2000

Defining Business Process Requirements for Large Scale Public Sector ERP Implementations: A Case Study

George Blick
Condor Technology Solutions, Inc.

Thomas Gulledge
George Mason University

Rainer Sommer
George Mason University

Defining Business Process Requirements for Large-Scale Public Sector ERP Implementations: A Case Study

George Blick
Condor Technology Solutions, Inc.

Thomas Gulledge and Rainer Sommer
George Mason University

***Abstract* – We present our experiences in defining and documenting business process requirements for a large-scale public sector Enterprise Resource Planning (ERP) implementation in the United States. The implementing organization, the Naval Air Systems Command (NAVAIR), is investing in packaged software to integrate all aspects of its business processes. Prior to selecting implementation consultants, NAVAIR documented business process requirements to scope the implementation project and evaluate consulting team proposals. The details of the approach, problem areas, and lessons learned are presented.**

I. INTRODUCTION

"The Naval Aviation Systems Team (TEAM), in partnership with industry, serves the Nation and the Navy by developing, acquiring, and supporting naval aeronautical and related technology systems with which the operating forces, in support of the Unified Commanders and our allies, can train, fight, and win[1]." In short, NAVAIR is responsible for life-cycle management for Naval Aviation, including:

Acquisition management,
Government technology development,
Testing and evaluation,
In service engineering and logistical support,
Repair and modification, and
Interaction with industry, supply organizations, and the fleet.

NAVAIR is a public sector innovator in implementing private sector management and technology methodologies and systems. The ongoing objectives are to increase effectiveness while managing cost. NAVAIR has been reengineering its business processes and implementing activity-based costing with success, and will be implementing process-oriented packaged software in upcoming years. This Enterprise Resource Planning (ERP) implementation project was initiated in the spring of 2000, and NAVAIR preparations for the project have been underway since 1999.

[1] Background information on NAVAIR may be found at http://www.navair.navy.mil/

The Enterprise Solutions Program Office (ESPO) was created to select the software solution, select the implementation consultants, and to manage the project. Condor Technology Solutions and George Mason University (GMU) were selected by NAVAIR as consultants to help with the planning for the ERP implementation [1]. Business process requirements documentation was a part of the support provided by Condor/GMU. This paper describes the process that was used for defining requirements, including all problems and lessons learned. While there are some unique characteristics of the NAVAIR environment, we believe that the approach is a model for other public sector implementations.

GENERAL APPROACH

The approach taken in US public sector organizations must (by law) be different than that taken by private organizations. While government acquisition rules have changed in recent years, with the major providers of ERP software now appearing on the General Services Administration (GSA) procurement schedule [2,3], the acquisition process still requires significant front-end attention.

The implication is that the purchase of packaged software is approached as a major acquisition program; hence, a competitive source selection for the software and the implementation consultants. This implies that consulting teams must submit cost and technical proposals for completing the work, and consequently, NAVAIR must define the scope and requirements for the project.

In the private sector, after software selection, business process owners and team leaders are quickly identified, and an implementation methodology is established. In the US, the approach that is currently in fashion is Rapid Implementation. Examples of these approaches for the major providers on the GSA schedule are PeopleSoft Express, Oracle AIM Advantage, and AcceleratedSAP. These methodologies are characterized by a fairly rapid scoping and module assessment process and then configuring of the software to align with business processes that are in scope. Small teams of consultants and

business experts working together usually accomplish the configuring process.

It is our opinion that these approaches must be modified to accommodate public sector culture and regulations. This does not mean that the core of the implementation methodology must be changed, but that more care must be taken in defining requirements and documenting all aspects of the project. The requirements of the government program office (in this case the ESPO) cannot be ignored, and the best of the private sector methodologies must be incorporated into the government program management process.

