Understanding ISP Methodologies and Identifying Requirements of ISP-Supporting Software Tools[+]

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〈Abstract〉

There exist a number of information systems planning(ISP) methodologies. As the level of market competition gets intensified, firms are more likely to engage in organizational transformations such as BPR and CPI(continuous process improvement). Because this new requirement should be incorporated into ISP methodology, the number of ISP methodologies available will be continually increasing. However, we could not find a framework for understanding and classifying these divergent methodologies. So, we here present a framework for classifying ISP methodology classes. With this framework, we categorize different classes of ISP methodologies and identify their limitations in terms of missing elements and links. And we move on to present new technical innovations and other methodological advances that, if properly integrated with ISP methodologies, would help us derive an IT infrastructure plan more effectively. Furthermore, in search of software tools or aids supporting the application of ISP methodologies, we identify requirements of ISP-supporting software tools and evaluate functions of existing software tools, then suggesting a future direction to that end.

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1. Introduction

An ever-increasing market competition is demanding more firms to utilize information technology as a strategic enabler. The question is what combination of information technologies to select among a variety of IT products and services. There is general agreement that IT and the firms strategy should be matched seamlessly. Aligning information technology with business strategy often calls for a new IT infrastructure. The importance of this issue continually remains one of key issues to information systems managers[2].

To come up with a blueprint for IT infrastructure appropriate to a firm's business and strategic direction is not an easy task, rather a complex, time-consuming process since many different aspects of the enterprise including strategic, organizational, and technical elements must be thoroughly studied. Generally, it requires participation by not only information systems staffs but also executives and users at various levels of management hierarchy. So, it normally takes lots of organizational resource and a significant amount of time to come up with an IT infrastructure plan. Therefore, to facilitate and support this planning effort, many firms rely upon a guiding framework which is called Information Systems Planning(ISP) methodology. Such methodology usually constitutes a series of procedural tasks to be undertaken, a number of techniques employed, and a description of deliverables. So, one can systematically come up with an appropriate IT architecture from analysis of the enterprises strategic directions and various work-related elements by proceeding along the course of the given task sequence.

In fact, the search for such a methodology started a long ago in information systems area. The pioneering work of this kind is IBMs Business Systems Planning(BSP) introduced in 1970s[14]. A more formal methodology called Information Engineering was introduced by James Martin who had been involved in development of BSP at IBM[Martin 89]. After an overwhelming reception of IE methodology, the similar endeavor was taken by many including IT consulting agencies in order to develop their own. In 1990s the level of market competition was so intensive that it was commonly believed that only highly competitive firms could survive in market. A natural consequence was the prevalence of organizational transformations including Business Process Reengineering or Total Quality Improvement. The emergence of these new management paradigms became a driving force for altering existing ones or creating new ones with respect to ISP methodology.

As a result, the number of ISP methodologies available is continually increasing. What is significantly lacking is a comparative study of these methodologies. Most ISP studies have focused on empirical implementation of ISP[19] and introductory presentation of ISP approaches[17,26]. Lederer and Sethi[19] surveyed ISP methodologies frequently employed. Just a few research were designed to characterize these divergent methodologies. Dantzig[7,8] illustrated the evolution of various information systems planning methods in chronological order. The concept of method in his work is somewhat limited as compared with that of methodology. An attempt to classify ISP methodologies was also made by Tozer[37].

The criteria applied in his classification, however, are ambiguous and incomplete. Conclusively speaking, work on comparison of ISP methodologies is scant. We think that this problem can mainly be ascribed to two reasons. First, most of ISP methodologies are proprietary products[37]. Second, there is no framework for characterizing them effectively. These factors significantly limited a comparative study of ISP methodologies, making it hard to accumulate our experience and knowledge in methodology development.

Another major problem in the ISP process is that the process takes too long and costs too much to do[19,37]. It is generally believed that, in order to speed this planning process, a use of software tools or aids during the process is necessary or recommended[20,21]. However, there is little research on identifying requirements of these software tools and suggesting which or what type of tools to use.

