

ERP Implementation in Aviation Industry

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ABSTRACT---- *This peculiar case study reviews a three-stage ERPs implementation of major ERP packages at an aviation firm in a shrinking market. The firm took the successful implementation of ERP as the key competitive advantage against its global competitors. The firm strived for efficiency by ERP implementation of three packages; SAP R2, BaaN IV, and Pentagon in a continuous improvement process. We identified the management involvement, project management, management control and ownership, recognition of striving for the organizational fit, strategic IT integration, and personnel dedication as key critical success factors (KCSFs) with in particular personnel dedication and their valuable contributions to changes.*

Keywords---- ERP Implementation, Key Critical Success Factors, Manufacturing, Service Industry

Glossary:

AS	Aircraft support services
CS	Component support services
ERP	Enterprise Resource Planning
FKS	Target Company
FK	Aircraft Manufacturing Firm
KCSF	Key Critical Success Factors
MRO	Maintenance, Revision & Overhaul
MS	Material Support
SBU	Strategic Business Unit
SK	Target Group Company
TS	Technical Support Services

1. INTRODUCTION

The Enterprise, FKS

FKS is part of the SK Aerospace Services division of SK Aerospace group. FKS has four business units for aircraft support services (AS), material support (MS), component support services (CS) and technical support services (TS). AS business unit core business is selling maintenance hours for aircraft maintenance in the base and out-of-stations; referring to aircraft conversions and modifications; damage assessments, repairs, and painting aircraft. This core business concentrates on the FK market as the focus point in this case study. FKS was seeking new business in maintenance of Boeing, Embraer, Gulfstream aircraft, and in the combat aircraft market (F16). This case study investigated the application of ERP in the earlier and future FKS positioning, with a focus on one of its four strategic business units (SBU) referring to business unit aircraft support services (AS).

FKS Strategic Objective

FKS is an integrated knowledge based service organization that works in partnership with both the owners and operators of the aircrafts. FKS is an organization that enables the customers to have maximum availability of their regional aircrafts at the lowest possible costs while maintaining a profitable business. The intended Maintenance, Revision & Overhaul (MRO) partner must be able to deal with four key issues of technology, logistics, process and people from the airline carriers' MRO perspective. The carriers look for reductions of fixed MRO costs. They rationalize on direct MRO costs (i.e. staff, spare-parts, process management, resources, IT costs and so on), and on increased efficiency and flexibility in MRO activities.

FKS followed a unique rationalization approach by restructuring its internal processes for cost savings across the supply chain with external orientation to the suppliers' inbound logistics and clients' outbound logistics. The FKS core business offered complete services in aviation MRO with a "one-stop-shop" philosophy. FKS's target market was the FKS aircraft

market with nearly 1100 aircrafts worldwide. In three phases of the restructuring process, FKS changed its ERP system from SAP R/2 to BaaN IV and then to Pentagon in order to achieve three objectives of (a) continuous improvement, (b) new business strategy, and (c) organizational fit. In the course of ERP Pentagon implementation, FKS carried out a business case analysis in order to improve the chance of success in a post Pentagon implementation period.

2. PROBLEM DEFINITION AT FKS

FKS restructured its business processes on a continuous basis to comply with the upcoming internal and external clients' demands. After FK Aircraft bankruptcy, FKS (an independent service provider) encountered a drastic slow down of business due to decreasing number of FK aircraft in operation, and later due to September 11th impact on the MRO market. For a sustainable business, FKS searched for new ways of conducting business in new markets. Further due to changing market conditions, FKS searched for new objectives, new strategies and operational key critical success factors.

In the shrinking MRO market, the AS MRO maintenance revenue dropped from one million hours in 1992 to approximately four hundred and fifty thousand hours in 2002. At the same time, FKS sales breakeven point rose from 500000 maintenance hours to 600000 maintenance hours.

Reasons for Changes

Because of its weak financial results, FKS anticipated shortcomings in its organizational structure and its market approach in aviation market. Therefore, the market approach had to be reengineered and objectives had to be reset to improve its positioning in the weak market. An internal and external company analysis identified the project goals in continuous reengineering of processes; a) by increasing the market share to a minimum of 25% to achieve the breakeven point; b) lowering internal costs by at least 20% to reach a competitive man-hour cost price rate; c) lowering the time delay to the request for quotation (RFQ) processing; d) creating more transparency in processes, e) presenting mission and vision of FKS as a unique MRO supplier in the market, f) and developing and promoting a partnership attitude across the supply chain with suppliers and clients. For this reason, the market perception of FKS had to be changed from an e-shopping mall, i.e. irregular, incidental and partial sales (Figure 1), to a potential partner for airlines in the MRO market, i.e. organized total package sales (Figure 2).

Figure 1: Airline market behavior and airline MRO outsourcing structure

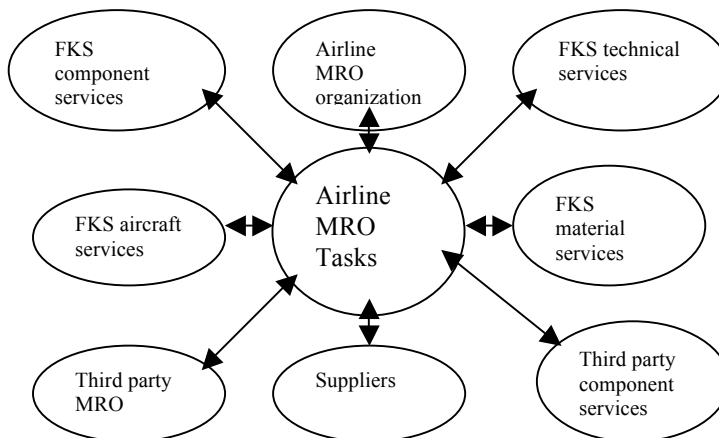
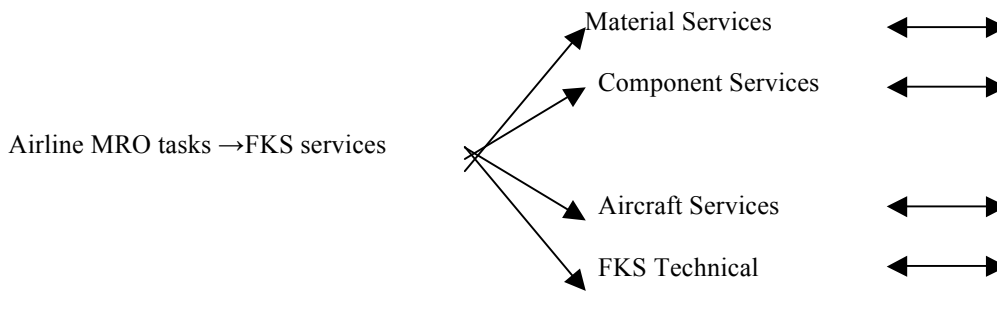


Figure 2: New business structure-partnership and collaboration



In its restructuring and process optimization processes, FKS achieved four key items in its restructuring processes; a) internal and external integration of the four SBU's, b) knowledge sharing with the client, c) partnership with owners and operators, and d) developing actively key competitive advantages for each operator.

Market Threats

The external market crisis had generated some new opportunities for FKS to benefit from. The airlines' MRO expenses were primarily costs without any yield; therefore, the costs had to be reduced while quality of maintenance and safety complied with the best standard practices. The traditional MRO requires heavy investments. Airlines make heavy MRO costs to hedge the unpredictability of high quality and safe aircraft maintenance. The main MRO costs are in: a) manpower, b) logistics, c) tooling, d) IT costs, e) and hangar availability. Although, all these key cost items are essential parts of the MRO process, they have not been effectively utilized. The improvement in utilization of these resources could result in a substantial reduction in the fixed MRO costs. Both MRO service providers and their clients (e.g. airlines) were keen to improve their positions in their markets by sharing; a) manpower, b) logistics, c) tooling, d) IT costs, e) hangar availability, f) and other fixed costs. FKS competitive position was vulnerable. FKS identified reorganizing its business processes, its structure, and its market approach as the key success factors to survive in the declining market.

3. BUSINESS SOLUTION AT FKS

In the past, FKS had focused on restructuring its internal processes at back-office and its related applications. These changes were essential for the switch over from SAP R/2 to BaaN IV due to Y2K problems with the SAP R/2 system. An explicit change of focus was apparent, from internal processes to external processes with the clients and suppliers. The external relations with the clients and suppliers became more important, and the internal automation was no longer the most important critical issue at FKS.

Project Goals (Restructuring)

Among the external threats FKS identified; presence of intermediaries, presence of other on-line service providers with in particular second hand brokers, low man hour rates in eastern and southern Europe, decreasing number of FK Aircraft in operation, declining American market share on the MRO due to Sept 11th, and an increase in "stand-alone" maintenance providers looking for MRO works. At the same time FKS identified new opportunities for profit due to; growth of the aircraft market in the Far East and Eastern Europe; development of digital salesman (lowering fixed costs) by the FK site, split of maintenance work from the core business by airlines, application of ERP by airlines, and lower transaction costs for FKS by increasing e-applications.

FKS manifested the necessity to target three main objectives of; (1) decreasing internal overhead costs, possibly through cost and efficiency drivers; (2) restructuring and ERP orientation at in/outbound logistics, referring to the two key areas of the procurement process and sales process; (3) sharing MRO data with airlines to increase MRO market share, being more transparent in processes and costs, being more market competitive, and by offering real partnership to the clients. To achieve these objectives, there were four main areas of focus in its MRO market positioning:

1. *Maintenance Management*: It is the support by skilled and certified aircraft maintenance technicians and services.
2. *Engineering and Planning*: This is the know-how to define aircraft configurations, maintenance programs, work requirements and associated documentations to meet regulatory and MRO specifications and operator needs. It is the ability to plan and schedule effective utilization of all resources including aircraft, materials, tools, people, and facilities.

3. *Information Technology*: This is the technology to manage, track and communicate across logistics, procurement, supply chain and mechanics, with the goal to make maintenance more predictive for client and vendor. Ideally, a service provider will digitally integrate the airliner’s flight schedules and other information systems to its overall operation and customer service database.

4. *Supply Chain*: It is effective procurement, inventory, warehousing and transportation management processes, including a resource strategy, which will allow operations to be more efficient. With an aggregated supply chain, purchasing power will be increased and the inventory can be optimised across multiple carriers.

FKS offered four items as four individual items and not as a package to the market. The ERP was a tool to change its products’ portfolio to a complete and synergic MRO approach to the market.

After review, AS decided on the following six main conclusions and related recommendations: (a) *Growth through integration*, the growth of AS was possible by integration of the four strategic business units of FKS, (b) *Synergy improvement*, the “four different companies with their own core-businesses” perception must be changed into a “one company-one core-business” perception, (c) *Internal integration*, the integration and synergy between the four SBUs, the worldwide scattered clients and the magnitude of the MRO flow of data could only be qualitatively managed by an ERP system and a well thought implementation strategy; (d) *External integration*, streamlining all FKS internal organizational processes and elements of the value chain network to a complete integration, (e) *Cultural change*, changing corporate culture and adapting business-processes towards partnership were major KCSFs in improving its competitive position, (f) *E-Business development*, Incorporating e-business strategy as part of the traditional business strategy would also improve the traditional business strategy. In a continuous improvement process, for each of these items a thorough and detailed plan was developed with respect to ERP risk management and return on investment.

4. THE BUSINESS (RE) ENGINEERING PROCESS AT FKS

FKS worked towards client demands and reengineered its business structure for a smoother integration with the clients’ business processes. The maintenance value chain suggests the added value that FKS could offer its clients with ERP system.

The maintenance value chain at FKS consisted of the following elements:

Maintenance Request → Trouble Shooting → Repair Order → Logistics Needs → Skilled Engineer Planning → Hanger Site Reservation → Actual Repair Process → Testing → Closing Maintenance Request → Data Processing and Managing.

There were four possible maintenance options for FKS (Table 1);

1. Daily scheduled maintenance,
2. Daily unscheduled maintenance,
3. Periodical scheduled maintenance,
4. Unscheduled maintenance.

Each individual maintenance inquiry represents a process segment to four sub-chains of: Technology, Logistics, Process and Labor.

In turn these sub-chains were segmented into predictable and unpredictable key issues. The added value in processes could be obtained through decreasing the unpredictability, and supporting and encouraging partnership with the airliner. The maintenance value chain was designed in such a way that the same processes were present for all four possible maintenance options. After analysis of the maintenance value chain, FKS found the logistics support and unscheduled maintenance as the items to focus on. Since unscheduled repairs contributed to a dominant part (90%) of scheduled maintenance, this part of the chain was also important due to its unpredictability. Furthermore, the main items in the value chain difficult to predict were: Logistics (i.e. flow of spare parts and components-inbound logistics) and Labor (i.e. planning hours and allocation of man-hours). These two high cost items in the airliner business covered a substantial part of the airliner expense budget (12-15%) on MRO costs. Furthermore, it was striking to find that both “processes” and “technologies” were highly predictable in daily and periodical scheduled maintenance (table 1). The reason was the regulations dictated by authorities and the worldwide standardization of aviation maintenance.

In its new structure, FKS required only one design in maintenance processes for all four options resulting in benefits in design-costs and users ease.

Table 1: Maintenance Options

TECHNOLOGY	LOGISTICS	PROCESS	LABOUR
DAILY SCHEDULED MAINTENANCE			
Highly predictable	Highly predictable	Highly predictable	Highly predictable
DAILY UNSCHEDULED MAINTENANCE			
Highly predictable	<i>Unpredictable</i>	Highly predictable	Predictable
PERIODICAL SCHEDULED MAINTENANCE			
Highly predictable	<i>Unpredictable</i>	Highly predictable	<i>Unpredictable</i>
UNSCHEDULED MAINTENANCE			
Predictable	<i>Unpredictable</i>	Highly predictable	<i>Unpredictable</i>

5. ERP PACKAGES

At the time of case study, there were several ERP packages that could fit into the requirements of aviation industry firmly BaaN was designed for application at Boeing manufacturing and Pentagon followed up with misfits on several modules. The use of SAP R/2 and its follower SAP R/3 required software modifications to aviation industry and there were no generic solution for aviation at the time by SAP.

ERP SAP R/2

At the time of our research, FKS was equipped with the SAP R/2 maintenance module to support its primary processes at MRO aviation services. The internal processes were modified prior to the SAP implementation. In this context, FKS strived for survival in the competitive market through internal cost savings measures. This measure was the primary reason for the ERP adoption as a whole.

ERP BaaN IV

In 1998, the management complemented the changes with implementation of another ERP package due to Y2K. Although the millennium problem was the main reason for the new ERP adoption, the report structure of SAP R/2, organizational fit and its fit to FKS internal processes also motivated the changes for a shift from SAP R2 to BaaN IV. The customization of the SAP R/2 report structure and of the maintenance module into the business processes was no longer the only issue.

Reasons for the Changeover from ERP SAP R/2 to ERP BaaN IV

At FKS, the reasons for a new ERP adoption were Y2K and the misfit of the SAP report structure (*shortcomings; low level, low quality, with no total overview of available information, and incomplete management report*). To change the ERP package, FKS benchmarked its ERP SAP with the other operating models. The objective was to find the best fit to FKS primary processes. The scope of implementation was replacement of the outdated ERP system, SAP R/2, with the BaaN IV system. Among other factors justifying this decision, the FKS quoted that “*First of all SAP was not a millennium proof package and the new version of SAP was not ready for implementation at the time and mother company SK was ready to switch from SAP over to BaaN IV for the entire organization. In a way, our business unit was pushed to switch over to BaaN IV.*”

Main Internal Processes at ERP BaaN IV

In the process of implementation, the main processes were identified as sales, projects, work preparation, MRO works, aircraft test, technical certification to authorities and project management. The main internal processes were logistics, control of shop floor, planning and report structure.

The project management progress reports played a key role in the success of the ERP BaaN IV implementation. During the one-year implementation period, FKS invested eight million euros in ERP implementation. The immediate intangible benefits were stock control, reporting, scheduling and planning.

The overall improvement in the system was in project control, reporting structure and speed of processes. A full-scale implementation plan was outsourced to an outside consulting company. However, FKS suggested that; “*the degree of training provided by the consultant for the new system was inadequate*”.

Reasons for Changeover from ERP BaaN IV to ERP Pentagon

The FKS stated that “*In our view, BaaN IV did not meet the user expectations and intangible benefits, if any, they are hard to point out. In fact, one of the reasons to look for another system was the continuous costs associated with updating and changing (customization) the BaaN IV software up to our actual requirements.*

Even after the changes and adjustments, a lot of reports were just nearly ‘good reports’. There was no major improvement in working with BaaN IV in comparison with its predecessor, SAP R2. Another major barrier with BaaN IV software was its configuration, which was primarily made for maintenance services within the aircraft manufacturing industry (e.g. Boeing etc).”

In view of the above shortcomings mentioned, FKS decided to switch from BaaN IV to the Pentagon ERP system. The selection of Pentagon was a bottom-top technology strategic approach. FKS stated: “*It was the users’ request to change over to Pentagon. It was, of course, the management decision to proceed with the change over.*” BaaN originally designed an ERP manufacturing package, BaaN IV package, in partnership with Boeing to support the Boeing manufacturing system. Thus, the ERP MRO module did not fit directly into FKS operations; however, it was the closest match in organizational fit that FKS could find in the market. Pentagon was the new generation of a customized MRO package in aviation services. FKS finally replaced the earlier ERP BaaN package with Pentagon.

ERP Pentagon

Pentagon is a U.S. based IT firm specialized in aviation maintenance software and FKS was its first European client. Over the years, FKS spent its resources in restructuring its internal processes for the back-office systems and its related applications. This was necessary for the continuation of the processes after the change over from SAP to BaaN IV due to millennium impact.

This change was an explicit shift in focus from internal processes to external processes. In other words, the external relations with customers and suppliers were at the centre of the changes. FKS worked on the total integration of its business processes with clients and suppliers. This was to fulfill the FKS business strategy from cooperation to collaboration and partnership with the suppliers and clients.

“The aviation industry is a complex business with respect to traceability of parts, components and tasks responsibilities. The Pentagon program seems to be the first program, which fulfils our requirements in the complex maintenance process.” This conclusion was based on the fact that the use of the Internet Application turned FKS into an e-shopping mall for airliners. The restructuring business strategy was to present the four business units as one to clients while clients only made use of services of one unit at a time. This client behavior had turned FKS into a kind of MRO discount centre.

Project Goals (Pentagon)

The project goal was integration of internal processes to external processes, e-strategy synergy, partnerships, and sharing information and knowledge across the supply chain with global clients. The external focus was on the customer side of the MRO value chain.

A marketing SWOT analysis by FKS identified those key areas in customer relationship together with the new opportunities in the market.

Tangible and intangible benefits (ERPs)

FKS expected that the fulfillment of project goals would lead to lowering MRO fixed costs (i.e. the costs of manpower, logistics, tooling, IT costs and hangar costs).

Onward and upward phases -Post Pentagon implementation business analysis

Figure 1 shows how the clients used the four SBU’s of FKS frequently as four separate services while the SBU’s had the objective of working as one unit to the clients.

The clients used the most attractive parts out of the four SBU’s in any inquiry. Because of this market behavior FKS had changed into a kind of MRO discount center. In this format of outsourcing market to airliners, FKS only provided one of its capabilities with one option out of a multiple capabilities of MRO options to its clients.

6. CONCLUSION

FKS case presented a firm that gone through three restructuring and ERP implementation processes in SAP R2, BaaN IV, and Pentagon by following a holistic approach using global collective knowledge and self-embedded innovation. The firm strived towards higher efficiency using ERP systems in a tough shrinking competitive global market. We learnt about a number of KCSFs, with in particular the required personnel (user) dedication and contribution to changes. The firm built up a particular experience in ERP implementation processes, from which we could all learn. They continued benchmarking these experiences for a continuous process of changes for improvements.

FKS benefited from ERP implementation following and recognizing the KCSFs in the management involvement, project management, management control and ownership, recognition of striving for the organizational fit, strategic IT integration, and personnel dedication.

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