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# 6P. A New System Development Life Cycle Model:

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# **6P. A New System Development Life Cycle Model: Vertical, Integrative and Dynamic**

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## ***Abstract***

Information systems (IS) building, as described in the literature, consist of two main phases: IS strategic planning and IS development. The IS strategic planning phase is performed every few years and produces a long-term strategic plan. The IS development phase is performed annually by IS management and produces a development plan for the next year and outlines development activities. The activities performed in the building process are also called in literature system development life cycle (SDLC). Existing models describe sequential activities with a limited amount of dynamism. We argue that dynamism and iterative development are necessary for business competition. Traditional development models were defined by researchers chronologically before work system theory was formalized, thus appropriate revisions are necessary. We propose a new development model that overcomes the limitations of current SDLC models, and enables better mitigation of IS activities with business management's needs as a focal point.

## ***Keywords***

Software Development Model, Information Technology Strategy, Information Systems Development, Software Development Life Cycle.

## **1. Introduction**

Traditional SDLC describes a sequence of activities aimed at the implementation of an information system. The activities are performed by IS professionals, and the organization considers these activities IS projects. The IS community requires the involvement of other organizational unit experts at several points, but primarily at the beginning phase of defining system requirements and at the end of the project for acceptance testing and assimilation of the system into the organization's processes.

The work system modern approach looks at the development process as an organizational process, incorporating all needed organizational units so that the project succeeds. Software development methodologies developed over recent decades emphasize the iterative and dynamic nature of the process for the sake of order and software quality to improve the quickness and responsiveness of the process to business needs. This has resulted in the development of several models like prototyping and spiral model, new development methods such as agile development, object oriented analysis and design and agile programming, which enable the rapid building of information systems. Current development models consist of two parts, an organizational strategic activity performed once every few years and an IS development part performed on a yearly basis. We claim that organizations cannot survive competition in the long term while waiting on management for end-year strategic organizational decisions. We will describe a development model based on work system theory principles that addresses the above challenges.

We shall use the two terms information technology “IT” and “IS” interchangeably to reflect referenced research. Our research is focused on IT, which includes infrastructure and technologies, such as hardware, system software, and communication. We also use the term IS, which is referred mainly to information systems used for business applications.

## **2. Current information systems strategic planning models**

IT strategy planning is the process of defining IT infrastructures and applications that will be needed by the organization in the coming years. IT strategy formulation may be performed by searching for new technologies that can contribute value in gaining new competitive advantages over the competitors. Researchers view the activity of IT strategy planning as a sequential activity performed chronologically after business strategy planning. Ward and Peppard (2004) describe an IS/IT strategic formulation and planning framework as including five building blocks performed sequentially: business strategy formulation, IT strategy formulation, IT portfolio formulation, project formulation and IT development. Lederer and Sethi (2004) conducted a survey among 251 organizations and found that the four most popular methodologies describe two sequential phases, the strategic planning phase and the development phase.

## **3. Current system development life cycle models**

The software development process refers to the activities, methods, practices, and transformations that are used to develop software. Several methods that define these development phases are described in the literature. The waterfall model is the traditional list of ordered activities producing an IT product. (Paulk et al. 1993). Other methodologies, like prototyping and spiral model, try to reduce the product time-to-market by redefinition of development phases. According to Ahituv and Neumann (1984), the information systems software development cycle (ISDLC) is a formal, logical, and well-defined process that includes a sequence of ordered steps. The development process is generally from top to bottom. ISDLC is described as a flexible and dynamic process rather than a uniform process. Singh (1993) proposed a framework that consists of sequentially performed phases according to the waterfall process. Singh's model describes a gap between the tactical planning phase and the implementation phases.

In conclusion, SDLCs are usually initiated with the requirements for analysis activity after IT strategy formulation has been performed. All development models assume the existence of an IT strategy document. SDLCs are waterfall process models formed from a sequential list of activities. Some models include iterative and dynamic aspects within the well defined ordered process.

## **4. Work system theory**

Steven Alter developed work system theory, which describes a system in which human participants and machines perform work using information, technology, and other resources to produce products and services for internal or external customers (Alter, 2002). An information system in this context consists of processes all involved in information processing. A static view of a work system is represented by the work system framework, which includes nine elements: customers, products and services, processes and activities, participants, information, technology, infrastructure, environment, and strategy. A dynamic

view of how a work system changes over time is represented by the work system life cycle model (WSLC). The WSLC is different from the system development life cycle (SDLC), which is basically a project model rather than a system life cycle. The WSLC treats unplanned changes as part of a work system's natural evolution. The WSLC is an iterative cycle that crosses organizational unit borders. The work system method is more broadly applicable than the techniques used to develop information systems and is designed to be more prescriptive and powerful than other systems analysis methods, such as soft system methodology (Alter, 2006). Typical IS life cycle models emphasize computerized capabilities and de-emphasize business and human realities.

