Strategic Outsourcing of Engineering and Technical Documentation to India: an Experience from a Company Leader in the Railway Sector

MARCO MOSCA  
Bombardier Inc.  
Brown Boveri Str. 5, 8050, Zürich  
SWITZERLAND

FLAVIO TONELLI  
Department of Production Engineering, Thermo energetic, and Mathematical Models  
University of Genoa  
Via All’Opera Pia 15, 16145 Genoa  
ITALY  
flavio.tonelli@diptem.unige.it

ROBERTO REVETRIA  
Department of Production Engineering, Thermo energetic, and Mathematical Models  
University of Genoa  
Via All’Opera Pia 15, 16145 Genoa  
ITALY  
roberto.revetria@unige.it

PAOLO TATICCHI  
Department of Industrial Engineering  
University of Perugia  
Via Duranti 17, Perugia  
ITALY  
paolo.taticchi@unipg.it

Abstract: - Scope of this paper is to report an applied research for transferring different key European Projects related to Vehicle Engineering and Technical Documentation to a major Indian Outsourcing Company performing engineering activities. This research was conducted by a Multinational Company, leader in the railway sector, for economical reasons and considering the labor cost as the primary driver. Hourly rate negotiated with India Outsourcing Company is about ratio one to seven compared to the European average. Aim of this research was the analysis of the phases that led to the decision to outsource, including an extended analysis of the potential risks identified and the related mitigation actions proposed. The proposed approach required, to one of the Authors, more journeys to India to visit the Supplier at all levels from the top and middle management, to each engineer department, including a deep audit of all the working processes and the technologies used. Key factor for success was a Project of Integration between the two Companies in order to harmonize the European processes and systems across the different countries with the Indian ones, to develop clear tools, protocols and rules for a clear communication and making people collaboration effective. Due to the results of this research the Internal Engineering Department of the Multinational Company was strongly resized, in a three years period, by releasing up to several European engineers per country. This provided the Company with exceptional yearly savings to reach the competitiveness needed on the market, and allowed to a selected pool of European engineers to lead India Outsourcer effectively, while focusing on the core Engineering business. The paper reports quantitative results only for Technical Documentation project due to not disclosure agreement clauses.

Key-Words: - Strategic Out-Sourcing, India, Engineering, Technical Documentation, Operations Integration.

1 Introduction

The competition in the railway market got harder in the last years. A multinational environment has different contexts in relation to the country of belonging, due to completely different social and economical scenarios. These environmental changes forced all competitors to take solid actions to survive in a more competitive market, making the change itself becoming a need and representing the
possibility to survive. Three major causes can be identified as a common issue:

- Privatization of the Railways leads to a bigger attention to gross margin by the rail operators,
- The possibility of spending was reduced, and
- Open markets provoked a stronger pressure on costs.

A more detailed analysis of the last point can be articulated in order to identify the forces driving actions in this sector and source, potency and nature of these forces.

From the operational point of view, in the last decade, the railway market faced an increasing competition due to open markets, which, in turn, provided new suppliers (especially those from low-cost countries), forcing companies to change procurement activities into strategic sourcing process. Unfortunately, benefits of this change were not so good as, in the meanwhile, raw material costs increased with unexpected angle.

The deliver and after-sales processes saw parts suppliers becoming competitors operating unfair sales to the company’s customers at reduced price, trying to take over the after-sales business. Furthermore, customers becoming competitors developing new infrastructures and forming dedicated personnel with the scope to include maintenance as core business.

On the product development side, engineering activities usually devoted to excellence, suffering increasing pressure on the costs.

To fight this rapidly evolving situation, collaborative relationships became a factor of success and dedicated organizations raised in the company to evaluate and negotiate new partnerships with the following observed results:

- Mergers and acquisitions changed the shape of the Market for more players,
- More projects were assigned to consortiums instead of single players, and
- Low cost Countries providing engineering services became integrated suppliers, so transforming the concept of out-sourcing into in-sourcing.

In this framework old players died or became stronger even thanks to merging and acquisition processes making some companies get huge.

2 Purpose and rationale of the research

The competitiveness in the market for a Railways Multinational Company Leader is based on prices, which determine the attractiveness for the customers related to the goods offered. The main purpose of this research was to reduce costs to overcome competition. In 2004 a strategic partnership was started up, between Bombardier Transportation and Infotech (Indian Provider of Engineering Services, counting more than 2.000 Engineers), building up an Engineering Centre in Hyderabad, fully dedicated to Bombardier. It was named BTECI (Bombardier Transportation Engineering Centre India).