Therefore, this paper is to present a framework for classifying ISP methodologies and at the same time to introduce some of newly available ISP methodologies that are of great worth to IT architecture planners. With this framework, we categorize different classes of ISP methodologies and identify their limitations in terms of missing elements and links. And, we move on to present new technical innovations and other methodological advances that, if properly integrated with ISP methodologies, would help us derive an IT infrastructure plan more effectively. Finally, we identify requirements of ISP-supporting software tools and analyze functions of existing software tools against these requirements in search of a suitable ISP-supporting tool.

2. A Framework for ISP Methodologies

The concept of ISP methodologies is continually changing as the objective of ISP itself varies over time. In other words, what to accomplish from information systems planning ought to influence greatly what sort of elements need to be studied and in what sequence of steps one may proceed to attain that objective.

Dantzig[7,8] described the evolution of ISP as a shift from selecting one among a set of a particular systems development alternatives to effectively allocating organizational resource toward maximizing contributions of IS investment to business. It may be noted from his finding that a strategic component of the became increasingly essential in derivation of IT infrastructure plan.

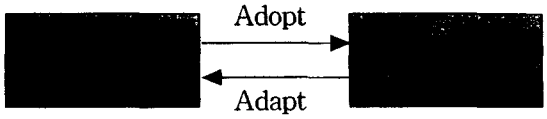
Since the beginning of 1990s, more firms recognized that they had to transform the way they do business in order to survive in highly competitive environment. A number of ideas for organizational transformation have been proposed including BPR[12] and TQM[31]. The underlying theme behind these effort was that IT can and should become a great enabler for transforming their business and operations. Some pioneering researchers have already suggested that an ISP methodology be devised to reflect the need for not only an IT infrastructure plan but also a plan of redesigning existing business processes and operations. Teng[35,36] proposed a framework for integrating BPR and information Narchitecture. Similarly, Nedzel[28] indicated shortcomings of Information

Engineering, the most well-known ISP methodology and implied further requirements for ISP methodology as follows:

"the phase in which process design often takes place, business area analysis (which is the second phase mainly analyzing a particular business area in search of change alternatives the phase following ISP phase in Information Engineering methodology), is too late for successful process innovation to take place; only the planning phase has the strategic context and high-level management participation for high-level process objectives and attributes to be defined. If it is to happen at all, process innovation should be the focus during the planning phase."

The above studies indicate that the organizational work itself has to be an essential component in information systems planning. The relationship between BPR planning and information systems planning is bidirectional. Determining what part of work and which direction to be redesigned would influence an IT architecture to be attained. At the same time, in deciding how to reengineer or streamline the work, we would have to take into consideration what the current IT infrastructure looks like and how the new IT architecture under consideration would support the streamlined work. Grover et al.[11] describes this relationship as adopt and adapt as depicted in Figure 1.

In order to better understand relationships among components of ISP methodology, we think a new framework for ISP methodologies needs to be established. This framework is believed to reflect two ingredients: analysis and reference.



(source: Grover et al. [93] pp.29)

Figure 1: The relationship between BPR planning and IT planning

In fact, there exist many components to be analyzed over the course of ISP, including enterprises objectives, strategies, organizational structure, people, functions, work, and information technology. These components are not independent, rather interrelated. For instance, work itself has a close relationship with human resource to perform it, organizational structure designed to systematically execute it, and information technology to effectively support its performance. Our study views the component work as an inclusive concept for organizational structure, people, culture, and any other work-related elements. By the same token, the component strategy includes objectives and any other goaloriented elements. So, in our study we view the three essential analysis components covered in ISP methodology as strategy, work, information technology.

Among them the technology component becomes the most important one since an ultimate goal of ISP methodology is a derivation of IT infrastructure plan. There is general agreement in the field that the IT infrastructure constitutes three architectures such as data, application, and technology[35,39].

The other type of ingredients that should be covered in ISP methodology is of reference

models. We may define the reference component as a description of generic solutions, a solution framework, or a framework for past solutions. Over the course of problem solving it can be referred, compared, or anchored. It is generally believed in the area of ISP that working from a reasonably robust architecture and refining it toward meeting unique project characteristics is more effective and speedy than starting from scratch[4,16]. However, this sort of wisdom learned from the field were yet hardly reflected into methodology development. Many existing ISP methodologies are short of these reference models and so cannot make effective use of work already done or best practice[37]. They still have to be the essential ingredient of ISP methodology. Further, we view that the reference model, as in the above analysis ingredient, can be dissected into the three components: strategy, work, and IT.