## **5. Limitations of current IS development models**

- Time-discontinuity between IT strategy planning and development activities;  
There is a time discontinuity between IT strategic and information systems development activities. IT development might be initiated long after strategy formulation. During that period, changes in the external environment, technological or business changes might lessen the relevance of the IT strategy. In a survey performed by Lederer and Sethi (2004), only 23% of project plans were started according to plan, and organizations initiated projects that were not part of the IS plan. Top management found the IS planning process slow and costly. According to existing methodologies, organizations will generate a time gap by postponing implementation of architectural changes to a future point in time, often the end of the following budget year, thus preventing future benefits from the new architecture. This reasoning might delay important decisions the organization must make when environmental changes occur, thus generating the described time discontinuity.
- Development process model inflexibility, lack of dynamism and time-to-market irresponsiveness;  
An empirical-based study of the practical use of development methods is described in Kautz, Hansen and Jacobson (2004). Their research supports the idea that there is a move towards using methodologies that include an incremental workflow. They found that rapid changes in the application domain and business environment make it inappropriate to base development on traditional life cycle approaches.
- Rigidity, organizational culture of IT developers that cause rigid development process;  
The influence of organizational culture on the deployment of development model systems was analyzed by Livari and Huisman (2007). The results of their survey show that the deployment of methodologies by IS developers is primarily associated with routine and order, contrasting business managers, who strive for dynamism and flexibility.
- Business competitiveness limitations;  
Business strategy formulation is the outcome of research and study over a future time frame of 10 years or more (Porter, 1996). Here, we describe common models used by firms for the definition of business strategy. PEST is a commonly used model that aids the analysis of surrounding factors of a firm's ability to survive and succeed (Middleton, 2003). SWOT is a model that outlines internal strengths and weaknesses and external opportunities and threats (Ferrell et al. 1998). The theory of dynamic capabilities refers to the ability of a firm to achieve new competitive advantages for improved congruence with the changing business environment (Teece et al. 1997). Organizational culture theory is described by Schein (1988) as a behavioral pattern coping with problems of external adaptation. In conclusion, competitive capabilities are essential for survival in

today's technological world. Methodologies that improve business strategy formulation stress the importance of the identification of external changes. The firm must continually build, adapt, and reconfigure its capabilities in order to compete.

- SDLC activities not consistent with new research;  
SDLCs often start with a requirements analysis. Ahituv and Neumann (1984) used an ISDLC model including nine activities, starting with studying the organization and a requirements study that assumed a previously defined IS strategy. According to Singh (1993), the process begins with organizational strategic planning after portfolio planning, but lacks IT strategy planning. Updated research includes activities not detailed in SDLCs: IS role, IS sourcing, and IS structure (Hirshheim and Sabherval 2001). Researchers view IS strategy as IT architecture planning, IT alignment planning, and IT value planning (DeJarnett et al. 2004), which are lacking in SDLC models.
- Inconsistency with work system theory;  
WSLC is a horizontal integrative process that regards IS as one of several organizational activities acting in harmony, whereas SDLC deals mainly with information systems. WSLC describes an iterative and continuous life cycle, whereas SDLC describes a process including a time gap between organizational and IS development activities.

## **6. Proposed model for information systems development**

Two types of developments, projects and enhancements, are treated identically in our model, according to the one unique process model. The activities in the development process are performed on a time-flexible basis. Each development activity decision is examined for all of its impacts on SDLC activities, from organizational strategy planning, continuing in IT strategy planning, to development and operation. The process is continuous, iterative, and dynamic without time-gaps. Below, we describe the SDLC activities according to the proposed model.

Description of the development process, phases and functions performed for each phase. (see Figure 1).

Description of vertical, iterative and dynamic process and factors that impact on process activities. (see Figure 2).

A list of the influential factors and references for each activity is provided. (see Table 1).

### **6.1 Origination**

Origination of a specific development process may occur at any point in time. Any kind of development can be included, whether it be a project, a minor enhancement, or a bug fix. Any external or internal change may lead to a decision to develop an information system or enhancement. Changes may arise from any source: external competitor initiatives, market changes, internal management strategy decisions, or technological needs.

### **6.2 Organizational strategic planning**

During this phase, the organization studies the external environment and the influences on the organization, defines its future market and products, and tries to find ways to impact competitors or competing industry forces. Business strategy formulation is the outcome of research performed by looking at a future time frame of 10 years or more (Porter, 1996), examining numerous aspects such as macro forces and inner-firm capabilities. We will mention the common methods here. A commonly used analysis model is PEST, which assists in the analysis of surrounding macro factors (Political, Economical, Social, and

Technological) on the ability of a firm to survive and succeed (Middleton, 2003). SWOT model is used to outline internal organizational strengths and weaknesses and external organizational opportunities and threats (Ferrell et al. 1998). The theory of dynamic capabilities refers to the ability of a firm to achieve new competitive advantages to achieve congruence with the changing business environment (Teece et al. 1997). According to organizational culture theory (Schein, 1988), organizations should address external adaptation or internal integration to achieve its strategic goals.

