Enterprise Frameworks address such broad application domains as telecommunications, avionics, financial services, and manufacturing. Enterprise frameworks are expensive to develop and/or purchase, relative to system infrastructure (such as GUI and Choice Operating Systems) and middle-ware integration frameworks (object request brokers). However, enterprise frameworks can provide a substantial return on investment since they directly support the development of end-user applications and products [1]. In addition, the economic impact of framework technology is gaining momentum and therefore requires the attention of information and systems engineers as well as managers, executives, consultants, and researchers.

System infrastructure and middle-ware integration focuses only on internal software development concerns. These are important aspects of an information system and are essential to the rapid creation and modification of high-quality software, but they typically do not contribute to revenue generation for large enterprises [1]. In fact, corporate accounting accurately views the information systems department and its projects as cost center activities.

Even though well architected information systems can yield a strategic advantage, an organization’s information system does not directly generate revenues. As a result, it is often more cost effective to buy an enterprise framework with a built-in system infrastructure and middle-ware framework rather than engaging in large-scale, in-house development projects [2, 3].

In order to realize the advantages offered by enterprise frameworks, it is critical that decision-makers understand the characteristics of a good enterprise framework [2, 3]. This column discusses the strategic budgetary, marketing, technical, and managerial advantages that impact an organization’s bottom-line and its ability to support and adapt to changes in the marketplace. Finally, we characterize the broader economic impact that we anticipate will result from the enterprise framework marketplace.

Budgetary Advantages

Budgetary advantages are realized through overall improvements in planning and budgeting. Enterprise frameworks contribute to improvements in planning and budgeting because framework projects must be planned out in exhaustive detail before selection and deployment occur. Since most, if not all, of the components required for the system infrastructure are specified by the framework vendor, the information systems team can easily derive project plans and budgeting guidelines from the framework vendor and, in some cases, from other framework users. In addition, annual charges for upgrades and technical support services are negotiated in advance. These factors lead to improved cost management over the life cycle of ownership.

Life-cycle costs are also reduced due to the emphasis on standards that are exploited in an application framework development environment. The emphasis on standards results in formal processes for reuse and accelerates the time to deliver new application content. This means it will cost less to produce or extend applications for the enterprise.

A final advantage in the budgetary process is the clear delin-
Thinking Objectively

eation between infrastructure costs and departmental projects that should be funded outside the information systems budget. Generally, departments are unwilling to fund infrastructure activities that do not directly lead to applications that further their interests. Therefore, there are organizational stresses and budgetary problems resulting from the business-as-usual approach to application development. With a framework infrastructure already in place, the users or departments will not have to worry about paying for infrastructure. Instead, projects for end-user departments will accurately reflect the costs of developing the application and only those infrastructure costs associated with the new project.

Thus multi-year, cash-flow analysis and decision making is enhanced in an enterprise framework-centered infrastructure. Leveraging the improved cost management features of enterprise frameworks, managers can more readily evaluate economic considerations such as economic profit [4]. Namely, how does the information system contribute to earnings and/or reduced overhead, versus the cost of the framework. Employing a budgetary model such as Favaro’s Economic Profit model results in a management tool for measuring the economics and progress from year to year that preserves the integrity of multi-year, cash-flow analysis and decision-making. Enterprise frameworks are well suited for this form of analysis.

Marketing Advantages
Favaro states two primary strategic determinants of value creation: market economics and competitive position [4]. Thus, a good enterprise framework is linked to competitive strategy. Frameworks linked to a competitive strategy result in a very flexible information infrastructure. Therefore, the framework approach allows the organization to manage information and processes in a way that produces a market advantage.

Moreover, frameworks ensure that applications will be produced and distributed rapidly to the organization. This contributes to market advantage by providing the information and infrastructure needed to reduce time to market for new products.

Technical Advantages
In one sense, a good application framework excels in providing technical advantages above all other advantages. Enterprise frameworks are only compelling if they leverage technology in a better way than other approaches. There are many technical advantages associated with enterprise frameworks. We will highlight a few here.

Enterprise frameworks benefit the organization through a well-defined strategy for system upgrades and enhancements. This strategy is realized in concert with the framework vendor. A framework vendor must have a strategic vision for its technology. That vision determines the release cycle for system upgrades and enhancements. As a result, acceptance testing and validation activities can be scheduled in the context of the release cycle. The framework customer can choose to implement or pass on minor releases that may not provide an economic return or simply wait for major releases that typically occur on an annual or semi-annual basis. In either case, the framework vendor assumes a greater role in the release cycle which reduces the resources the customer must dedicate to this function. A benefit of the vendor’s role in defining the strategy for upgrades and enhancements is a workable and flexible 5- to 10-year roadmap for systems development.

An enterprise framework offers stable, yet flexible architectural designs embodying the core domain knowledge. When building a particular application, we focus on how to extend and modify the framework architecture rather than its code. Framework and design patterns make the reuse of architectural design possible. Therefore, enterprise frameworks enforce a reuse strategy. Well-trained developers that attune themselves to application designs that leverage the models and objects in the framework to the fullest extent. As the framework team gains experience in applying the framework, solutions compromising the object-oriented nature of the framework will be discarded for approaches which increasingly leverage the reuse model.

The framework team will also gain technical advantages by leveraging a framework that has well-defined mechanisms for system administration, business process modeling, information modeling and application extensibility. With non-framework centered systems, process of administering a production system which is relied on by the entire enterprise is quite costly and complex. A good enterprise
framework provides built-in automated administration utilities for startup and shutdown, fail-over and recovery, and archival. Similarly, with embedded tools for business process modeling, information modeling, and application design, robust enterprise frameworks allow design models to be rapidly converted into working application content. With non-framework centered systems, these modeling tools are not integrated and therefore the process of translating the models into functioning logic is manual.