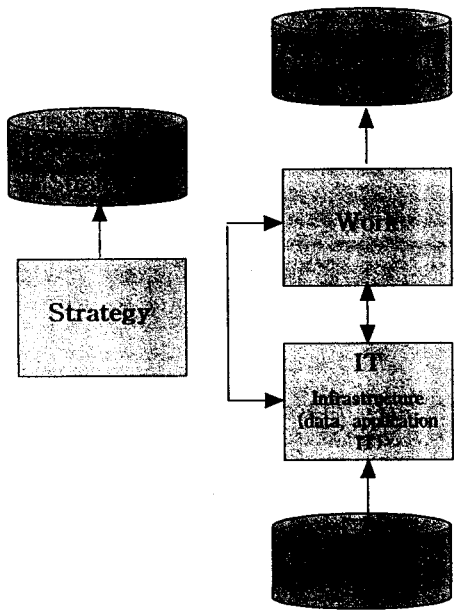


Figure 2: A framework for SP methodology

So, our framework depicted in Figure 2 has three components, each having its corresponding reference element. The three components are interrelated. Reviews of MIS literature stress that an organization ought to design how to work and which technologies to employ in order to attain a given strategic direction. We, however, may find some real examples in which IT itself guided the organizations strategic direction. Though these cases are not rare especially for organizations whose IT level is mature, we viewed this direction as somewhat indirect. So, in our study the component strategy is expected to guide two other components while work and IT are influencing each other.

3. Analysis of ISP Methodologies

In the Section 2 we presented a framework for understanding ISP methodologies. Now we classify existing ISP methodologies based upon this framework and characterize them. Please note that we do not attempt to assess specific methodologies. Our analysis is limited to a comparative evaluation of methodology classes, not methodologies themselves. For the same token, instead of building an extensive list of methodologies for each class we just list most representative methodologies for illustration.

There exist a number of ISP methodologies. Only a few studies attempted to classify them. Dantzig[7,8] used a chronological order as a criterion for classification. And, a four-way classification was made by Tozer[96]. They, however, were incomplete and rather ambiguous since their criteria are not clear-cut and many new approaches were not under consideration.

In our effort to classify the methodologies we were striving to apply a clear anchor. We

thought the coverage of the ISP methodology components can be used as the anchor. To be more specific, which components are mainly covered in a particular ISP methodology was the major concern. Two different types of coverage were taken into account. One is as to whether the component is used to accomplish a given objective, whether or not it is created or modified over the course of ISP is the other. We assumed that by analyzing both whether an element belongs to the system and whether the element is a given artifact or a transmutable artifact within the system we can determine the level of completeness or suitability of the system.

3.1 Data-Model Orientation

The main objective is to identify information requirements of each function of the enterprise and further to derive a data model that would ensure data availability, data accuracy, and integrity when building enterprise-wide integrated systems. IBMs Business Systems Planning (BSP) is a most representative one. In this category, the work component is the main part of its analysis to come up with the IT infrastructure plan. And, this class of methodology does not employ any reference component, instead relying heavily on a great number of interview meetings for managers and users so as to identify their requirements. What to be derived from this analysis is mainly data and application architecture only.

3.2 Strategic Information Systems Planning

The methodology belonging to this category aims, along with a desire to employ IT solutions as a competitive weapon, to identify information systems workable for the enterprises strategic direction. For this, a careful analysis of its external environment, strategic direction, and inherent capabilities normally is performed. Many approaches may be classified into this category. Weismans SIS(strategic information systems) planning methodology and Rockarts CSF(critical success factors) approach are two good examples. While the strategy component is heavily involved in this project, three is no apparent effort to execute a systematical and intensive investigation on the work component. Accordingly, only the application architecture at most is expected from this endeavor.

3.3 Information Engineering Orientation

A derivation of IT most appropriate to their strategic direction and critical business area is the main objective of methodologies belonging to this category. There is general agreement that James Martins Information Engineering (IE) methodology introduced at the beginning of 1990s is one of the first endeavor toward this avenue. After an overwhelming reception of this, many similar ones were developed by IT consulting firms as their own proprietary product. In deriving an appropriate IT infrastructure, an extensive analysis on strategy and work components is made. The IT infrastructure derived from this effort includes an entire set of IT architectures: data, application, and IT. As indicated by Nedzel[28], this type of methodology views the work component as only the entity to be analyzed, not to be modified or re-created. It literally implies that the work(process) redesign if necessary can

take place after ISP. As to this problem, Nedzel thinks it as too late and further provides a suggestion that for successful process innovation it should be done during the ISP phase[28].