### **6.3 IT strategic planning**

Past efforts have defined three major functions of this phase: first, identifying ways that IT can improve competition; second, defining guidelines for IS roles and sourcing and defining the IS structure; and third, searching for IT activities that contribute value to the business. We shall now describe each activity.

#### *6.3.1 Competitive advantage*

Significant research since the early 1980s has investigated the strategic role of IT and its potential for creating competitive advantages. It is widely accepted that IT can be used for efficiency improvements, differentiation, and channel domination (Sethi and King 1994). Porter defined five forces in a competitive model that facilitate the understanding of competitive forces (new entrants, existing competitors, customers, suppliers, and products). He suggests strategies for competing effectively against those forces and gaining strategic advantages by harnessing IT strategy (Porter, 1980).

#### *6.3.2 IS strategy formulation*

IS strategy is composed of IS role, IS sourcing, and IS structure (Hirshheim and Sabherval 2001). IS role reflects the contribution of IS function to organizational targets and business strategy. IS sourcing is internal and external sources of IS products and services offered to the organization. IS structure refers to the configuration of the IS function. IS configuration refers to IT infrastructure and IS information systems. IT infrastructure includes hardware and software: operating systems, utilities, database management systems, and communication software services. Many researchers (Hirshheim and Sabherval, for example), also note the potential for the development of IS applications that improve business flexibility and provide new capabilities. IT infrastructure components include architecture, processes, and skills. (Duncan, 1995). Duncan developed an infrastructure flexibility model that can measure the flexibility of a specific IT organizational infrastructure in order to improve IT-business alignment. Chung et al. (2003) examined the impact of components of IT infrastructure flexibility on strategic IT-business alignment. ElSawy and Pavlou (2008) state that business capabilities should include three kinds of capabilities: operational, dynamic, and improvisational. Three kinds of architectures enable those capabilities: event-driven architecture, service-oriented architecture (SOA), and self-learning architecture. IT strategy includes the IT infrastructure and configuration defined for the next couple of years, enables the development of new applications, and generates new capabilities through business-aligned applications.

#### *6.3.3 IT value*

IT investment is the largest capital item in most U.S. firms (Tanriverdi and Ruefli, 2004). Information econometrics has tried to measure IT value since 1988 (DeJarnett et al. 2004), and it has expanded the value concept beyond ROI to include measures like strategic match, competitive advantage and strategic IT architecture. The information technology

productivity paradox has generated considerable research interest (Ives, 1994). Paradox proponents claim that investments in IT have not produced significant improvements in industrial productivity. Several studies have shined some light into the dark corners of the paradox (Brynjolfsson, 2003). Much has been written in the debate surrounding the Nicolas Carr article "IT Doesn't Matter" (Carr, 2003). Carr claimed that the evolution of information technology in business follows a pattern similar to that of earlier technologies like railroads and electric power. As they become ubiquitous, they become commodity inputs and they no longer matter. The value chain model (Porter and Millar, 1985) looks at business processes performed in the organization. The model suggests ways to shorten the processes and looks for ways IT can contribute value for the process. Several researchers have attempted to explain the effects of IT on businesses. Some studies identify a positive relationship whereas others do not (Tanriverdi and Ruefli 2004). The term "IT business value" is commonly used to refer to business performance impacts of IT. IT performance impacts include productivity enhancements, profitability improvements, cost reduction, competitive advantage, inventory reduction, and other measures of performance (Melville et al, 2004). The integrative model developed by Melville et al. (2004) describes how phenomena in external and internal parameters shape the relationship between IT and business performance. IT researchers explain performance effects using two major theories (Melville et al, 2004): The economic theory of complementarities (Millgram and Roberts 1995), and the resource-based view (RBV) of the firm (Peteraf and Barney 2003). The theory of complementarities asserts that IT influences firm performance through complementary relationships with other firm capabilities. The theory of RBV originated with Jay Barney (Barney, 1986), who claims that competitive advantage is an outcome of the productive use of resources. Makadok (2001) also claims that RBV approach can create competitive advantages by assembling a firm's resources to create organizational capabilities. In a survey of 110 manufacturing firms performed by Oh and Pinsonneault (2007), the impacts of IT alignment type on firm performance were studied. They compared the RBV and the theory of complementarities approach and measured their IT strategic value on the business. They found that the complementarities approach is a better predictor of the strategic value of IT compared to the RBV approach in cost-related firm strategies. RBV was empirically studied by Santhanam and Hartono (2003), who tested the relationship between IT firm investments and firm performance by comparing the financial performance of firms. They found that IT capabilities impact firm performance, not only in the near future through IT investments but also during subsequent years. Wheeler (2002) used the dynamic capabilities theory for predicting firm's ability to create IT value through the use of digital networks. The knowledge-based view theory, or KBV (Grant, 1996), is an extension of the RBV, considering knowledge as the most strategically important resource of the firm. Since it is so difficult to duplicate and is complex and heterogeneous, it is a major determinant of competitive advantage. Pavlou et al. (2005) argued that existing methods like RBV and the theory of complementarities are difficult to measure and proposed a KBV that measures the historical revenue and cost of IT investments by estimating the amount of knowledge necessary to generate a common unit of output from any business process.