The research reported focuses on the adoption of:

- A Six Sigma methodology,
- An in-sourcing strategy,

To select the Indian Engineering Company in which performing engineering non-core activities with the target to reduce drastically engineering costs.

The paper reports on the action research conducted in BTECI, joining the efforts of one company’s manager, responsible for the outsourcing process, and a staff of academic researchers, responsible for the approach and the methodology. The Authors consider this research worthwhile since the above-described situation is quite common to a large number of worldwide companies.

Many important companies, in different markets, have adopted the strategic outsourcing approach moving non-core business activities in low-cost countries like India and China, considering different attitudes and capabilities. The academic literature and reported experiences on this topic are relevant, offering a well-structured background and very interesting case studies [1]. Nevertheless, the strategic decision toward a strategic outsourcing process is a big challenge requiring dramatic efforts and huge investments that are known for sure, while the benefits are usually featured by a high degree of uncertainty. Thus, managers and experts considering this strategy are still claiming for rigorous methodologies to support this critical transition in a practical way.

The action research approach has been considered an appropriate methodology to improve knowledge on this topic leading to practical outcomes with broad relevance to practitioners and important contributes to theory refinements [2]. The knowledge contribution is about the process that Railway Company has to perform to achieve this relevant change through the clear evidence of hidden problems and potential pitfalls. Moreover the Authors believe that this action research experience can be resumed in practical guidelines to support whoever will take the decision to dismiss part of the company activities in favor of any kind of supplier becoming a partner and requiring an integration process.

2.1 Diagnosing for problem identification

The economical and industrial environments have been modified in the last five years facing new issues continuously so that multinational companies have tried to react adopting different strategies. In this paper Authors analyze the cost reduction strategy. According to this strategic choice, the cost structure needed to be resized, so every cost impacting on the final product cost was evaluated with the scope to cut down useless costs. The first step was devoted to analyze processes, setting variables and parameters to be measured, and improve the processes to get savings.
At this purpose a six-sigma organization was developed and it took three years to reach full efficiency from design to delivery. Six-sigma process of continuous improvement was implemented in the whole organization. It worked as the well-known bottom up approach involving progressively all the employees. Major scope was to develop saving projects to be approved by local managers and controllers. The Six Sigma organization had virtually costs, because projects and people were fully paid back by the savings achieved. For example, only in Services Italy, in the 2004 year, the total amount of savings, certified by the controller, overcame the sum of 300k€ when the relevant working time invested was less than 22k€. A Recognize, Define, Measure, Analyze, Design, and Verify (RDMADV) approach has been used according to the figure 1.

Figure 1 – The RDMADV approach

The minimization of the waste allowed achieving a sensitive cost reduction, but the result was not enough to reach the expected competitiveness on the market, neither to respect the margins targeted by the management. More efforts were needed leading the issue to a strategic decision, changing the Company in depth, with strong impact on the organization and processes: the strategic outsourcing of non-core activities to India. This approach would have required major investments and dramatic efforts, at all levels, finally resulting in exceptional savings, allowing BTECI to reach the goal.

Table 1 – SWOT Analysis results (partnering with BTECI on documentation)