3.4 Transformation-Driven Orientation

Given the opportunity that a construction of new IT infrastructure could open new roads for work streamlining, this methodologys prime objective is to derive a blueprint for new IT infrastructure that would support work reengineering as well as the enterprises business and strategic direction. Those categorized into this type include James Martin's Enterprise Engineering(EE)[25], SHLs Transform, another commercially-available methodology[27], and TISP[15]. The underlying theme behind them is an integration of ISP and organizational transformation strategies[35,36]. Mische[27] stresses that the IT architecture must address various business, organizational, and technology issues, including:

- the major strategic imperatives, business drivers, and technology needs of the enterprise
- the technologies, capabilities, and systems that are subject to reengineering in order to support customer service requirements and new business processes
- the business, IT, and global initiatives that other transnational organizations are pursuing.

Such requirements were reflected in transpformation-driven ISP methodologies. For instance, the TISP methodology aims, prior to derivation of a plan for IT infrastructure, to come up with a to-be enterprise model first and then to construct the IT infrastructure plan reflecting this to-be model. In this sort of methodology both the strategy and the work are under an extensive analysis and its outcome is a new IT plan along with a revised enterprise model. This IT plan has to constitute an entire set of architectures.

3.5 Reference-Based Planning

There is general concern in the ISP field that the developed IT infrastructure plan often ends up with just a plan and is neither read nor used for ensuing system development efforts. Though there are many factors causing this problem, one puzzling situation is that organizational, functional, or technology changes occur before action is taken. The methodology designed to overcome this problem relies upon defining a commonly accepted framework around which architecture decisions can be based. DoD(US Department of Defense)s TAFIM(Technical Architecture Framework for Information Management) is a good example [9].

TAFIM is a common framework and profile of standards for the computing and communication infrastructure. With the TAFIM, as shown in Figure 3, both a set of technology architecture