Despite the existence of performance measures, executives remain frustrated with the ability of metrics to assess the IT value of their firms (Tallon and Kraemer 2007). Their frustration comes from a sense that IT firm-level measures, such as sales and financial ratios, do not convey the broad diversity of IT impacts on a firm. Therefore, Tallon and Kraemer (2007) developed a model using executives' perceptions on IT value in their firms. The link between IT and culture was studied by Leidner and Kayworth (2006), who laid the groundwork for a value-based and conflicting issues theory of IT and culture. They found

that values play a common role in determining patterns of IT development and outcome. The diffusion of innovation theory in the IS context help determine implementation success and technology adoption (Moore and Benbasat, 1991). Luftman et al. (1999) reported on a study conducted between 1992-1997 involving 500 US firms and defined a model that describes constructs influencing on IT–business alignment.

In summary, the product of the strategic IT planning phase is the formulation of IT strategy and includes issues that concern competitive advantages through IT role, IT sourcing, IT structure and IT value.

#### **6.4 Portfolio tactical planning**

On an annual basis, management usually begins a decision-making process targeted at generating an annual plan of IT projects that defines the portfolio of projects that will be developed in the upcoming 3-5 years (McFarlan, 1989). The plan includes the budget and resources needed for the implementation of IT projects. Each year, management decides the specific IT projects that will be implemented. Management tries to prioritize projects according to their value to the business under a given budget and with given IT resources. IT – business alignment is defined according to how IT is aligned with the business and how the business is aligned with IT (Luftman, 2000). Nevertheless, according to Luftman and Kempaiah (2007), there is no “silver bullet” to fulfill these requirements, and achieving IT-business alignment was one of the top ten IT management issues from 1980 to 1994. Reich and Benbasat (2000) defined alignment types and found that both short- and long-term factors influence IT-business alignment. Strategic IT-business alignment is also affected by knowledge-based factors (Kearns and Sabherwal 2006-7). They developed a comprehensive model that describes how two contextual factors affect IT-business strategic alignment through effects on top management knowledge of IT. Management business/IT participation in IT/business planning processes positively impacts strategic alignment and IT project planning, which improve business value. Piccoli and Ives (2005) reviewed abstracts of 648 articles from IT literature and categorized 117 articles relevant to the issue of competitive advantage gained by IT. They developed an integrative model that summarizes the determinants of competitive advantage rooted in information systems. Lederer and Hannu, (1996) studied the impact of including SIS (Strategic information systems) in IT-portfolio. They found that SIS's enable an organization to harness IT for better competition and to gain new strategic capabilities. Sabherwal and Chan (2001) defined three theoretical IS strategy profiles that correspond to the three business strategies classified by Miles and Snow (1978): defender, analyzer, and prospector. They surveyed 226 companies for evidence of the best alignment between business strategies and IS strategy. They found associations between business strategy types and IS strategies. In 1992, DeLone and McLean developed the Model of IS Success, and updated it in 2003 (DeLone and McLean 2003). According to the model, information and IS impact IS use and the benefits gained by the firm.

Task-technology fit theory (TTF) holds that IT is more likely to have a positive impact on individual performance and be used if the IT capabilities match the tasks that the user performs (Goodhue and Thompson 1995). According to TTF theory, a high fit indicates a positive effect on individual performance and system utilization. Organizational decisions that concern IT portfolio selection in a manufacturing environment are described by Kathuria, Anandarajan, and Igarria (1999) as a decision that accounts for the relative importance of competitive priorities and the process structure of the specific organization. Mcfarlan (1989) published the strategic grid analysis, which enables an evaluation of



organizational versus IT applications in a 2-dimensional matrix, wherein the vertical is the present strategic status and the horizontal is the future planned strategic status. Peters (1994) also studied the issue of portfolio selection and published the IT investment mapping model, which maps IT investments on a two-scale matrix, wherein the horizontal is the organizational benefits and the vertical is investment orientation. The model enables a comparison of business benefits versus IT investments.

To summarize, the portfolio tactical planning phase results in IT projects and information systems applications that include issues that concern IT/IS alignment, projects, resources, and schedule.