A number of significant activities were completed by the ESPO in preparing for the ERP implementation. This paper only focuses on the defining and documenting of the business process requirements. Our approach called for:

> Establishing a high-level project scope by working with senior executives to determine which business processes were included in the implementation and which were not,
> Establishing ownership for those business processes that are included,
> Defining business team leaders to document the business processes that are in scope,
> Distributing the documented business processes to potential implementation consulting teams as part of a request for proposals; i.e., the proposed solution must cover the functionality of the documented business process, or gaps must be identified,
> Using the effort required to "close the gap" as one criterion for proposal evaluation.
> Developing a final negotiating baseline for actual gap closure,
> Establishing procedures for documenting the business processes that are aligned with the ERP software through the configuration process, and
> Developing procedures for establishing and maintaining a business process repository.

Each point will be discussed in detail, but it is important to note the implications of such an approach to requirements definition and evaluation. First, a meaningful technical differentiation among proposals is obtained. Packaged software products have different functionality, so the effort associated with gap closure is important to understand. Second, the government program office has a better understanding of its business processes and how future business processes align with the processes that are enabled by the software solution. The discussion in the following sections is aligned with the approach as outlined above.

HIGH-LEVEL PROJECT SCOPE

The establishment of high-level project scope for the NAVAIR project was difficult. With some effort we were able to document the Naval Aviation Life-Cycle Domain. A high-level view of that domain is presented in Figure 1.

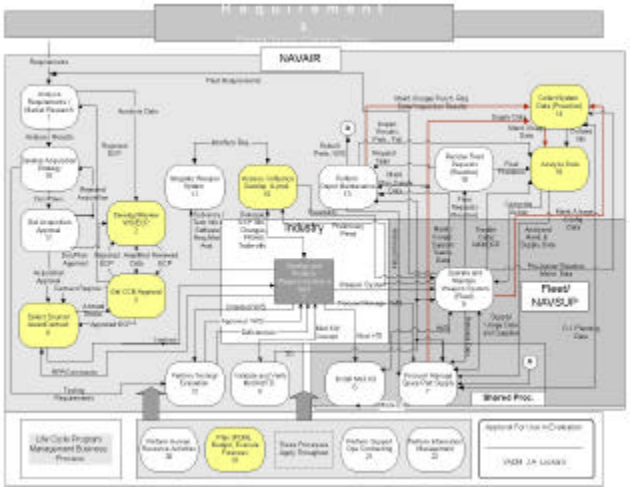

Fig. 1 Naval Aviation Life-Cycle Management Domain

This picture documents twenty-two primary functions that must be executed for the life-cycle management of an aviation system. Figure 1 is complex because NAVAIR interacts with industry, the Department of the Navy, the Office of the Secretary of Defense, the Defense Logistics Agency, and other organizations. The business processes defined by these twenty-two functions are presently supported by hundreds of "legacy" systems. In some cases, law mandates the use of these legacy systems. In other cases, strong political influences make it difficult to consider the elimination of a legacy system.

PROCESS OWNERSHIP

The private sector experience suggests that ERP implementations should properly be characterized as business projects, not IT projects. Historically, IS/IT Departments have led the implementation of enterprise projects. This was accomplished with the support of *business leads*, who establish a need and provide requirements. The IS/IT department was typically end-to-end responsible, including ownership and maintenance. Packaged software is implemented in a different way. Business leads, with the support of implementation consultants, define requirements and configure the software to meet specific needs. Initially the IT/IS Department plays a supporting role, primarily in providing data conversion support. This does not mean that they are not players – there are literally hundreds of support areas,

and in the end, the IT/IS Department assumes technical ownership. In fact, one important failure factor is getting the IT/IS Department involved too late. However, the reason the implementation process is structured with *business leads* in charge, is that there is a more critical key to failure. The literature supports the assertion that the key to successful implementation is to follow the private sector model – business teams lead, with IT/IS support, and eventually a transition to the IT/IS department. This last statement is what is meant by packaged software implementation being a "business project as opposed to an IT project."

Hence, we place significant attention on identifying process owners and their representatives. In our terminology, the representatives are called the business team leaders. Process ownership was relatively easy to establish. NAVAIR has been reengineering its business processes, so the concept of process management was not foreign to the NAVAIR culture. Educating the process owners and determining the proper role of the ESPO in interacting with the process owners and the implementation consultants was more difficult. This education process is essential, since the process owners are the final decision authority on significant business process changes and legacy system retirement. They must understand the management aspects of implementing packaged software, and they must be prepared to empower business team leads to proactively work with the implementation consultants.