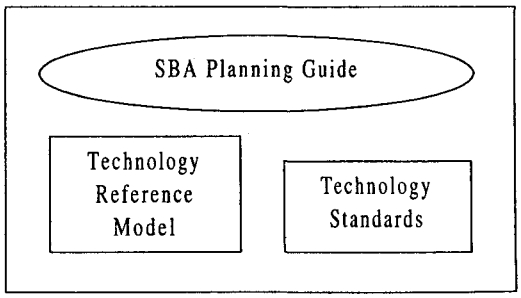


Figure 3: Components of TAFIM

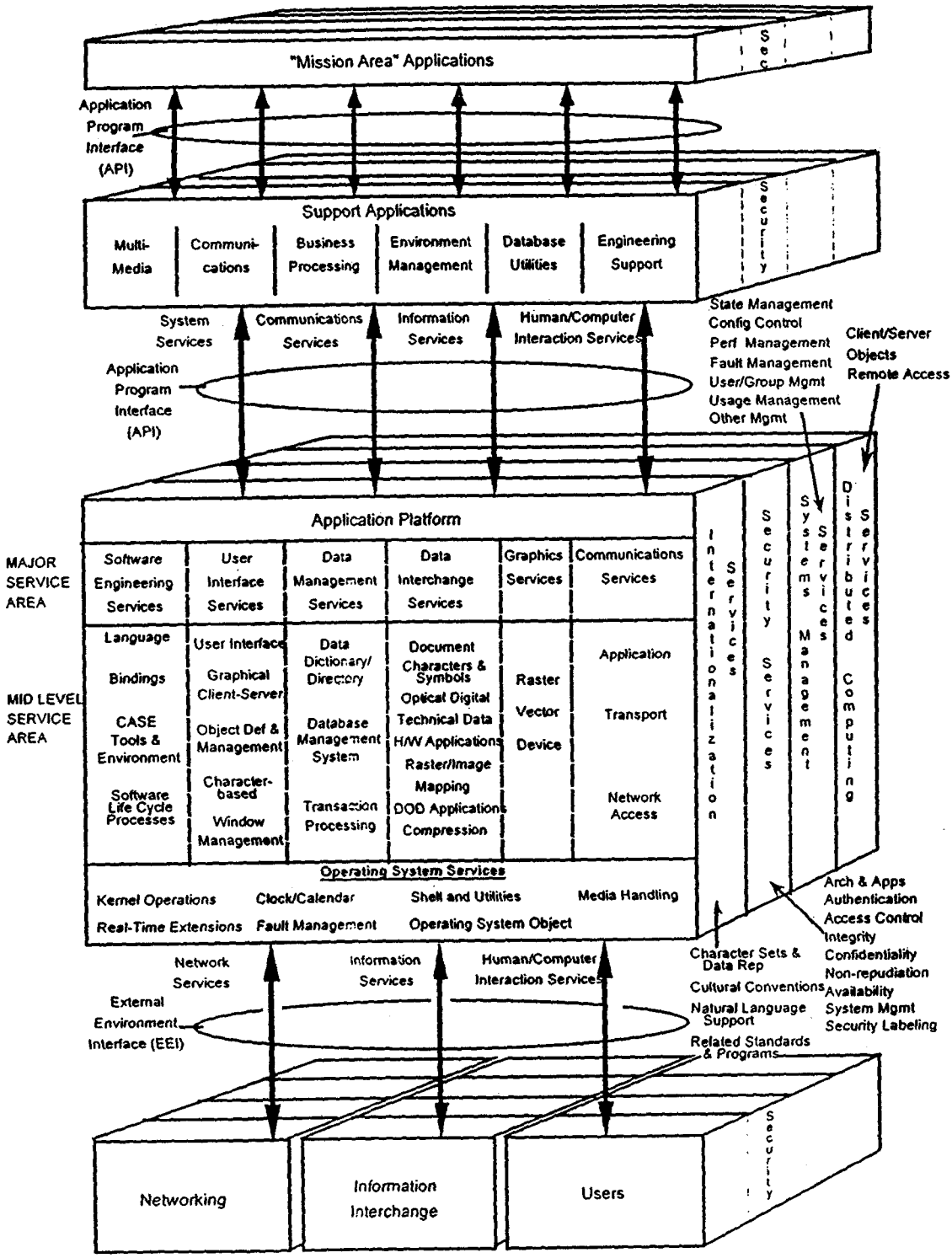


Figure 4: Detailed DoD Technical Reference Model

in terms of technical reference model and technology standards and a planning guide are provided. The technical reference model is to provide a common conceptual framework and to define a common vocabulary so that the diverse components within an organization can better coordinate acquisition, development, and support of the enterprises information systems. Figure 4 shows a detailed DoD Technical Reference Model.

Given the technical reference model, the SBA (Standards-Based Architecture) Planning Guide provides a way of mapping the technology architecture to the three other views of an integrated architecture: work, data or information, and application.

We here provide a brief introduction of the SBA methodology. The SBA planning process consists of seven distinct, but interdependent, phases, each phase being intended to create specific deliverables, as shown in Figure 5.

(1) Initiation & architectural framework: The methodology begins with properly initiating the process and reviews a set of strategic drivers for the organization. And, a set of architecture principles is developed to establish what are believed to be good architecture practices for the organization. Architecture principles are simple, direct statements of how an organization wants to use information technology in the long term for five to ten years. An examplewould be like Where feasible, our organization will use Commercial-Off-The-Shelf(COTS) and Government-

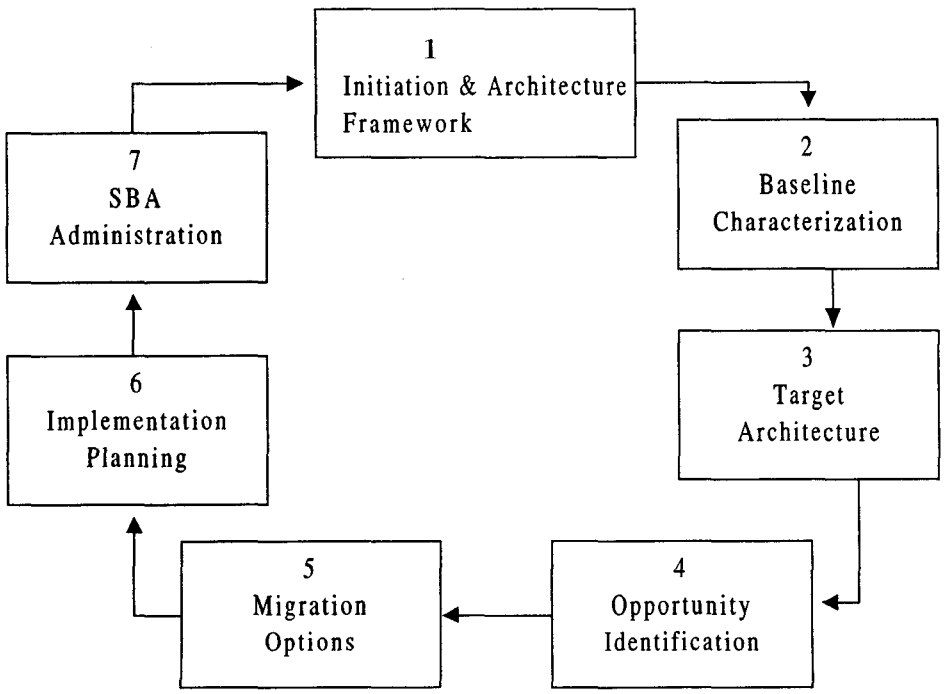


Figure 5: SBA planning process

Off-The-Shelf(GOTS) application components and systems rather than develop them internally.

(2) Baseline characterization: This is to conduct a high-level characterization of existing work organization, information, applications, technology, and standards. This phase results in a picture of the existing architecture over four key dimensions: work, information, applications, and technology.

(3) Target architecture: This process consists of defining each set of architectural components and its key attributes and highlighting the key opportunities for improvement over the baseline. This phase results in the Target Architecture Document in all of the architecture views such as work organization, information, applications, and technology. Reflecting problems of being too general or too product-specific target architectures created in many traditional planning methodologies, we should define the target architecture in such a way that it would remain open and flexible over time as technology, products, and infrastructure evolve.

(4) Opportunity identification: This phase is to identify the projects needed to move the organization from the present to the target architecture. A definition of parameters of change and major activities to be undertaken is its major deliverable.

(5) Migration options: At this phase we are to identify and develop migration options for moving to the new target architecture. This phase results in the Migration Options Document specifying recommendations for the priority of the project initiatives that must be performed to move the enterprise toward the target architecture.

(6) Implementation planning: This phase is to define a detailed implementation plan for the first project initiatives identified as Plateau 1 of the Migration Options Document

(7) SBA administration: This phase defines the procedures, human resources, and communication devices needed to keep the plan current with the organizations mission and priorities.

With a reliance on the technical reference model, one may decouple the technology from the architecture in the context of standards, leaving the outcome of the planing effort more stable. The importance of standardization was described historically[29] and in the domain of enterprise information architecture Cook 96]. Therefore, standards-based architecture planning is considered more beneficial than traditional architecture planning as described in Table 1.

With this sort of methodology, IT infrastructure plan requires an analysis of both strategy and work while the to-be model of work is also derived over the course of ISP. And, more importantly, a reference component of IT is utilized for deriving the new target architecture.

For a clear illustration we summarize results of the above analysis in Table 2. From the above table, it is obvious to see that the reference component is not much used yet by most existing ISP methodologies. Just the IT architecture reference model is being used in the reference-based ISP methodology. In fact, a number of empirical studies on ISP have indicated that a consumption of a large amount

Table 1: Traditional vs. SBA planning

Traditional IT Planning	Standards-Based IT Planning
Long-term vision, long-term payoff	Long-term vision, short-term payoff
Major function-wide data gathering effort	Function fast-path process
Proprietary vendor architecture owned by vendors	Standards-based, open architecture owned by the user
Static document-oriented deliverable	Project-oriented deliverable payoffs
Obsolete when organization or technology changes	Continuously modified on quarterly basis

Table 2: Comparison Result of ISP Methodologies

Component	Class of methodologies		Data-model oriented	SIS planning	IE-oriented	Transformation-driven	Reference-driven
Analysis Component	Strategy			U	U	U	U
	Work		U		U	U/C	U/C
	IT Infra	Data	C		C	C	C
		Application	C	C	C	C	C
		IT			C	C	C
Reference Component	Strategy						
	Work						
	IT Infra	Data					
		Application					
		IT					C/U