A huge technical advantage is gained in the area of domain analysis, because enterprise framework vendors deliver products that reflect extensive knowledge of the application domain. Thus the business process engineering has been completed in part or in total when the framework is delivered. Furthermore, a good framework vendor employs numerous experts with specific industry expertise and offers training programs that educate their customers in the appropriate application of the framework to specific business problems.

Enterprise frameworks also yield technical advantages with respect to architectural design. Architectural abstractions, the enterprise framework, and its domain model are highly stable and provide a basis for adaptations and integration. Furthermore, OO analysis and design techniques are matured, in part, due to the rich set of domain specific artifacts delivered with the framework. Architectural design advantages are also realized as a result of the common vocabulary the framework architecture provides for users and developers—a feature that is greatly exploited when the framework provides a high level of domain knowledge.

Another area where enterprise frameworks provide an advantage is with respect to documentation. Documentation is a costly activity. The cost of technical and user documentation for software can exceed $500 per page. Enterprise framework documentation is, in principle, of very high quality. Thus, much of the cost of the documentation is built-in to the framework acquisition. In addition, when the framework documentation is extensible, it allows production of new documents for framework extensions and framework-based applications in a very rapid manner.

**Managerial Advantages**

When a company invests in an expensive architecture, it must be managed well. It is essential to keep track of the evolution and leveraging the most out of it. Management must be able to substantiate its framework purchase and make sure expectations are met. Expectations include:

- Satifying end-users
- Supporting the organization’s key strategic objectives
- Satisfying business requirements
- Operating with higher quality and performance
- Deploying on time and on budget

In addition, it is essential opportunities take advantage of increased return on investment. During the development of applications that extend the framework, the organization may create a commercially viable product leading to increased revenues.

The increased focus on the management of the framework deployment and development activities has associated risks due to the size and cost of such activities. With an understanding of the associated risks comes a greater appreciation for the importance of managing project schedules, budgets, quality, and personnel which can produce sweeping improvements. Moreover, the overall management activities related to a framework should be less than the related management activities for a slew of loosely coupled applications and infrastructure without an underlying framework. Framework projects are like anything else: if you manage them well, you increase their life expectancy and gain more from them. An enterprise framework must be monitored on a daily basis. Management of the enterprise framework protects the organization’s investment.

These improvements would be difficult to appreciate if some of the risks associated with frameworks could not be mitigated. Adoption of enterprise frameworks by an organization delegates the evaluation of new technologies to the framework vendor. Since the framework vendor will be best positioned in the marketplace by keeping pace with technology trends, the organization does not need to dedicate resources to evaluate these trends in technology. This task is deferred to the framework vendor introduces new technologies when they are sufficiently mature and in demand in the marketplace. Hence adoption of an enterprise framework has an
advantage with respect to research and development cost savings.

Management must plan well for developing or buying enterprise frameworks. Management also must plan well for the utilization of the enterprise frameworks. Planning increases awareness of different risks and issues and aids in making the right decisions.

Enterprise frameworks make the issue of data collection and reuse metrics more applicable. Since enterprise frameworks are reusable, semi-complete applications, there is greater emphasis on reuse. In fact, enterprise frameworks are real reuse. With an enterprise framework, the organization can enjoy the ability to collect data against a system that, by definition, is the cornerstone of any organization. One can measure and estimate:

- The percentage of reused and un-reused code for every application
- The number of reused elements utilized the most in every application generated
- The cost of extending a given enterprise framework
- The cost of integrating several frameworks to build applications
- ROI from extending the framework to an application or several applications and rank alternative framework extensions
- Savings by collecting data to identify the cost drivers

Furthermore, the organization can apply several approaches to investment analysis, such as Net Present Value, Average Return on Book Value, and Profitability Index.

**Economic Impact**

Enterprise Frameworks impact local business and global economies. Why? There are an increasingly large number of services and products related to framework technology, such as consulting, research, books, training, search services, legal services, tools, and environments.

Frameworks will generate significantly higher revenues for those technology and service firms competing for a piece of the framework technology marketplace. We cannot project today what the size of the framework economy will be. However, we acknowledge that framework vendors and service providers are highly specialized in an industry or commercial domain with teams of well-compensated experts.

While early adopters of enterprise frameworks will have to pay a premium for these products and services, the framework economy will ensure that even very complex solutions will be deployed in a turn-key fashion and while hourly and capital costs may increase, lengthy implementation schedules will be compressed from years to months and months to weeks or even days.

As the Internet is used increasingly for commerce, enterprises will find ways to work more effectively through electronic data transfer and through online transactions over either identical or disparate frameworks. In either case, frameworks will be an enabling technology, without which the benefits of the Internet will not be fully realized. Frameworks will empower cooperative supply chains and enable business partners to work together more efficiently and manage complex business transactions in minutes or even seconds with little or no human intervention. The end result is a faster response to a customer’s needs and faster time to market.

**Conclusion**

We believe the information systems space will be dominated by enterprise frameworks well into the next century. This will result in the establishment of a framework marketplace that will have a measurable economic impact. While the short-term cost of entry for enterprise frameworks is higher than traditional alternatives, the life-cycle costs are less and return on investment is greater due to the ability to rapidly deploy and extend enterprise frameworks. Thus, the technical benefits of this approach to systems engineering are compelling. However the benefits extend beyond the technical aspects of this methodology. Specifically, adopters of enterprise frameworks will realize additional budgetary, managerial, and market benefits resulting in bottom-line improvements.

**References**


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