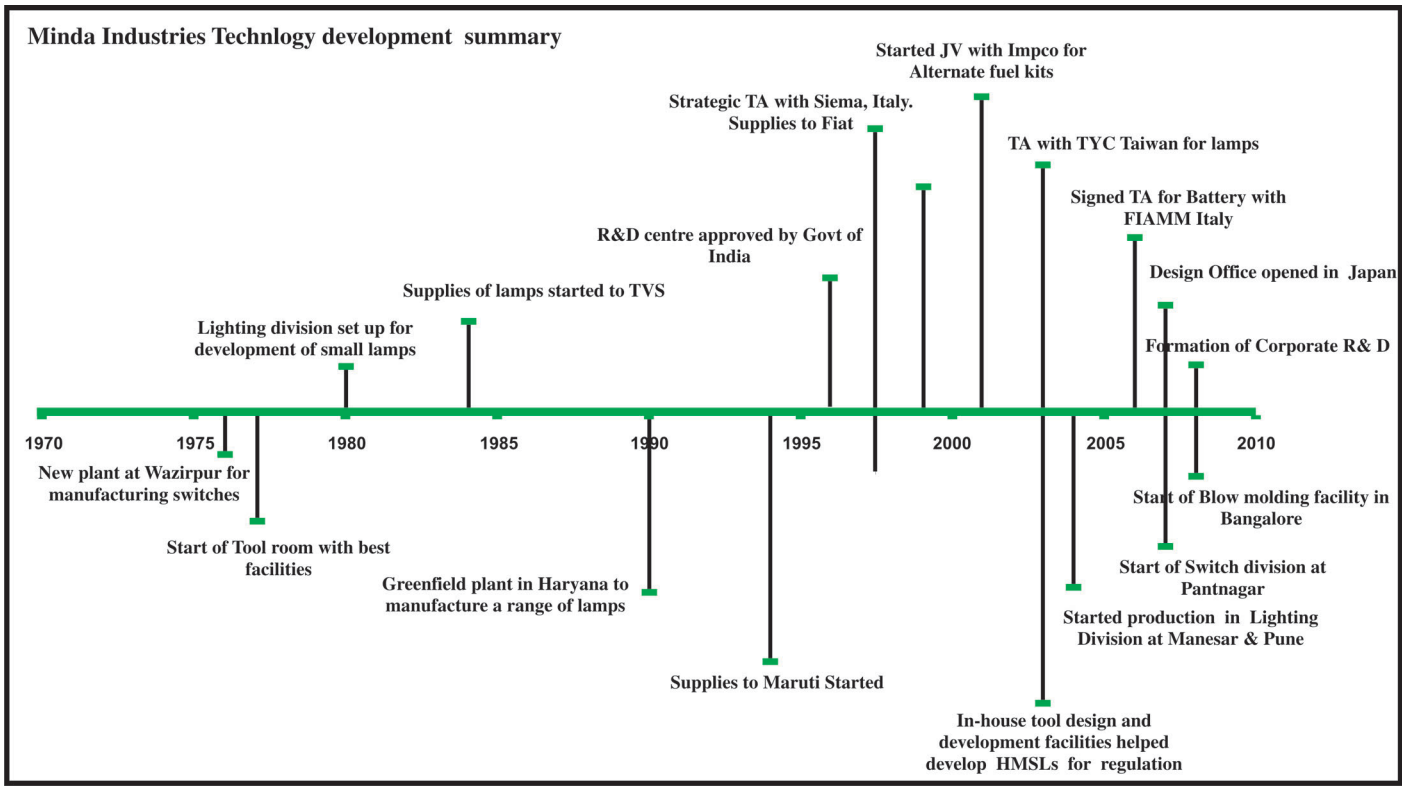
Sushil (1997) Flexible Systems Management: An Evolving Paradigm, *Systems Research and Behavioral Science*, 14(4):259–275.

Sushil (2001) SAP-LAP Framework, *Global Journal of Flexible Systems Management*, 2(1):51–55.

Sushil and Husain Z. (1999). Management of Technology: Learning Issues for Seven Indian Companies, *Technology Management: Strategies and Application,* 3, 109-135.

Bhardwaj B.R., Sushil and Momaya K. (2005). Synthesis of Issues in Corporate Entrepreneurship: Study of IT Services Firm. Proceedings of Fifth Global Conference on Flexible Systems Management.

Annexure I: Technology Development History of Minda Industries



Annexure II: Dynamic SAP Analysis of Minda Industries

	Before STM Initiatives	After STM Initiatives
Situation	• Increasing demand for the automotive switches and lamps due to frequent Minor/Full body changes & regulations • No end-to-end technical support from the then collaborators (M/s Siema Italy)	• Technical collaboration with suitable partners in different product areas • Emphasis on acquiring new technologies with the support of the collaborators and to upgrade the design & development capabilities of the group for becoming a competitive lighting system supplier • Corporate R&D setup to work on future technologies to support design sections of respective divisions
Actors	• Employees and Managers	• Top Management, Employees and Managers • Business Head to be responsible for technology management function including technology planning, initiating new ventures, product up gradation and new product developments • Divisional head (Mktg & Engg) looks after Engg and marketing functions to have a holistic understanding of customer requirements
Process	• No formal processes for technology up gradation, benchmarking and technology management • No objective judgments of the quality improvement initiatives • Low focus on in house development resulting in longer time to market • Relatively lower productivity levels considering the production levels with desired quality, quantity and variety	• Adoption of formal technology management function for efficient technology planning and initiation of new ventures • Managing product up gradation and new product developments in a structured manner • Focused in-house development leading to shortening of Time to market • Productivity enhancement by adoption of the single piece flow concept • Objective judgment of technological improvements measures through monitoring of parameters like quality improvement and rejection rates

Key Research Questions

1. Where is your organization positioned in the STM flexibility continuum developed in this case?
2. Can you identify other parameters which can be of significance for STM flexibility continuum?
3. To what extent are the findings of the paper relevant for adoption of STM practices in your organization?
4. Critically analyze if the technical advances and innovations in your organization are reactive or proactive.

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