Legend: U for use, C for Create

of organizational resource in the undertaking of ISP and therefore taking a long period to complete is the major, serious problem. Under this situation do managers tend to lose patience and interests, frequently driving ISP project to failure[Lederer & Sethi 88,91; Tozer 96]. In order to save ISP projects from this often doomed-to-failure course, the ISP methodology should be tailored in such a way that a variety of reference models can be easily utilized. Introduction of recent technical innovations with a set of ideas for incorporating reference models into ISP methodologies is the subject of next section.

4. Alternative Sources for Refe-Rence Models

We have shown that the reference models in ISP methodology may be a description of generic solutions, a solution framework, or a framework for past solutions. The effective use of reference models was evident in many areas. One noted example is the use of Zachmans framework in developing enterprise information architecture[6,39]. In addition, recent technical innovations were emerged that contains or aims to construct a variety of reference models. We here present some of

them and describe how these reference models would be used as an anchor in ISP methodology.

4.1 MITs Process Library(22,23)

The ultimate objective is to build an on-line database of best-practices with respect to process description. The contents in the database would be used as an anchor against which a process under question can be compared and from which an innovative alternative can be devised. They are now working to come up with a general representation model with which a variety of processes can be generically represented and compared. Once this process library is constructed, we can compare the work under question against best practices in the same domain and can easily derive a streamlined process from the library.

4.2 Industry-Specific Reference Architecture

Some IT service firms presented industry-specific architecture so that a firm can easily identify an appropriate IT architecture by using the industry-specific reference architecture. For instance, IBM has announced that both insurance and retail industry-specific architectures were devised[34]. With these industry-specific reference architecture, one can easily come up with a target architecture appropriate to a given firm.

4.3 Enterprise Integration Work

There have been a few enterprise integration efforts. They aim to support process-oriented modeling of manufacturing enterprises and to provide execution support for operation of enterprise systems based on these models. The most representative work in this avenue is CIMOSA[1].

4.4 ERP Software

New software solutions called ERP(Enterprise Resource Planning) packages have reference models that would be compared against a particular firms data, process, etc. The operational requirements could be compared to the processes realized in the ERP system. SAP, Baan, Oracle ERP belong to this category. For

Table 3: Categories of reference models constructed in other related work

Compone / Relevant work			Process Library	Industry-specific	EI	ERP
Reference Component	Strategy					
	Work		X	X	X	X
	IT Infra	Data		X	X	X
		Application		X	X	X
		IT		X	X	X

instance, SAPs reference model includes function model, process model, information flow model, communication model, organization model, distribution model, and data model [5].

We now describe how these above reference models would be used as an anchor in ISP methodology. The MITs process library work can constitute the reference model for the work component. The other works are believed to be able to provide the reference model with respect to the work and IT Infra components. However, no reference model for the Strategy component exists as far as we know. This is obvious in a sense that each firm must have its unique environment and business opportunities. The table 3 shows the result of the analysis.

5. Requirements of ISP-Supporting Software Aids

The ISP process usually takes a lot of resource and time [Lederer & Sethi 90]. Since the process should need an involvement of senior managers whose time constraints are very severe, the lengthy process often incurs the loss of management patience, a leading cause of the ISP project failure. How to speed the ISP process has been one major issue in the ISP research community.

One obvious avenue toward that end is the use of automated aids or software tools in information systems planning[20,21]. Tozer[37] suggested several important factors dictating the need for automated support as follows:

- the high volume of information involved in the ISP process
- the required completeness in covering the key ingredients within limited time scales
- complexity and variety of documents involved
- the need for rapid re-iteration and re-work
- the need for complete, accurate traceability among ISP objects
- the need to limit the need for continuing high levels of expensive expertise.

Another important factor dictating the need for software aids is the necessity of using reference models in the ISP process. We in the previous section indicated that the utilization of a variety of reference models may be an answer to this often doomed-to-failure ISP project. To more effectively use the reference models, we ought to retain the reference models in the software-readable format and easily retrieve or compare them against the corresponding objects in the organization under the question.

What kinds of functional requirements would be needed for the ISP-supporting software aids? Du Plessis described a method for CASE tool evaluation[10]. Henderson & Cooprider introduced three general dimensions and seven components of CASE technology[13]. The first dimension production is concerned with functionality that directly impacts the capacity of an individual(s) to generate planning and design decisions and subsequent artifacts or products. We also view the coordination dimension as functionality that enables or supports the interaction of multiple agents in the execution of a planning or design task. The last dimension organizational technology is concerned with functionality and associated policy

Table 4: Functional requirements of ISP-supporting software aids

dimension	components	description	Requirements of ISP-supporting aids
Production	Representation	To enable the user to define, describe or change a definition or description of an object, relationship or process	- recording management interviews - recording business plan structures - recording architectural components - representing reference components - management presentations
	Analysis	To enable the user to explore, simulate, or evaluate alternate representations or models of objects, relationships or processes	- analysis of management interviews - analysis of business plan structures - analysis of architectural components - analysis of reference models(gap analysis) - document retrieval and text management
	Transformation	To execute a significant planning or design task, thereby replacing or substituting for a human designer/planner	- constructing a To-Be model based on current requirements and recommended opportunities - deriving an IT architecture based on analyses of IT components
Coordination	Control	To enable the user to plan for and enforce rules, policies or priorities that will govern or restrict the activities of team members during the planning or design process	- define roles of agents at a given stage - project definition and management - acquire approval of deliverables from management - resource capacity planning
	Cooperative	To enable the user to exchange information with others for the purpose of influencing the concept, process or product of the planning/design team	- brainstorming ideas among participants - allow the use of common repositories including reference components
Organizational	Support	To help a user understand and use a planning and design aid effectively	- version management of various deliverables - providing help facilities for easier use
	Infrastructure	To enable portability of skills, knowledge, procedures, or methods across planning or designing processes	- Unify terms concerning planning and reference components - Understanding frameworks/standards concerning reference models

or procedures that determine the environment in which production and coordination technology will be applied to the planning and designing process. We utilize this functional CASE technology model in identifying requirements of ISP-supporting software aids.

Since the ISP process involves many managers or users at a variety of levels and covers the entire set of business functions, the tools designed to support the ISP process

should possess a diverse set of functional requirements as shown in Table 5. In particular, not only the number of objects required to represent during the ISP process but also the number of the inter-object associations which need to be supported can be large. Table 5 shows the classification of these objects which needs to be represented[30,37].

There are two different types of software aids which are supportable for the ISP process. CASE tools such as Cool Stuff are the one type and the other is of application builder tools such as Oracless CASE×Method. A preliminary analysis on these ISP-supporting software aids indicates that none of existing CASE tools or other software aids fully qualify for exclusive use in the ISP process[37,40]. Above all, these currently available tools lack in reference components. At need is the integration of these different tools. In particular, we think the integration of CASE tools with the development workbench tools[5] usually provided by ERP software companies such as SAP will be a promising avenue.

6. Conclusion

We here presented a framework by which ISP methodologies can be classified and analyzed effectively. At the same time we also described some of newly introduced ISP methodologies that are of great worth to IT architecture planners. After our classification of these ISP methodologies classed, it was obvious to see that reference models were not fully utilized in existing ISP methodologies. One way to incorporate a variety of reference models in ISP methodology is to utilize reference models that were constructed and used in other technical innovations. We here introduced some of them briefly. What is needed is to come up with a procedure to incorporate these reference models into ISP methodology.

One natural way of utilizing the reference model in the ISP process is to retain the reference models in the software-readable format and to be able to easily retrieve and compare them against the corresponding objects. Besides, the use of software aids in the ISP process

Table 5: Classification of objects to be represented in ISP-supporting aids

type	Objects to be represented		
Organization/work	- Organization unit - Business functions	- products/service - key performance indicators	- performance measure - person
Goals	- objective - business strategy - critical success factors	- business problems - change alternative	
Project	- project - cost	- resource	
Information architecture	- information required - application system - IT infra - Database		

has been recommended by ISP researchers or practitioners in order to speed the process and effectively handle a large volume of documents and information. In this regard, wehave identified functional requirements of the ISP-supporting software tools and suggested a future direction toward integrating different types of tools.

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