## **6.5 IT Project planning**

According to portfolio project planning, projects are planned for the near future. For each project, a decision is made on time schedule, resources, and information systems functionality. All of the above decisions take into account budget, IT strategy, and management guidelines. Throughout the year, organizations usually manage two kinds of activities: first is IT governance, which is the process of exerting tight control over ongoing IT portfolio projects and second is the maintenance of IT information technologies. Mooney, Gurbaxani, and Kraemer (1996) developed a conceptual framework of the business value of IT on a process-oriented basis, which links IT and firm performance. Because of the failure of productivity measures to find evidence to capture productivity gains from IT, there are researchers who focus on process-oriented research (Banker, Kauffman, and Mahmood, 1993). Kraemer et al. (1994) describe a set of measures that have been successfully applied in a multi-firm study of IT business value. Jiang et al. (2001) found after performing a 500-project survey that IS planning maturity is linked positively to project success and to project manager performance.

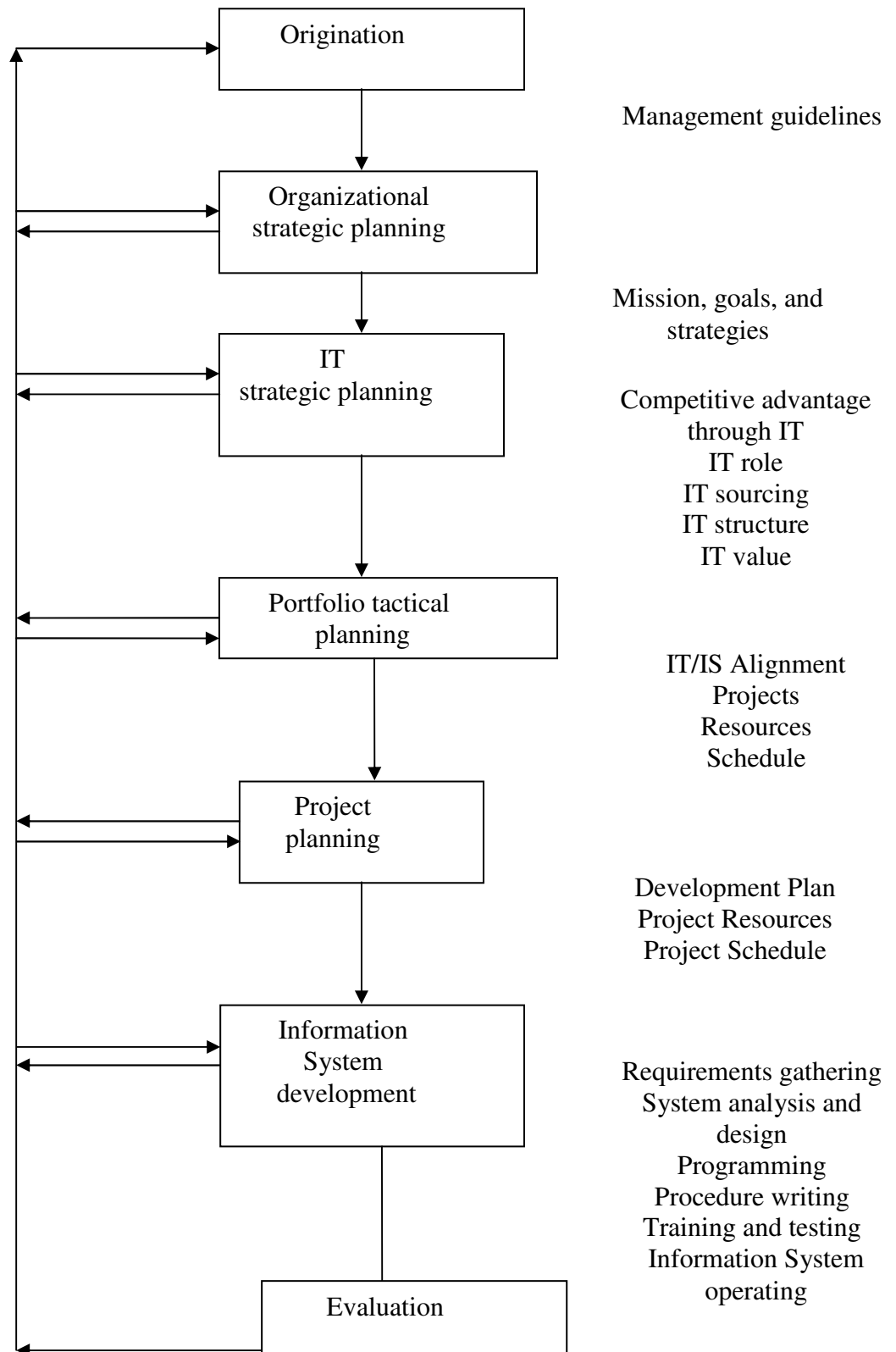
In conclusion, the product of the project plan includes the formulation of IT projects and information system applications, including issues concerning information system functionality, project plan, schedule, and resources.