<table>
<thead>
<tr>
<th>Strengths</th>
<th>Opportunities</th>
<th>Weaknesses</th>
<th>Key Threats</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leverage Business Services (G座位)</td>
<td>Support Parts Business growth (easy-to-order)</td>
<td>BTEC strategy to date is not yet mature enough</td>
<td>Document sourcing Documentation through 3rd Parties</td>
</tr>
<tr>
<td>Service cost reduction w/cur current status</td>
<td>Support maintenance Business growth (phasing &amp; Multitearing by supplier)</td>
<td>BTEC browser-based <a href="http://www.BTEC.com">www.BTEC.com</a></td>
<td>Travel costs incurred (lost productivity)</td>
</tr>
<tr>
<td>O&amp;I will be 1 of the most profitable business lines (cost by BTEC)</td>
<td>Increase Customers’ satisfaction</td>
<td>Language issues might cause problems in 1st year</td>
<td>Difficulties achieving 3rd party documentation (lost productivity)</td>
</tr>
<tr>
<td>Low vertical dependence (buying A-B-C-D-E)</td>
<td>BTEC 2010 more refined with BTEC performance</td>
<td>Language issues might cause problems in 1st year</td>
<td>Difficulties achieving 3rd party documentation (lost productivity)</td>
</tr>
<tr>
<td>BTEC as Centre of Excellence for documentation</td>
<td>BTEC 2010 more refined with BTEC performance</td>
<td>BTEC language issues might cause problems in 1st year</td>
<td>Difficulties achieving 3rd party documentation (lost productivity)</td>
</tr>
<tr>
<td>BTEC being a platform for BTEC’s products</td>
<td>BTEC 2010 more refined with BTEC performance</td>
<td>BTEC language issues might cause problems in 1st year</td>
<td>Difficulties achieving 3rd party documentation (lost productivity)</td>
</tr>
<tr>
<td>BTEC being a platform for BTEC’s products</td>
<td>BTEC 2010 more refined with BTEC performance</td>
<td>BTEC language issues might cause problems in 1st year</td>
<td>Difficulties achieving 3rd party documentation (lost productivity)</td>
</tr>
<tr>
<td>BTEC being a platform for BTEC’s products</td>
<td>BTEC 2010 more refined with BTEC performance</td>
<td>BTEC language issues might cause problems in 1st year</td>
<td>Difficulties achieving 3rd party documentation (lost productivity)</td>
</tr>
<tr>
<td>BTEC being a platform for BTEC’s products</td>
<td>BTEC 2010 more refined with BTEC performance</td>
<td>BTEC language issues might cause problems in 1st year</td>
<td>Difficulties achieving 3rd party documentation (lost productivity)</td>
</tr>
<tr>
<td>BTEC being a platform for BTEC’s products</td>
<td>BTEC 2010 more refined with BTEC performance</td>
<td>BTEC language issues might cause problems in 1st year</td>
<td>Difficulties achieving 3rd party documentation (lost productivity)</td>
</tr>
</tbody>
</table>

Nevertheless, the process to outsource non-core activities related to Engineering and Technical Documentation to India presented several criticalities not previously and completely faced by the management. In order to minimize negative impacts of implementing this type of strategy a diagnosis and problem identification methodology has been adopted by using a SWOT analysis (see Table 1). Data required to perform this analysis was collected or generated in different ways. “Hard” data have been gathered through performance statistics, derived from Six Sigma methodology, such as information on time, hours spent, costs, saving achieved, necessity of re-work. “Soft” data, such as employees’ expectations and perceptions of outsourcing process, quality, processes, and human resources feeling, have been gathered through direct observation, discussion, interview, and general informal observation-in-action. For the hard and soft sides of IT outsourcing management see [3]. Starting from weakness and key threats a list of the key risks understanding and mitigation actions has been prepared as follows in table 2.

Table 2 – Key risks understanding

<table>
<thead>
<tr>
<th>Cause of risk</th>
<th>Probability</th>
<th>Impact</th>
<th>Mitigation Actions</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor quality</td>
<td>Medium</td>
<td>High</td>
<td>Developing new forms of BTEC</td>
<td>Medium</td>
</tr>
<tr>
<td>Risk number</td>
<td>Medium</td>
<td>High</td>
<td>Developing new forms of BTEC</td>
<td>Medium</td>
</tr>
<tr>
<td>Risk number</td>
<td>Medium</td>
<td>High</td>
<td>Developing new forms of BTEC</td>
<td>Medium</td>
</tr>
<tr>
<td>Risk number</td>
<td>Medium</td>
<td>High</td>
<td>Developing new forms of BTEC</td>
<td>Medium</td>
</tr>
<tr>
<td>Risk number</td>
<td>Medium</td>
<td>High</td>
<td>Developing new forms of BTEC</td>
<td>Medium</td>
</tr>
</tbody>
</table>

2.2 Outsourcing activities portfolio

The selection of work type to be outsourced would have been based on a mix of activities best performed by India along the pilot projects done. According to this considerations the management formulated an ambitious target: the opportunity of reducing engineering costs thanks to a hourly rate reduced with ratio 1 to 7. Most significant projects moved to India would have been related to design engineering for coaches (particularly the interiors). Design engineering for coaches was considered one of the examples most fitting the possibility of India to perform. In fact the tasks are usually simple and re-iterated, giving to Indian the possibility to develop an excellent learning curve. Other projects of great satisfaction were:

- Virtual Reality (VR) for Vehicle Refurbished Modernization (VRM),
- Development of Technical Documentation,
- Archiving and scanning,
• Development management of databases. The results obtained from this first analysis steps clearly indicated that the integration should have been extended from technologies to the whole factors impacting the efficiency, in order to harmonize not only the Systems and the Tools but also the European processes cross countries with the Indian ones, the Procedures, the Human Resources and the Infrastructures.