NAVAIR accepted the challenge and defined the project structure in Figure 2.

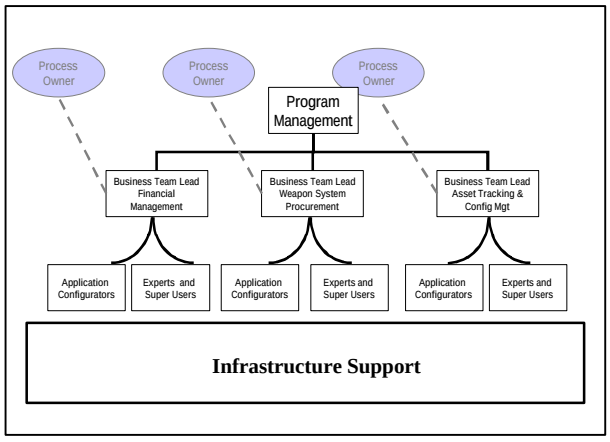

Fig. 2 Project Team Structure

This figure, which indicates the structure for three key areas of the domain, is in our opinion a good model for public sector projects. The Process Owners tend to be Flag Officers or Senior Executive Service, and they don't pay a day-to-day role in the implementation of the software. The business team leaders, who are the empowered representatives of the process owners, are the key to the implementation. The infrastructure support is provided by the program office (i.e., the ESPO) and the internal IT/IS Department.

DOCUMENTING THE REQUIREMENTS

Since we were documenting business process requirements, we selected a methodology that supports integration around business process. The Architecture of Integrated Information Systems [4,5] was selected, because the methodology has a business process orientation [6] and it is supported by an integrated toolset, which is classified as the industry leader [7]. The broad superiority of ARIS is addressed in [7], but in our case, there is no bettor methodology and toolset for defining business process requirements.

Our modeling team of three senior consultants worked with the business team leads to model the complete NAVAIR organization. This included business process models and dataflow models to three levels of decomposition. The model repository includes thousands of linked objects across four views. Tabular descriptions were constructed for the attributes of all functions, and legacy systems were linked to functions, when they could be identified. This was a fairly intense effort with most of the work being completed in a three-month period. The work could have been completed quicker, but we were slowed somewhat by the process of identifying and educating the business team leaders.

USING THE MODELS

There are many uses for the models, but the most urgent use was in support of the selection of the software and implementation consultants. The models defined the scope of the proposals, indicating what would be included in the ERP implementation. Without some boundaries on the business processes included, it would have been impossible to evaluate the proposals. That is, without a common baseline defining the functionality of the implementation, it would have been impossible to compare the proposals.

There were a number of evaluation criteria that were considered. For the purposes of this paper, the criterion of interest is *gap analysis*. Gap analysis, discussed in detail in the next section, is used to determine the extent of business process change that is required for a particular solution, as well as determining software customization and interfacing requirements. After the discussion of gap analysis, we discuss how the models are also used to support business process configuration management over the life-cycle of the ERP solution.

GAP ANALYSIS

ERP systems have different designs, and consultants have different solution approaches. Some ERP solutions are process-oriented, while others are more function-oriented. In addition, the pure functionality of the systems is different, or can be implemented in different ways. Consultants take advantage of these differences in advantageous ways. NAVAIR understood that these differences existed, and viewed them as an opportunity for designing and implementing a superior ERP solution.

NAVAIR has a very complex environment. There are some business processes that are owned by other Navy organizations. This requires that the consultant must have a strategy for implementing ERP in a "mixed environment." "Mixed," in this case, mean that some modular components may have to be implemented in non-traditional ways. For example, it could be that a relatively standard component of "financials" might not be implemented because of a requirement to interface with a mandated business process and systems that are external to NAVAIR and non-controllable by NAVAIR. The interface function may even be a part of another ERP project in a different Navy organization. NAVAIR managers knew that they must understand the consulting team's approach to dealing with this complexity.

In addition, NAVAIR's business processes are different from best or leading practice commercial processes. NAVAIR wants to adopt commercial best practice, but there are some unique processes that are required by law, and for these, it may be impossible to adopt the commercial processes. For these processes, NAVIR tried to understand when these special business processes should be included in the ERP solution, and when they should be excluded. In some instances, the business process could be so critical that NAVAIR may need to extend the ERP system functionality, but the decision was made to minimize extensions, and if possible, exclude them completely.

The bottom line is that NAVAIR was sensitive to three critical areas:

- NAVAIR is constrained by a non-traditional "mixed" implementation,
- Public sector business processes may be different from private sector processes, and
- NAVAIR wanted to minimize extensions and interface development.

Given this background, there are a number of factors that NAVAIR (or any other public sector organization) must understand from cost/schedule and change management perspectives:

- At a most basic level, is the consulting team's solution able to align with NAVAIR's required business processes? If alignment is possible, NAVAIR desired to adopt the best practice business processes that are supported by the software.
- For those processes where there is no alignment, NAVAIR felt that it must understand:
  - The implications and cost/schedule estimates of changing business processes to agree with those that are supported by the software, or
  - The implications and cost/schedule estimates of extending/customizing the software to meet business process requirements.
- The business process and cost/schedule implications of implementing in a mixed environment must be understood and managed.

To address these considerations at a **high-level**, NAVAIR asked the offerors to perform a *gap analysis* (or gap-fit analysis) that addressed these issues. The primary objective was to evaluate the offeror's approach for identifying and closing the gap when aligning NAVAIR business process with the packaged software.

The structure of a gap analysis is better understood with the aid of Figure 3.

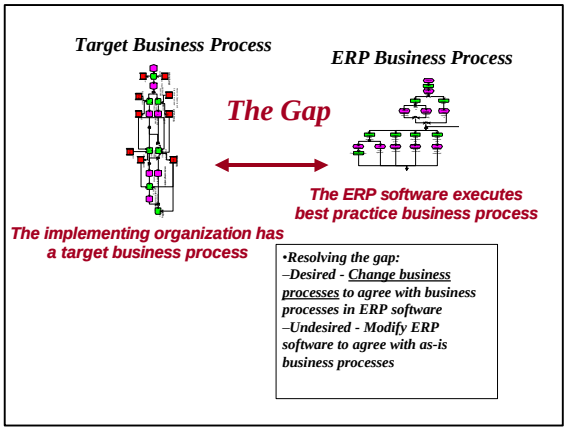

Fig. 3 Gap Analysis

The packaged software executes specific business processes, and there is a target business process in the implementing organization. Consultants try to align the software with the target through the configuration process. If the gap can be closed through configuration, cost and

risk are minimized. If third party bolt-ons or customized extensions to the software are required, an element of increased cost is imposed on the solution. Gap closure is critical in any implementation, but it is particularly critical in the current wave of public sector implementations.

If the packaged software has been implemented many times on private sector business processes, and if the implementing organization is willing to adapt to the processes that are supported by the software, then it is reasonable to expect that gap closure may be realized through configuration. In the public sector, however, we have limited implementation experience, and public sector business processes are often different that private sector processes. This suggests that more attention should be focused on understanding the gap.

NAVAIR provided the following information with the request for proposals:

> A description (in tabular form) of the business processes that are included in the implementation.
> A detailed description (in tabular form) of the business processes that clearly fall in the NAVAIR ERP domain, including a list of systems that are known to support these processes.
> A description (in graphical form) of the same NAVAIR business processes, arranged in a time-sequenced display

As part of the technical submission, the offeror was asked to provide the following:

> A description of the consulting team's approach to gap identification and closure for the complex NAVAIR environment.
> An actual gap analysis, given the available information.

NAVAIR requested that the offeror use its normal methodology for identifying, assessing and closing the gap. The objective of the gap analysis at this stage of the implementation process is to discriminate on risk and high-level functionality. Is there an understanding of the complex NAVAIR environment and does the proposed solution align with existing (or newly engineered) NAVAIR processes? The offerors' gap analyses were summarized in tabular form, using a format that was provided by the ESPO. The proposal gap analysis evaluation process is critical in differentiating the offerors, but there is a second use that occurs after the consulting contract is awarded.

POST AWARD GAP NEGOTIATION

It is unreasonable to expect an offeror to completely address all gap closure issues in a proposal. The offeror does not have access to the process owners or the business teams, so final gap closure must be negotiated post award. The concept of post award gap negotiation is increasingly used on fixed price private sector ERP implementations in the US. The business team and consultants work for some short period (60-90 days) in defining the gap, and then a final price is negotiated, considering the effort required to achieve gap closure.

Given GSA contracting rules, it is possible to take a similar approach in the public sector. A fixed price delivery order can be issued immediately after contract award, with the objective of refining the gap analysis from the original proposal. In this phase, the implementation consultants can work direct with the business teams and process owners to refine the estimates of the effort required to close the gap.

The business process and dataflow models are invaluable for supporting this process. The business teams understand the business processes prior to contract award, because they constructed the as-is models. The models, at some level, describe the functionality that must be included in the ERP solution; hence, they become a powerful aid in "jump starting" the gap closure negotiations. If the models did not exist, then the consultants would have to extract the same information from the business teams, using their own methodology. That is, the consultants must understand scope and business process functionality before they can recommend modules and configure the software.

The ARIS models were critical for a number of reasons:

> The modeling process educated the business team leads, preparing them to support the implementation process.
> The models were used as a discriminator in the proposal evaluation process, since the offerors had to propose solutions that covered the business process functionality that was described in the models.
> The models are used as a negotiating baseline to support a post award refined gap analysis.

These are operational uses that help a public sector organization add structure and discipline to the complex software acquisition process. However, there are also benefits that accrue over the lifecycle of the software solution. These issues, which relate to business process

configuration management, are addressed in the next section.

BUSINESS PROCESS REPOSITORY

NAVAIR is a very complex organization, with many specialized business processes that will never be supported by packaged software. Still, NAVAIR enables these non-ERP processes with IT, and documents these processes in an architectural repository. Configuration management is taken seriously at NAVAIR, and business processes are not excluded. While this part of the implementation project is still unfolding, NAVAIR is committed to maintaining a business process repository for ERP as well as non-ERP processes.

This presents a particular challenge, since implementation consultants using rapid implementation methodologies don't build business process repositories. For example, consider the AcceleratedSAP (ASAP) methodology [8]. After the implementation is completed, the business process procedures are descriptively documented. These word processing files, called scripts, are used to generate personalized training materials, but more importantly they represent the extent of the business process documentation for the ERP solution.

NAVAIR prefers configuration management documentation that is more extensive than that provided in the script files. Our current plan, which will be refined during the implementation process, is for the ESPO to document the configured business processes in ARIS, using information that is provided by the business teams as they are configuring the ERP software. It is our understanding that some of the providers are introducing new products that permit the reverse engineering of script files into business process models, so our strategy may change as we learn more about these products.

PROBLEMS AND LESSONS LEARNED

NAVAIR is one of the first US government organizations to implement multi-module standard software. There are a number of stovepiped financial and human resource implementations, but integrated multi-module implementations are rare. Hence, NAVAIR is defining a public sector implementation methodology. The ESPO program manager has a difficult job, since he must consider private sector implementation experiences and tailor them to the public environment.

The incentive system is much different in the public sector (i.e., there is no profit incentive), but from a pure technical perspective, public and private implementations are essentially the same. On our project, we had the support of senior consultants who have implemented ERP in some of the largest corporations in the US. The political problems relating to business process and legacy system ownership are surprisingly similar. However, there are some differences. We focus on one difference for this paper, the role of the government program office.

For implementing in the private sector, small teams are typically preferred to large. For example, a typical business team to support a single module is comprised of 3-5 people. The composition is usually 1-2 consultants and 2-3 managers from the business. Subject matter experts (as required) support the team, but the teams are relatively small. The primary objectives are to configure, convert data, test, and go live as quickly as possible.

The government approach to managing a program is quite different. When establishing a program to support a major acquisition, say for an aircraft, a large number of people may be required. The program office defines requirements and reviews proposals from industry. After award, industry produces a product and delivers it to the government for independent testing. Finally, the product is accepted and maintained in the fleet. This program office model is highly effective, and it is used throughout government.

It is quite natural that when NAVAIR established a program office to support ERP acquisition that same approach was used. It is part of the culture and the acquisition regulations. However, this program office structure does not align perfectly with an ERP implementation.

When implementing an ERP solution in the private sector, the business teams complete the bulk of the work; i.e., the small teams that are described above. There is infrastructure support, as indicated in Figure 2, but this support is primarily data conversion support from internal IT/IS experts and legacy system owners. In short, there is no real private sector equivalent to a program office.

Since a program office is a government requirement, NAVAIR is defining the proper role as the implementation process unfolds. This has resulted in a painful process of defining organizational roles and responsibilities, especially as they relate to providing support to the process owners and business teams. This discovery process is still underway at NAVAIR, and it will be resolved in such a way that we understand the proper role of a program office in supporting an ERP implementation. However, there are some lessons learned.

The first lesson is that a traditional program office that is organized to support a traditional systems engineering waterfall model is not appropriate for these types of projects. ERP systems are not implemented according to

the traditional linear model that involves design, build, independent test, implement, and support. Design, build, and test occurs iteratively, and the critical requirements are not system requirements, but business process requirements. A more traditional private sector organizational model should be used; i.e., one that explicitly addresses the importance of business process requirements in defining an ERP implementation.

A second, and related lesson learned, involves program office size. Staff size and the allocation of staff resources in support of the business process teams must be given careful attention. It is much more important to identify and educate business process owners and team leads, as opposed to fully staffing a program office of support people.

SUMMARY AND CONCLUSIONS

A number of large-scale ERP implementations are underway in the US federal government. This is a growth industry, with a recent study estimating that the ERP market will grow from $2.8 billion in fiscal year 1998 to $3.7 billion in fiscal year 2003 [9]. The Naval Air Systems Command represents one of the larger federal implementations, and it represents an interesting case study for understanding how public implementations differ from private implementations.

This paper addresses one aspect of the public sector implementation process, the role of business process requirements modeling in support of the life-cycle implementation process. The following areas were identified and described:

> The modeling process educated the business team leads, preparing them to support the implementation process.
> The models were used as a discriminator in the proposal evaluation process, since the offerors had to propose solutions that covered the business process functionality that was described in the models.
> The models are used as a negotiating baseline to support a post award refined gap analysis.
> The models support the business process configuration management repository.

Business process requirements modeling is one element of a comprehensive public sector methodology that we have developed. However, it is a key element, and we know that it is useful for government managers who have special requirements that are not present in the private sector.

Finally, as part of out lessons learned, we discuss how a government program office should be organized to support ERP implementation. Small business teams that are focused on meeting business process requirements are central to the organizational structure.

REFERENCES

[1] M. Dunn, “Condor Federal Gets Boost from Navy Win,” *Washington Technology*, vol. 14, pp. 52-54, September 13, 1999 [Available at the following URL: http://www.wtonline.com/vol14_no12/netplex/776-1.html].

[2] D. Frank, “PeopleSoft, SAP Approved for Financial Schedule,” *Federal Computer Week*, vol. 13 #4, p. 41, February 23, 1999.

[3] L. Pender, “Pushing for Federal Contracts: ERP Vendors AMS and Ariba Will Target Marketplace at Government Purchasers,” *PC Week*, vol. 16 #50, p. 14, December 13, 1999.

[4] A.-W. Scheer, *ARIS: Business Process Frameworks*, Berlin: Springer-Verlag, 1998.

[5] A.-W. Scheer, *ARIS: Business Process Modeling*, Berlin: Springer-Verlag, 1999.

[6] M. Kirchmer, *Business Process Oriented Implementation of Standard Software*, 2nd ed., Berlin: Springer-Verlag, 1999.

[7] K. Kleinberg, “BPR Tool Functionality: What You Need, What They Have,” Strategic Analysis Report, Gartner Group, September 29, 1997.

[8] S. Miller, *AcceleratedSAP: Implementation at the Speed of Business*, New York: McGraw-Hill, 1998.

[9] Federal Sources, Inc., Enterprise Resource Planning in the Federal Government, McLean, Virginia: Federal Sources, Inc., 1999.