## **6.6 IT development**

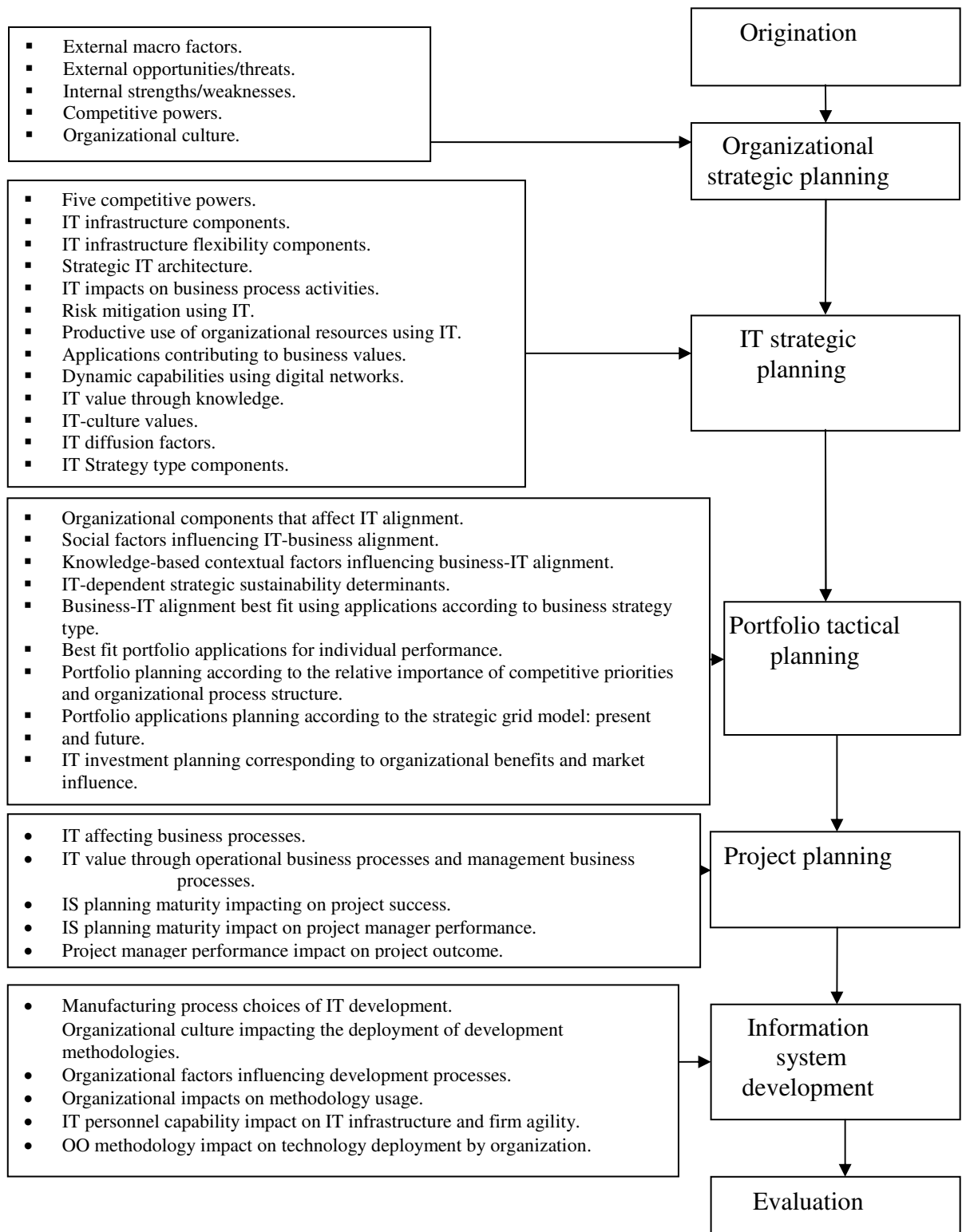
The IT development phase follows the project planning phase, which includes budget and schedule. IT development starts with requirements gathering; continues with system analysis, design, programming, and testing; and produces an information system operating within the organization. Development methods use software and design tools like object-oriented and component based models (Lerman, 2002), agile development (Cockburn, 2001) and extreme programming (Beck, 1999). Use of 4GL languages and case tools aimed at shortening software design and build times. According to Jacobson (1999), OO development method follows an iterative and incremental lifecycle. Researchers studied development method's impacts on the business. The product-process matrix developed by Hayes and Wheelwright (1984) is a basic framework for understanding the links between strategic competitive advantages and manufacturing product and process choices. The model has been validated in several manufacturing, service and IS operations. Sircar et al. (2001) studied the organizational impacts of OO technology implementation on organizations. They found out that the analysis and design levels cause an organizational revolution with major organizational changes. IS deployment models were studied by Livari and Huisman (2007) who found that success is influenced by organizational culture and by Slaugther (2006) who analyzed internet software development projects and identified influencing theoretical

constructs. Fink and Neumann (2007) studied the types of IT personnel capabilities that impact IT infrastructure capabilities: business, behavioral, and technical. Only behavioral and technical capabilities were found to positively impact IT infrastructure capabilities. IT infrastructure impacts a firm's agility through information agility and IT system agility.