2.3 Planned actions
When the strategic decision to outsource was taken by the management a plan of actions was prepared. The outsourcing strategy had the target to transfer hundred thousand hours to India with respect to Engineering and Technical Documentation activities. In order to evaluate activities best performed by India, several pilot projects would have been launched according to a formal mechanism of reiterated process of selecting minor projects with low exposure to risk and monitoring / measuring the results along all phases in order to secure the efficiency standards proposed. Moreover, in order to mitigate the risks and to move only safe steps the management planned a project of integration with the aim to learn how to work together in full efficiency. Consequently to this Project of Integration a change management approach had to be planned in order modify and integrate organizations at four different levels [4]:

1. Processes,
2. HR,
3. Technologies and Tools, and
4. Infrastructures.

All parts of the organization would have been affected and re-organized, from management and middle management, to engineering level. The engineering departments in both companies (joined under the BTECI company) would have been re-organized in workgroups with clear competences and hierarchies in order to facilitate the communication and the outsourcing relationship between Europe and India based on trust rather than a market based or bureaucratic based pattern [5]. The execution of these planned actions would have required the management support up to President level including legal aspects in order to avoid legal conflicts [6]. In order to manage the resistance a strong leadership would have been required while building up a list of best practices to show people that benefit is real. Feedback data would have been recovered directly from field people and managers belonging from the two companies.

2.3 Story and outcomes
BTECI developed from 6 to over 500 Employees in the last 4 years. This partnership would have ensured low prices per each activity on the basis of a flat utilization of resources. In case of under utilization, due to shortage of work, Bombardier Transportation would have provided BTECI with regular payment. At the time one of the Authors was manager in Europe engineering division and was assigned with the target to investigate all engineering activities, including technical documentation, which could have transferred to India. In parallel he had the role to audit India to identify risks, introduce mitigations and redefine processes, according to the research outcomes derived from literature analysis and from working experiences. The other Authors had the role to guarantee the rigor of the research and the correct application of the following planned actions. The detailed action plan over the three years period was the following:

- **Year 1:** Pilot Projects, audits, 6σ RDMADV.
- **Year 2:** Pilot Projects and real Projects, audits, 6σ RDMADV, continuous improvement.
- **Year 3:** Major Projects shifted to India.

A Pilot Project was run with the scope to reduce risks, reduce cost exposure and allow improvement in future contracts. In figure 2 a schema of the Pilot Project “Excellence in Documentation Business” has been reported.

**Figure 2 – The Pilot Project “Excellence in Documentation Business”**

According to the plan the Organization was modified and integrated at four different levels:

**Process Level:**
- **Scope:** Integrate working processes in order to maximize the effectiveness of the collaboration and reduce the level of re-work.
- **Key-figures:** Timetables associated to existing processes to measure the efficiency, compared to the ones of the new processes.
- **Methodology:** Mapping all European processes relevant to each activity to be outsourced and defining a standard; then mapping Indian processes; adopting Business Process Reengineering (BPR) techniques in order to harmonize the processes into one single process properly designed to work together, in full respect of the constrains of both the parties; writing down clear procedures to follow; training the personnel.
- **Related issues:** Know how retention by the personnel provoking difficulty in process mapping, passive resistance to change.
- **Achievements:** Same efficiency with lower costs.
HR Level:
- **Scope**: Integrate people in order to minimize the conflicts between resources.
- **Key-figures**: Changing the way to work together, fixing clear rules, increasing discipline and checking understanding before assigning actions according to an organizational change [7]. Design and implementation of a rigorous change management program to make people understand that change is needed and will lead to an improvement. Assigning internal Champions in the change process and ensuring that people have a clear leader to refer to whatever issue they might face along the change.
- **Related issues**: Jet lag, work on turns, ethics and religion, rules, mindset, know how retention, language, communication, understanding. Passive resistance by critical Resources.
- **Achievements**: Better collaboration, different approach, understanding that cooperation is not an option in order to achieve a common goal.

