Case Study of SAP Implementation in a Corporation Network Plant

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Introduction

Enterprise resource planning (ERP) systems have had a major impact on business over the past twenty years. ERP is the streamlining of many systems with the goal of being able to use an integrated tool to manage many functions of an organization. Zeng and Skibniewski (2013) noted that if successfully deployed, ERP systems save cost, reduce cycle times, increase productivity and effectiveness, lead to more informed decisions, enable organizations to better cope with growth, and enhance competitiveness. Beheshti and Beheshti (2010) reported ways in which ERP has improved productivity and firm performance. Gajic et al. (2014) reviewed ways that ERP integrate information system functions, leading to better control of processes within organizations (Peslak, 2006). The two main benefits are "(1) a unified enterprise view of the business that encompasses all functions and departments; and (2) an enterprise database where all business transactions are entered, recorded, processed, monitored, and reported" (Umble et al., 2003). ERP systems reduce manipulative reporting of earnings used to influence trading (Tsai et al., 2012). With digital computing, and the rise of multinational corporations, ERP has become a cornerstone for many businesses to standardize and streamline their data and functions.

The ERP environment is an evolving landscape for small, medium, and large business that along with great benefits presents great risk (Zach et al., 2014). Challenges have been reviewed by many authors, to include Malhotra and Temponi (2010) and Upadhyay et al. (2011). From the 2015 ERP Report from Panorama Consulting Solutions (Panorama Consulting, 2015) 562 implementations across the globe were quantified with half of the organizations reporting under \$300M revenue and the other half over \$300 in revenue to give an overall view of the landscape. Some key findings help layout the landscape. ERP costs have been rising; with increasing operations costs rising \$1.7M (35%) year on year, while ERP failure rates have increased 5% year on year. However, in the study it was found investing in CSF's (critical success factors) of organizational change management and business process reengineering have a long term cost reduction benefit which will help right first time implementation to offset the increase in initial ERP cost and lower that failure rate.

The purpose of this paper is to share a case study of the implementation of SAP into a large biopharmaceutical company in order to demonstrate the need for careful management of human aspects in ERP implementation. The literature identifies many cases of implementation failure and suggests many critical success factors. While these are certainly relevant to form a framework of the task and issues, this case will demonstrate the challenges and successes of SAP implementation from an "in the trenches" perspective to give a better understanding of day to day operational challenges during ERP implementation and unforeseen impact on the workforce for this particular plant. Section 2 reviews literature related to ERP, CSF's, and root causes of implementation failures. Section 3 will provide a case study of implementation from pre to post go-live for the biopharmaceutical plant. Section 4 will present conclusions.

Literature review

There are many options for ERP software, with the most popular proprietary ERP vendors being SAP, Oracle, and Microsoft (Olson, et al., 2012). Open source ERP such as ERP5, OpenERP, and Compiere are increasing in use (Olson and Staley, 2012). But open source has a number of contexts, including any program or software whose source code and some other rights are made

available for use or modification, in which the software is developed in public collaboration and often freely available (Shukla and Anand, 2013). Small to medium sized companies may find Open Source more advantageous due to lower cost, and the customization of the source code that allows a more tailored approach for the product characteristics to fit the company. Smaller systems are also found in international ERP implementations, such as Columbia and Switzerland (Murcia and Whitley, 2007), Sri Lanka (Wickramasinghe and Gunawardena, 2010), Saudi Arabia (Aldayel et al. 2011), and Taiwan (Tsai et al., 2015).

Overall ERP allows management access to real time data to find out how an organizational unit is performing, determine high/low margins across the globe on product lines, and calculate costs across the company. This access to real time data has shortened the information supply chain by a great magnitude allowing companies to identify red flags, and react to opportunities quicker. The "visibility" to the data takes the decision from being hunches to calculated decisions.

ERP implementation issues

Many failures in ERP project implementation have been reported (Ram et al., 2013). Aloini et al. (2012) provided a list of 19 risk factors in the broad categories of strategic planning, project management, communication, and financial issues. These authors also identified ten negative effects, with the primary impacts being budget and time overrun, project cancellation, or negative impact on business performance. One symptom of ERP implementation failure is the challenge of accurate estimation of effort (Fryling, 2010; Koch and Mitlöhner, 2010). Ravasan and Mansouri (2016) focused on critical failures, classifying the impacts of 27 studies into 27

critical factors. These authors provided the primary groupings of technology, human resources, strategies, project management, and communication.

Success in implementing ERP systems was found to best be served by include the alignment strategies of including functional expertise, integrating knowledge, providing liaison mechanisms, and project governance (Sumner, 2009). CSF's are important to understand for ERP implementation at the outset so that the goal and vision will be in alignment with the identified CSF's. While there are many CSF's identified throughout literature, top management support, business process reengineering, and project teams are often indicated as critical. Top Management Commitment/Support, BPR, and use of project management to manage implementation were identified in reviews by Nah et al. (2003) and Aldayel et al. (2011) as being critical in ERP implementation. These three CSF's also have a very wide reach on ERP implementation, and are key for other CSF's to be implemented successfully.

"Unlike other information systems, the major problems of ERP implementation are not technologically related issues such as technological complexity, compatibility, standardization, etc. but mostly [about] organization and human related issues like resistance to change, organizational culture, incompatible business processes, project mismanagement, top management commitment" (Huang et al., 2004). It is essential to understand the necessary commitment and resources and prepare the whole organization for the implementation no matter how good the system is you are implementing.

Top management support

Top management support has two main facets: 1) providing leaders, and 2) providing the necessary resources. The willingness to provided necessary resources is an indicator of the

commitment to the ERP project, and monitoring implementation closely through interaction with the team, and providing clear instructions are key for a smooth and successful ERP implementation.

BPR

BPR according to Hammer and Champy (2001) is "the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical, contemporary measures of performance, such as cost, quality, service and speed". In relation to ERP systems that are built on best practices, to successfully install an ERP, all the processes in the company need to be redesigned to align with the ERP model (Saravanan, 2014). Many organizations have made unnecessary, complex customizations to ERP due to the people making decisions not fully understanding the organizations business practices. If customization is to be avoided, organizations have to change their business processes.

Changes of ERP implementation must be addressed early on in the ERP implementation's as they may cause dramatic work flow changes, organizational structure realignment, and the way employees conduct their day to day activities Matende and Ogao (2013). This may result in job cuts, rationalities of responsibilities in departments due to the customization, which in turn may prompt resistance to adopt new practices as stated by Matende and Ogao, who go on to stress the importance of managing these concerns from the onset through implementation, and follow through the "rough" period after go-live.

Human factors play a critical role in the implementation of software within organizations. Vilpola (2008) suggested benefits of early user involvement in ERP implementation. A case study by Matende and Ogao (2013) identified user participation as important in order to help mold and improve the functionality of ERP modules. They state some key advantages to having heavy user participation in implementation such as: ability to understand and define organization needs during implementation, aligning business priorities with customization needs, and giving users influence during implementation which allow users to react positively with the ERP system which is key to getting early adoption. A project team that is successfully able to coordinate the skills of the employees will reap the benefits throughout the ERP implementation. Another important human factor is training, with its own set of critical success factors (Esteves, 2014).

Project team

In a study of CSF's in ERP implementation (Rabaa'i) notes that it is a critical need to put in place a core implementation team that comprises of the best, brightest colleagues spanning all areas of the organization. A project team coordinates the use of skills and knowledge, and monitors the progress and achievement of objectives throughout the lifecycle of the ERP implementation (Saravanan, 2014).

Successfully identifying these three CSF's early in your process, and ensuring the proper preparation is made to attain them will has a positive influence on the ERP project as they are very interrelated with all of the core functions and CSF's needed for successful implementation.

Implementation failure review

A lot of research has been devoted to studying why ERP implementations fail. While the truth is that many factors unique to each situation can cause failure, but there are themes that arise for ERP failure.

ERP has a scary reputation for some good reason. Some recent cases (Ram et al., 2013) include Lumber Liquidators difficulties with an SAP system implementation in 2010, Marin County California suit over failure involving Deloitte and SAP in 2011, and the CityTime Payroll System project in New York in 2011 (failure due to cost overruns from a \$63 million budget to expenditures over \$760 million, with criminal investigations involved).

Case study of an SAP implementation

The company BPC Bio Pharma Company (name altered to protect identity) is a Fortune 500 company that produces biological vaccines and pharmaceuticals. The focus of the case will be limited to the SAP implementation experience for one of the largest plants in the network. The period discussed will cover one and a half years, with 6 months prior implementation, and one year post implementation.

This plant produces vaccines and pharmaceuticals for over 120 countries. Recent growth for the company over the past decade has included many acquisitions, and expanding portfolio of products into new countries. BPC plant volume experience increases of 5% to 8% per year. Acquisitions and steady growth called for a streamlined approach to ERP to leverage competitive advantage on the global market with real time data, and to ensure standard data quality, practices, and usage in the network.

Pre-SAP conditions

To understand the advantages of a single ERP system that SAP provides it is important to understand the prior landscape to see what has been improved upon. BPC plant operates with vendors, and marketing for their data with their ERP. Vendors do not have any software integration with the BPC plant. There were 7 separate information systems that the plant used:

- Demand Forecasting Software-Replenishment model
- Demand Forecasting Software-make to order
- Reporting Software
- Cross Reference Software
- MRP Software
- FG Invoice Software
- Raw Material Invoicing

30 markets use the make to order software, and the other 90 markets use a replenishment model for forecasting. Currently each market may have their own sales forecasting software that feeds into the demand forecasting software. Due to acquisitions there are three unique SKU identifier for each product since the market keeps its own SKU numbering system, and the plant retains their own unique SKU number, and therefore a cross reference data warehouse number needed to be implemented to be the system link between the two. The data integrity of the data warehouse insured that the sales forecast systems could pass forecast to the demand forecasting system; which in turn was passed to the plant MRP.

Sales forecasts based on market orders were loaded into the demand forecasting system once per month (unless requested on an ad-hoc basis). The MRP system at the plant level was (and is) run every night. Each market could run an ad-hoc forecast at any time during the month, but this did not have to be approved by the plant. This resulted in an unpredictable forecast tracking for the plant. The final piece of software is reporting software that runs market inventory, sales, and forecast accuracy reports, directly linked to demand forecasting system. This was updated once per month, and therefore would not be running using live data. Figure 1 displays the pre-SAP system:



Figure 1: BPC System prior to SAP Implementation

Figure 1 shows each step creating additional room for error, requiring additional labor to manage the data. Major challenges included:

- Data Quality
- Data Management
- Communication issues between plant and market

- System Connection issues
- Lag of real time data

An extensive amount of time and effort was given to data quality and management. Creation of new SKU's was steady at the plant through label claims updates, trade dress changes, market harmonization which in turn created more data management, and increased the stress on maintaining data quality. The multiple SKU's references in the network also caused great confusion between market and plant. Often times Excel sheets of cross references were maintained outside the system to make sure discussion is aligned when replenishment is brought into discussion over e-mail.

When different product lines were using many different sales forecast systems, there were many opportunities for system failure. Often system failure was not immediately recognized due to "noise" in the systems. With multiple interacting operations, it is difficult to notice one single problem occurring on a given day. For example, if only one product line had a system failure, that would not be easily noticed at the plant and they would often have to be notified via e-mail. When production has about a 6 month lead time for biological products, and a 3 month lead time for pharmaceutical products, the bullwhip effect is very damaging when any disruption in the forecast is experienced. An issue in the master data of the demand forecasting system that disrupts the link of the MRP, or a sales forecasting system not updating correctly could cause a product line to stock out for months due to the long lead times.

Thus the case for a single ERP system was very strong, offering many benefits for BPC. An SAP system was selected encompassing finance, production, materials management, sales, distribution, warehouse and human resources. As with many large companies, project managers on the plant level were not involved with the ERP selection decision. Figure 2 shows the postimplementation SAP system:



Figure 2: Implemented SAP system

SAP gave BPC real time data, increased visibility, software alignment, and common SKU numbering to name a few advantages. From a high level view this allowed for more effective communication, globalized SOP's, and localization for data quality management.

Structure

Implementation of a large ERP system is a monumental task that can be a multi-year project. We will focus on the human side of implementation, emphasizing the feeling of lack of control on the part of employees that is often overlooked in the literature. Six months prior to go-live, BPC assigned local employees as leads, to be full time participants for implementation. Figure 3 displays the organizational chart for the implementation project. At this point SAP was an "unknown" project to local team members. The structure inside the plant consisted of:



Figure 3: Implementation project organizational chart

The plant had around 200 employees who make transactions or actively use the information systems. Each department had identified colleagues to become dedicated to implementation for 6 months prior to go-live, and would be "Super Users". The super users identified consisted of 3 employees from each department. These super users had been with the company for many years and were SME's (subject matter experts) over their areas, and were often the most technically savvy colleagues.

These super users were responsible for writing job aides prior to go-live for specific functions for their department, and would be the SME for any questions leading to implementation, and as many found out would be the SME's even a year after go-live. Every colleague identified as a super user will still get weekly to even daily calls on functionality questions even 1 year after implementation. The super users had their jobs backfilled by employees within the same department, no new employees were hired.

The project lead would drive the project forward, track training progress, and layout milestones for data and training preparation. In conjunction the department leads along with the super user would work with consultants to determine any customization that needed to occur, and functionality of current systems that needed to be present in SAP.

Pre-Implementation

At the onset of the implementation project training of the project lead and super users started. Training consisted of 95% web-ex led sessions over teleconference. While this may be the easiest approach to reach the biggest audience, it has some major learning drawbacks. Training gave a general overview of SAP functionality but was not sufficiently detailed. Teleconferences included many plants, and questions often led to tangents not germane to specific users, eating up training time without productive gain. This would result in unanswered questions leaving users feel like they had incomplete training. Another problem was that the training sessions were boring and uninteresting. Finally, teleconference background noise, disconnections, and lag all made it hard to concentrate. A lesson learned is that as much face to face training in smaller settings will lead to better results, despite the time, geographic location, and resource benefits of teleconferences.

A very strong positive aspect of BPC's training was that they continuously had at least one consultant on site. Often this involved a rotation every week where a consultant for one module would visit one week, and the next week a different consultant for another module would be on-site. While resources did not allow them to dedicate all their time on training, as they had their own deadlines and tasks, this time did allow super users and leads to get some face time, and real time Q & A sessions provided deeper knowledge of the functionality of SAP. Making compromises in using resources can have a very positive impact on implementation.

A key factor is that 12 to 18 months prior to going live, the BPC Global Implementation team laid out the functionality of SAP for all BPC plants. This included customizations needed to align with BPC needs, to include T-Code access, master data fields, etc. The local plant was not involved with this decision making. While people on the global team had worked for plants, a key piece that was missed was knowledge of how current processes operated, which functionalities were critical to users and which are not. Some high level decisions over what process the plant could do without were made by the global team. Once it was realized that some eliminated processes were needed after go-live; the processes would have to re-engineered by the plant. This led to many delays, and increased work load. It needs to be recognized that each plant (over 25) in the network had their own processes, so it was difficult to globally standardize to best business practices.

Local teams were often disagreed about what current processes needed reengineering to align with SAP processes, and would be upset when work operations changed. Questions like "We did it like this in XXX, why can't we do that now?" While sometimes these complaints were valid, they also weighed down progress, and created an air of "Why are we transitioning to this new system?" or "I thought this new system was supposed to be great, but it can even do a simple task such as this." It is key to keep focus on new advantages offered by SAP. Spreading the vision and goal of implementing an improved set of processes throughout the company to those who were not involved in implementation was a challenge that BPC struggled with throughout. The project lead and super users continuously discussed the benefits and process improvements to keep up morale.

Major challenges the onset of training prior go-live included the difficulty of time sharing by the implementation team, who would often be diverted to their other job responsibilities. The project lead, who was an integral part of operations, would often get pulled back into his former role, instead of being able to keep focus on leading the project. A struggle throughout implementation and post go-live was for top management to provide the necessary human resources to replace the department lead, project lead, and super users, all selected because they were previously integral plant employees. As cited in the literature review, user adoption is key, and the high stress from dual job requirements led to negative views of the SAP implementation. Colleagues who filled in for installation team members were overwhelmed with additional work, which required additional hours each week. The training to replacement employees was not given enough time, and required the attention of installation team employees. It is easy to see how implementation timelines are strained, and the difficulty of preparing for implementation.

Project Implementation

The period of pre implementation consisted of three big milestones: data loads one, two, and three.

Data Load One

The first phase was data collection. A super user for each module would go over which legacy system data could be converted into an SAP field. This activity was supported by consultants, and each super user would go over data field-by-field. The first upload into SAP was

accomplished four months after go-live. As can be expected there were many compatibility errors. During this time all training was via web-ex and each super user focused only on their department.

Data Load Two

After the first data load, an unexpected compatibility error occurred when all of the recipes failed to load into SAP. This caused three super users to focus roughly 70% of their effort for two months to manual keying every recipe for the plant. This was two months into the project, and these super users were unable to utilize their pre-implementation training to aid other employees, and they were unavailable to help their replacements for their normal jobs. Workloads were increased, and potential for data review errors increased.

For the next two months the recipes were loaded manually, and all other fields identified as incompatible for a data upload had to be manually entered by a super user. During this time training, and writing of SOP guides continued within each department. Time now became an issue, and everyone focused on their own module. At the end of Phase 2 the original plan was to have cross training between departments for super users, so that the interaction between the department's modules would be understood. Due to time constraints this was never accomplished. After data load two, there were less errors, but there were still large scale compatibility issues.

Data Load Three

Phase three consisted of deadlines, and there was high anxiety about project timely completion. The global timeline often resulted in super users working nights to manually fix data errors. Deadlines were not often consistent as plants around the world were going live at phased implementation dates, therefore data loads had to be timed precisely. A key point BPC recognized were that changes to existing systems would be much quicker if they could be transferred over correctly, rather than changing the new system errors as they were encountered. However it was quickly realized that unexpected errors took up more time than anticipated, resulting in less complete data checks. Near the end it was realized that there was variance in advice consultants provided super users in different locations concerning what data should have been uploaded. This resulted in colleagues from the supply chain department reviewing data sets that procurement was already reviewing. The lack of cross department discussion resulted in many inconsistencies between processes, and led to lost time.

During phase three, there was a department lead, and a super user who left the plant. These unexpected departures left very big gaps. Not only were key pieces of knowledge of system functionality lost, but future trainers, and the 40-60 hours a week they dedicated to the project were lost. This resulted in dividing their responsibilities over several super users (who already felt overburdened). As can be expected the increase of human error again increased. Even though it is not practical to quantify the rate error increase, or how many data errors were overlooked due to fatigue, it is important to recognize that these losses exists with a negative impact on implementation. These losses, and other unexpected losses cannot be necessarily predicted at the outset, but applying a lean approach in human resources to an implementation no doubt places ERP implementation at risk. Insuring communication between the departments is also key to learning from the mistakes of others, and to ensure training alignment and implementation strategy. One month prior to go-live training sessions were held with super users, consultants and the plant colleagues. To this point they had only received online training, and had no experience on SAP. One week of training was held prior to go-live for these colleagues. A major point of contention was that super users only received access to a sandbox. This sandbox only allowed access into SAP, but there was no ability to run mock transactions such as invoicing, launching process orders, resource allocation, and material movement. The first time any user at the plant level was able to see a transaction was after go-live. Training consisted of "How to" tutorials but for many employees there was no opportunity to actually walk through a transaction. A common feedback from employees and super users was that additional time for more data uploads would have made the post go-live period smoother and would have allowed for a clearer idea of data errors. Also more comprehensive training for employees who were not part of the implementation team would have been of benefit, and would have reduced the learning curve at go-live. Super users and leads were often so busy post go-live they could not assist all employees, so there was a lot of non-productive time.

Review of pre go-live

Often times the period prior to implementation involves heavy information overload, but after the dust settles there are some very valuable insights to be gained. Driven by the global timeline, with many decisions made at global levels outside the plant, the project leader often did not have enough authority to affect any timelines. When problems arose, deadlines could not be pushed back even when it was recognized that additional time would yield a much cleaner and complete system. Working with limited resources without authority often leads to high stress. It is therefore key to closely track progress in each area, and maintain project management timelines. As cited earlier it was often a struggle to make the entire plant aware of the importance and benefits of the ERP implementation. BPC had project management timelines displayed throughout the plant to bring an awareness to all employees, even though they were not directly involved at that point. This helped create a culture of transition, and projected the plan BPC had for implementation.

An unintended consequence during training was that each super user was dedicated to only one module, and the project lead, who ideally would be able to spend ample time in each area, was too often diverted to production support. This resulted in each super user not knowing how they were going to affect the other departments, and how they all fit together. Due to unforeseen time delays, and people leaving the project; cross training for super users never happened.

Not being involved in discussions, and learning each other's problems does not allow for knowledge sharing. After Phase two when data was loaded, each module had to verify sample data sets. This was a daily task of 3-4 hours. This consisted of entering SAP and manually checking each field, and comparing it to a master spreadsheet. It was not until phase three (months into manual data checks) that it was discovered that one module of super users had learned how to extract all necessary fields to cross reference data dumps from SAP. They simply had to cross reference the data dump with the master spreadsheet, making error identification very easy. This cut a 3-4 hour task to 15-20 minutes. Simple things that you would expect consultants or super users to be well aware of are easily overlooked in the rush of implementation. A knowledge sharing session each week, to identify successes and problems would have saved a lot of time.

One example demonstrates a consequence of not having user awareness across all modules and not have top management aware during the plant and warehouse setup. The plant and warehouse are two separate buildings, and the previous ERP had considered them one location. In the transition to SAP the plant and warehouse were set as two different locations. Many users were not aware of the change, and those who were in the plant did not have authority to change this, even when it was brought to the attention of the implementation team. Master data connections were not set up prior to go-live to allow proper requirements and stock transfer orders (STOs) to flow through the system from warehouse to plant. The super user under materials management handled much of the supply oriented master data for the plant, but did not understand the implications of setting up the warehouse as a separate entity as that was under the warehouse module. Without the two modules communicating, implications were not fully understood. This resulted in daily work to set up these connections in the two months after golive. Until the majority of the connections were established, paper STO's and invoices were created and manually uploaded into the system. To insure inventory accuracy an additional full physical inventory was performed. This plant wide cooperation is a major drain on resources and time (300 employees over four days) in order to maintain correct inventory data.

With time rush and deadlines a lot of functionality that could have been set-up at the time of implementation were not, and now require large projects to fix. The first major project is cycle counting. A key feature that the BPC plant was looking forward to was the ability to cycle count materials throughout the year, in place of or in conjunction with a physical inventory. This would ensure inventory accuracy throughout the year, and eliminate unforeseen shortages. However when setting up locations during implementation the plant was divided into five major locations, with BIN locations inside the major locations. It was not until months after go-live that employees were able to test the cycle count function, and realize that it was not feasible to cycle count by location. The five major locations covered large sections of the plant, and triggering a cycle count locks down an entire location to ensure count integrity. In a plant that runs 24-7, locking down an entire location consisting of hundreds of BIN's is not feasible. A project to map and create new locations covering areas that can be strategically counted is being designed, and is expected to take about 2 months involving 30 employees. Cycle counting was not listed as a major priority, and therefore did not receive much attention at the global level, but after the fact it is clear that it would have been worth the effort to prepare for this functionality during implementation.

Another issue related to requirement planning, the ability for capacity modeling offered by the SAP package. In the previous MRP system, a master data field allowed entry of an inhouse production time into a field, which would then allow the MRP to plan orders based on requirements and create a recommended start date. The recipe was only used to generate labor and equipment run times each month. BPC has never had capacity modeling, and the recipe was used mainly by financial services. Functions that are not costed, such as standard hold times for products were not included in the recipe. There also is a field in SAP that has an "in house production" time, so even though the recipe did not account for the total time from start to finish, as it did not include non-costed hold times, we could plan our requirements based on the master data field of in-house production. It was not until about 6 months into go-live that it was realized that the backwards planning functionality in SAP used the in-house production time to back up the start date, and used the recipe run time to forward-calculate the finish date. When the recipe does not match the master data field of in-house production, all planned order start and finish dates will be off. When trying to drive business efficiency with metrics such as on-time in full, having a start and end date that are not correct give a very misleading picture for management. This also affects the capacity modeling module. Since every recipe does not account for the entire time a product may take to finish it does not give a complete picture to allow BPC to take advantage of the module. A separate project involving 12 people about one month is required to adjust all recipes. This demonstrates how ERP system functionality differs across systems. Since the fields were the same, it was not realized that they functioned differently and as a result it will require more backend time and lost functionality.

Impact on employees

When SAP went live, the learning curve was very large due to the lack of hands-on training at the outset. The planners are among the heavier users of ERP at the plant. They experienced 15-20 hours longer work weeks for the 3 months following go-live. This overtime has gradually dropped to about 10 hours per week, one year after implementation. A lot of this extra time is fixing master data as well as getting acclimated with the new system. Nonetheless, if there are no data errors present there is improved output for procurement and planning. It is expected that as the system becomes more "complete" and users are able to get to understand system nuances this will improve even more. Many felt that "you do not know what you've got, till you lose it" relative to the former ERP, but that was mainly due to over 20 years of experience with the prior system where everyone got used to the quirks, fixes, and tricks that make life easier. With patience those are being gained in SAP.

BPR post go-live

Business process re-engineering for the plant really started after go-live. The re-engineering focused around the SAP system, to align current business processes to adapt and take advantage of SAP. The main re-engineering at the plant level focused on how employees conducted their jobs.

Many employees had to re-think and design how to perform their daily activities. Prior to go-live many of the legacy reports employees had been using were submitted to the consultant and developers to customize into SAP, but after go-live it was found the majority of these reports were not transferred over. So planners and buyers had to rely on the new planning functionality in SAP. A lot of the re-engineering for quality, procurement, warehousing, supply chain, and finance focused for the first several months on learning the functionality of SAP. As stated earlier, one of the training deficiencies was that the Sandbox did not have usable data to conduct experiments. SAP is a very linear system (conduct step A, move to Step B, and complete Step C). This helps limit human error but increases time spent doing the transaction, leading to re-engineering of past processes to SAP processes. Each department mapped their past processes, using the knowledge of the super users to develop new and more efficient ways of accomplishing standard work.

Real-time data between the plant and markets increased confidence in forecasting. An important step in re-designing the plant's supply chain was to include mid-range planners. Previously the plant would only freeze five weeks of production. The rest of the planned orders were moved out beyond five weeks. This created uncertainty for the markets to know what they were getting since the MRP link to demand forecasting software did not differentiate between planned or process orders. The markets would often have to contact the plant to know when the next replenishment would be. Buyers would purchase based on only 5 weeks of frozen data, with

the rest based on planned requirements (which were often questioned due to system issues). Mid-range planners are now able to freeze 6-12 weeks while finite planners can launch and create productions plan for the upcoming 5 weeks. This re-engineering of supply chain processes resulted in top management being able to plan overtime, allows volume forecasting to predict shortfall/surplus, and lets managers add resources or reduce overtime if necessary. Buyers are able to see a larger window of upcoming requirements, and closer relationships with vendors are allowed, leading to fewer rush orders, as well as a clearer timeline of needs. This has led to reductions in inventory and scrap.

Each week new reports and functionality are found in SAP, and processes are still evolving to align with SAP to take full advantage of its capabilities. Knowledge sharing between plants in the network and hiring of individuals with prior SAP knowledge has aided in discovering SAP capabilities.

Conclusion

When ERP implementation failure is brought up a lot of different conclusions are made: strain on financial resources, non-adequate human resources, training, and system incompatibility with the company to name a few. Through this case study we note the following issues identified during implementation (Table 1):

Table	1:	Case	Key	Points
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Major Category	Lessons Learned	
TRAINING	Face-to-face training is more effective than global teleconference o	
	Web-delivered training	
	On-site consultants are valuable in local training	
	There were inadequate resources allowed to relieve leads and super	
	users to devote their time to the ERP installation	

	There was inadequate time given to train these replacements
BPR	More local input is needed
IMPLEMENTATION	Unexpected delays diverted efforts from planned installation
	Key people will leave
EMPLOYEE	Leads and super users were valuable in informing employees
INVOLVEMENT	There was insufficient coordination across modules

ERP implementation is a very complicated endeavor, and the analysis of its success and failures need to be in-depth and in the appropriate context. Often times it is not top management not wanting to support a project, but it can be them not understanding the full implications of their decisions on end users. Core teams do not want the project to fail, but working 65-70 hours weekly for month's will take its toll on anybody. Focus on software was not driven in this case study as it is the people that can have the biggest impact. Software can be customized, and predictable while top management, core teams, and end users decisions, commitment, and attitude can have the biggest impact.

During implementation there were many challenges as demonstrated with unforeseen delays due data incompatibility, underestimated data analysis time commitment, and loss of colleagues. Even with these challenges implementation of SAP can be have a very positive outcome. For an individual plant implementation the importance of a strong project lead and super users allowed BPC to rely heavily upon their knowledge and expertise, and handle the grunt of implementation which allowed BPC to have an overall successful implementation even though there is still work to be done, the worst of it has been weathered.

Before deciding implementing of an ERP system in a large corporation it is important to lay out a high level plan, but just as important to take the time to truly understand the day to day challenges that come with implementation. By enlisting strong project leads, super users, and giving proper top management support for human resources ERP can be successfully implemented even when unexpected challenges occur.

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