In conclusion, IT development methods have varying impacts on IT-business alignment and on business competitiveness.



**Figure 1:** VID-SDLC: Vertical Integrative Dynamic System Development Life Cycle Model



**Figure 2:** VID-SDLC model phases and factors model impacts on each decision phase

<b>Phase in development process</b>	<b>Method / Reference</b>	<b>Factors that influence the product of this phase</b>
Organizational strategic planning	PEST. (Middleton, 2003)	External macro factors: political, economical, social, and technological.
	SWOT. (Ferrell et al. 1998)	External opportunities/threats, internal strengths/weaknesses.
	The dynamic capabilities theory. (Teece et al. 1997)	The ability to integrate, build and reconfigure internal and external competencies to address rapidly-changing environments.
	Organizational culture theory. (Schein, 1988)	Organizational culture type, strength, and culture congruence.
Information technology strategic planning	Theory of competitive strategy: 5 forces model. (Porter, 1980)	Bargaining power of customers and suppliers, threats of new entrants and substitute products.
	IT-business alignment model – infrastructure components. (Luftman et al. 1999)	Business type components, organizational infrastructure, and process type components.
	IT infrastructure flexibility. (Duncan, 1995)	Flexibility qualities: compatibility, connectivity, and modularity.
	IT infrastructure flexibility. (Chung et al. 2003)	IT infrastructure flexibility components impacts on IT-business alignment.
	IT infrastructure flexibility. (ElSawy and Pavlou 2008)	Three kinds of capabilities: operational, dynamic, and improvisational.
	IT value as perceived by CIOs. (DeJarnett et al. 2004)	IT value perception.
	Sense-making theory. Executives' perceptions of IT business value. (Tallon and Kraemer 2007)	IT value perception by CEO and CIO.
	Risk/return. (Tanriverdi and Ruefli 2004)	IT value: contribution to business processes and activities.
	IT business value: An integrative model. (Melville et al, 2004)	Influence on business performance.
	The Theory of RBV.	Competitive advantage and firm

	(Barney, 1986)	sustainability.
	Resource-based view. (Makadok, 2001)	Firm-specific capabilities embedded in business processes.
	IT strategic value assessment using RBV. (Oh and Pinsonneault 2007)	IT strategy assessed by the amount of usage of actual applications.
	RBV. IT investments impacts on firm performance. (Santhanam and Hartono 2003).	Profit ratios.
	Dynamic capabilities theory in digital networked firms. (Wheeler, 2002)	IT value generation through the use of digital networks.
	Knowledge-based view theory. KBV. (Grant, 1996)	IT value through knowledge.
	IT's contribution to the business value chain. (Porter and Millar 1985)	IT value through the value chain.
	ROIT – Return on investment on IT using KBV. (Pavlou et al. 2005)	IT value through the usage of information in business process.
	A theory of IT culture conflict. Culture impact values and conflicts on IT development and outcomes. (Leidner and Kayworth 2006)	Culture, as characterized by taxonomy of more than 40 cultural values.
	Diffusion of innovation theory. (Moore and Benbasat 1991)	Compatibility of technology, complexity, and relative advantage.
	IT alignment model – infrastructure components. (Luftman et al. 1999)	IT strategy type components.
Portfolio tactical planning		
	IT-business alignment maturity level. (Luftman and	Organizational components that affect IT-business alignment.

	Kempaiah 2007) (Luftman, 2000)	
	Social factors that influence IT-business alignment. (Reich and Benbasat 2000).	Factors that influence alignment.
	Knowledge-based factors that influence IT-business alignment. (Kearns and Sabherwal 2006-7)	A model that describes how two contextual factors affect IT-business strategic alignment.
	Competitive advantage: IT-dependent strategic initiatives and competitive sustainability determinants. (Piccoli and Ives 2005)	Determinants of competitive sustainability.
	Strategic information systems – SIS. (Lederer and Hannu 1996).	IT potential capabilities by using SISs.
	IS strategy profile for best IT-business alignment. (Sabherwal and Chan 2001)	IT-business alignment impacts on firm performance.
	IS Success model theory (DeLone and McLean 2003)	An information system is evaluated in terms of information, system, and service quality.
	Task-technology fit theory. (Googhue, 1995)	Task-technology fit theory impacts.
	IT portfolio selection framework. (Kathuria and Anandarajan and Igarria 1999)	Relative importance of competitive priorities and the process structure.
	Strategic grid model. Mcfarlan (1989)	Evaluation of organizational versus IT applications.
	IT investment mapping model. Peters (1994)	IT investments on organizational benefits and market influence.
IT project planning	Process oriented framework of IT business value effects.	IT value through its impacts on a process-oriented basis.

	(Mooney et al. 1996)	
	IT business values. (Kraemer et al. 1994)	IT value through operational business processes.
	IS planning framework. (Jiang et al. 2001)	IS planning maturity.
IT development	Product-process choices matrix. (Hayes and Wheelwright 1984)	Manufacturing process choices of IT development.
	Organizational culture impacts development. (Livari and Huisman 2007)	Organizational culture values impact on deployment development methodologies.
	ISDLC activities. Ahituv and Neumann (1984)	Factors that influence the development process.
	Aligning software processes with strategy. Slaughter (2006)	Organizational factors that impact the development process of internet applications.
	Organizational impacts on development methodologies usage. (Kautz, Hansen and Jacobson 2004)	Organizational impacts on methodology usage.
	IT personnel impacts on firms' strategic agility through IT infrastructure agility. (Fink and Neumann 2007)	IT personnel capabilities impacts on IT infrastructure and firm agility.
	Object oriented methodology. (Sircar et al. 2001)	OO methodology impacts on technology deployment.

**Table 1:** Parameters that influence development process phases, with references

## 7. Advantages of the model

- A whole-organizational model;  
This model is based on work system theory, which regards IS development as one of several organizational activities that act in union, whereas SDLC deals primarily with information systems issues. Information development projects are not treated as isolated

activities of IT professionals, but as an organizational effort that consumes people and resources from throughout the organization.

- An iterative and dynamic process model;  
WSLC describes an iterative and continuous life cycle, whereas SDLC describes a process based on horizontal activities performed in sequential order, although some dimensions of each activity may be performed iteratively. The WSLC process is continuous, iterative, and dynamic, with no time gaps or organizational limitations during shifts from one development activity to the next. Dynamism is needed in the current technological and economical competitive environment.
- Inclusiveness for projects and enhancements;  
Our model treats two kinds of developments: new development projects and enhancements according to a unique process model that includes identical activities. The activities in the development process are performed on a time-flexible basis. It is not necessary to wait for the end of the year to make decisions for new projects or new enhancements or to wait for IT strategy formulation every couple of years. Each development activity decision is examined for all its impacts along the SDLC activities, from organizational strategy planning to development and operation.
- No time-discontinuity between IT strategy planning and development activities;  
IS development models are described in the literature as a process that consists of two main phases: strategic planning and IS development. The IT strategic planning phase is performed every 3-5 years by the management and produces a long-term strategic plan for the next 5-10 years. The second phase is IT development, which is performed annually by IT management, and produces a development plan for the following year. The model overcomes limitations of current IT life cycle development models and is particularly applicable to modern turbulent business environments when short time-to-market is critical.
- A detailed model that includes activities performed for each phase and the effects of parameters on decisions;  
The model describes activities performed in each phase and the parameters that influence decisions made by project managers. SDLC does not include activities, such as strategic decisions taken for IS role, IS structure, IT architecture, and IT-business alignment. Our model has a list of parameters that affect each activity as found in updated literature. For example, the parameters that impact the portfolio tactical planning phase include organizational components, social factors, and knowledge-based contextual factors.

## 8. Conclusions

We propose a new software development model called “VID-SDLC,” or “vertical integrative dynamic system development life cycle”. The model overcomes the limitations of current IT life cycle development models, and it is particularly useful in current turbulent business environments. Information systems (IS) development models are described in the literature as processes that consist of two main phases: strategic planning and IS development. In this study, we have described the development process model as one integrative model that includes no gaps between strategy formulation and the IT development process, but rather as one that is performed continuously as an iterative and dynamic process. Information systems development cannot be treated as an SDLC process isolated from other organization units, but instead should be treated as an entire organizational process that incorporates all organizational resources. This view is consistent with work systems theory. We have described the phases of the proposed development process, the activities performed in each



phase according to relevant literature, and activities that are not part of existing SDLCs. We have also described the parameter effects on each of the decisions made during development.

We claim that the VID-SDLC model contributes to an updated view of the organizational requirements of IT departments in the modern business environment and enables organizations to achieve their targets through the improved utilization of information technology.

We propose a model and outline new phases and parameters impacting on each one of IT activity. Researchers should search for achieving a thorough understanding of business-IT interrelationships during all SDLC activities. A good understanding might rise from an analysis of many other environmental and business-internal factors not studied in this research, impacting on each IT activity. Researchers should look for a characterization of the situations and parameters in which a business should conduct dynamic changes in his development activities, compared to regular situations in which a business should continue implementing his strategic plans. .

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