Technologies and Tools:
- **Scope**: Integrate technologies in order to enable effective communication through the parties.
- **Key-figures**: KPIs related to time to response to Customer’s inquiries; failure rate in communication protocols (FTP, video conferencing, remote access to DBs & Systems).
- **Methodology**: Harmonization of systems and investments in communication tools in order to give secure accessibility to trusted and entitled operators, to access all systems in remote and to guarantee real time data exchange. Dedicated databases to be developed to reach a proper level of data exchange.
- **Related issues**: Achievement of local permissions to access from remote; installation of proper tools for remote communication; cost of investment.
- **Achievements**: Failure rate decreasing from year 1 to year 2. Full stability and globalization achieved in year 3.

Infrastructures:
- **Scope**: Integrate infrastructures in order to facilitate communication and operations for performing professional activities at a lower rate.
- **Key-figures**: Rating of activities performed in India.
- **Methodology**: Hardware and Logistics reorganization of departments in European and Indian sites; movement of machinery from Europe to India.
- **Related issues**: Cost for moving machinery; resistance by European specialists to release activities and machinery.
- **Achievements**: Layout re-designed in European and Indian sites; key machineries identified and moved; dramatic cost improvement on activities performed.

3 Results
The integration project, in particular, took about 1 year from the kick-off to the testing phase. The results given were successful; in fact the two Companies were fully integrated. Joint work had same performances than the work previously done in Europe in terms of quality and re-work rate. Costs as well were dramatically reduced according to budget expected. Due to Bombardier IPR (Intellectual Property Rights) it can be presented the preliminary hypothesis exclusively, reflecting the initial estimation for Documentation and Training (function included in Engineering), and not the real and whole result out coming from the full integration of the major Engineering Function. The sustainability of the Documentation and Training (D&T) business is related to several factors. The five different scenarios were developed with the scope to:
- Understand if the D&T business is sustainable in house (Scenario 0-1),
- Maximize gross margin and minimize risks (Scenarios 2-3),
- Analyze in depth all the possibilities (Scenarios 4).

In the following figures (3, 4) a scenarios evaluation and comparison have been provided and the best scenario selected (figure 5).

![Figure 3 – Scenarios evaluation](image_url)
Scenario 3 gave good results by maximizing profit and minimizing risks.

3.1 Reflection on story in the light of the experience and the theory

After a three years period working to full integrate the two Companies some reflections can be reported and discussed. Feedback data process was disastrous in the first year, justifying the concern of management about the integration project. During this first year Authors needed to deal with rumors and to start a parallel change management project to keep people informed and understanding the reasons of the change. Due to this difficulty in operating major projects were moved along the course of the second year. At the end of the second year the project was already completed. Nevertheless to achieve full efficiency some more practice was needed. Pilot projects started gave all excellent results. As a consequence the second year saw a phase of ramp-up of activities, projects and Indian resources more involved. The reduction of European Personnel, replaced by Indian Engineers, allowed achieving exceptional savings. This means that in Europe no engineering department was willing to give activities up in favor of India and the selection needed to be forced; Worker Council and Employees Committee, in most countries, was a big obstacle as well. The original diagnosis was mainly correct as well as the action taken thanks to the integration project supporting the planning and implementation phases. This action research experience outlined the following issues: Motivation of people is important as processes and technologies for a successful integration. Integration plans shall be 360 degrees and well supported by change management program.

This action research experience has been extrapolated to a broader context. The gained knowledge, in terms of feasibility of a safe and profitable outsourcing, have been considered and used to extend the outsourcing approach to all major starting Engineering projects thanks to specific skills and capabilities acquired working with India for three years.

4 Conclusion

The integration of the two companies was really challenging and required several iterations; the level of efficiency targeted was reached only after three years. During the first steps, in fact, the passive resistance seriously risked to affect the project performance because people felt threatened by the Indian venture and was worried for their job. Both the Companies are leader in their business and developed strong competencies through the years with strong investments on recruiting and training only the best People. On this basis the focus of integrations was on technologies (same systems, tools, protocols of communications, FTP, mailing, video conferencing, …) to ensure real time communication. The initial diagnosis did not change significantly over the three years but the way to achieve it was not straight. The great collaboration of hundreds people through Europe and India, allowed a full success of this strategic approach and the results were far away from the ones expected.

References: