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A Framework for Business IT Alignment in Turbulent Environments

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Abstract

The paper proposes a framework for business IT alignment that merges traditional IT assessment parameters, such as application portfolio coverage and integration, with technological and architectural parameters providing flexibility to the System. The framework proves to be a practical decisional instrument, overcoming theoretical approaches which lack applicability to decision processes, and is useful in turbulent environments, where business needs may vary quickly and the adaptation capability of the Information System's is a crucial competitive benefit.

Keywords: Business IT alignment, process alignment, flexibility, uncertainty, application portfolio management.

Introduction

Business IT alignment has been widely analysed by researchers and practitioners over the last 20 years and a number of studies have been published. Despite the richness in literature, following are some of the reasons why this topic still deserves attention:

(i) Despite the apparent importance of aligning business and IT, the majority of the publications remain rather vague in terms of how to define and measure the alignment (Maes et al., 2000).
(ii) With the exception of few studies, most analyses focus on the alignment from a strategic perspective, addressing the process of guaranteeing business strategy and IT strategy, matching, but lacking, instruments and practical approaches to implement the alignment in companies (Cataldo et al., 2012; Chan and Reich, 2007; Cragg and Tagliavini, 2006).
(iii) Despite addressing turbulence and flexibility, researches mostly analyse the relationship between the flexibility of Information Systems and the company's performances, in order to prove the positive correlation (Power and Reid, 2005; Taskin and Verville, 2010), but they do not embed flexibility, as a design parameter, into the alignment models.

This paper gives a contribution, to the field of research, through the proposal of a new framework which can be adopted by organizations to better assist the achievement of business objectives and design ICT support to business processes, taking into account the turbulence of current competitive environments and the consequent need of flexibility.

The paper is organized as follows: Section 2 presents an alignment models' review present in literature in order to highlight the importance of focusing on the alignment's process perspective ; Section 3 introduces a new framework for alignment, based on the process perspective, and analyses the main components of the framework; Section 4 proposes considerations derived from the application of the framework to assess the alignment of a set of companies in Italy; Section 5 illustrates the result of the application of the framework to a case study, an SME operating in Italy which adopted the framework to identify the target Information System configuration better supporting its business; Section 6 comments the results of the study and proposes some issues for future research.

Literature Review on Business IT Alignment

The complexity of the business IT alignment problem is reflected in the abundance of literature. Over the years several models have been proposed,

addressing specific aspects of the alignment. The models can therefore be analyzed and classified according to different perspectives (Orlikowski, 1996).

Cataldo et al. (Cataldo et al. 2012) classify models into two categories according to the scope of the alignment: strategic alignment and operational, or process, alignment.

Strategic alignment is the degree to which a company's mission, goals, and business plans are shared and supported by IT strategy (Chan and Reich, 2007). According to Broadbent and Weill (Broadbent & Weill, 1993), strategic business IT alignment represents the extent to which business strategies are enabled, supported, and stimulated by information strategies. Nadler and Tushman (Nadler and Tushman, 1983; Gerow, 2013) define business strategic alignment as the degree to which the IT department and business needs, demands, goals, objectives, and structures are consistent with each other. All definitions share a common vision of the alignment as the result of the consistency of several domains: strategy, organization, processes, ICT resources.

Operational alignment focuses on the functional side of the Information System, considering alignment as the fit between company's business processes and the functionalities provided by the System. In process-oriented studies, the application component of the Information System, i.e. the application portfolio, is usually considered.

Table 1. *Classification of Models for Business IT Alignment*[1]

Strategic alignment	**Operational alignment**
MIT90, Scott Morton (1991) Henderson and Venkatraman (1992) Baets (1992) Smaczny (2001) McDonad (1991) Ward and Peppard (2007) Maes (1999) Luftman (1996, 2007)	Cragg et al. (2007) Levy and Powell (2005)

A Non-Exhaustive List of Models

The MIT90 model, proposed at MIT by Scott Morton (Scott Morton, 1991) describes the alignment between strategy and ICT through the harmony of some key elements (Chan and Reich, 2007): strategy, structure, technology, individual roles, and management processes. The model also explores the relationship between internal factors and three external factors: society, economy, and external environment of science and technology development.

Developed on the MIT90 model, the Strategic Alignment Model (SAM) proposed by Henderson and Venkatraman (Henderson and Venkatraman, 1992) investigates four key domains of alignment: business strategy, IT

[1]Scientific and business literature on business IT alignment is extremely wide, therefore the list of models analysed in the paper is not exhaustive. Publications were selected in order to show main research trends in alignment and highlight gaps.

strategy, IS infrastructure and processes, organizational infrastructure and processes. The authors classify the domains into external (business strategy and IT strategy) and internal (IS infrastructure and processes, organizational infrastructure and processes), and in business (business strategy and organizational infrastructure and processes) and IT (IT strategy and IS infrastructure and processes) and analyses several alignment combinations. They conclude that strategic alignment is achieved when strategic and internal domains are aligned, while functional integration is achieved when there is fit between business and IT.

Despite the clear vision and the identification of the relevant alignment domains, some researchers argue that SAM is too broad and lacks the capability to provide practical tools to help managers take decisions (Avison et al., 2004), especially in companies where there is no structured decisional process or strategic process. Baets (Baets, 1992) recognized that in many organizations there is no explicit strategy formulation process, or it is not shared with all managers, and proposes to consider the alignment as a process involving four activities: business strategy, organizational infrastructure and process, Information Systems infrastructure and process, and ICT strategy.

Several researchers attempted to extend SAM in order to enhance the applicability to companies.

McDonald (McDonald, 1991) introduced the relationship of the organization with external actors, customers and suppliers into the model, and details the various cycles needed to obtain the alignment.

Goedvolk et al. (Goedvolk et al., 1997) focused on technical and architectural requirements, moving towards an interpretation of the alignment more oriented to the design of the target ICT configuration.

Luftman (Luftman, 1996, 2007) tried to transform the model into a management tool through the introduction of governing alignment perspectives (the communication between business and technology management levels) and identifying enablers and inhibitors to alignment.

Maes (Maes, 1999; Maes et al. 2000) developed a unified framework that integrates additional functional layers that reflect the need for information and communication within the organization.

The thesis of the inapplicability of strategic approaches was supported by several authors (Cataldo et al., 2012; Avison et al., 2004, Levy et al., 2007) who concluded that an alignment process approach proved to be more effective than a strategic one.

Cragg et all (Cragg et al., 2007) proposed a methodology to align IT infrastructure and processes based on a processes standard classification , PCF (Process Classification Framework), defined by APQC (American Productivity and Quality Centre's International Benchmarking Clearinghouse, 2005). The authors used moderation to evaluate the alignment and then compared it with IT success. They found a significant correlation between process alignment and IT success.

Levy and Powell (Levy and Powell, 2005) proposed a model based on customer relationships and business focus (namely the "focus dominance").

Four types of business focuses are considered: efficiency, coordination, partnership and repositioning. Companies were therefore classified according to the business focus and the number of customers. The authors then suggested how to seek alignment for each type of company highlighting the configuration that better provided efficiency and effectiveness.

Considerations on Alignment Models

The value of strategic approaches to alignment lays in the capability to identify and analyse all the relevant alignment domains. This broadens the vision of decision makers and unfolds the opportunity of using ICT to support and to innovate the way of doing business.

However, strategic approaches lack the capability to be transformed into operational tools, and only a limited number of companies that have structured strategic and IT decisional processes can apply them fruitfully (Cataldo et al., 2012; Avison et al., 2004; Cragg et al., 2007).

On the other hand, operational approaches prove to be more practicable. They are based on a process view of organizations whose support by ICT is more suitably assessed, measured and improved. The idea of a process to reach alignment is consistent with the natural evolution of companies and the environment they compete in, and the necessity to continuously revise ICT choices. However within these approaches there is a tendency to identify the activities or methodologies to reach a certain degree of alignment, rather than defining the target state (Jarvenpaa and Ives, 1993; Thompson and Iacovou 1993).

Furthermore, alignment models address, in a limited way, the need of flexibility to cope with uncertainty as a design parameter for the Information System. Environmental uncertainty, or the degree of change and instability in a company's operating context, has an impact on performances, according to Tallon and Pinsonneault (Tallon and Pinsonneault, 2011). In times of high environmental uncertainty, organizations have a stronger need for information and flexible information systems. The uncertainty that companies have to face may come from several origins. Volberda (Volberda, 1999) and Sopelana et al. (Sopelana et al., 2012) identify three main sources of turbulence in organizations: dynamism, which is related to the frequency and intensity of changes in competition; technology and other environmental factors, complexity, which is related to the number, variability, and interconnectedness of environmental factors that cause change; predictability, which depends on the availability of data, its clarity and managers' awareness of it. Even though these analyses originated in organizational studies, they can be applied to investigate the relationship between turbulence and ICT, as part of company's technology.

Under the flexibility perspective, process-oriented alignment models seem to better address the vision of companies as organizations which constantly adapt to changes and contingences coming from external environment and internal pressures. IT is seen as a set of resources to be deployed according to

business needs that are deemed to change over time (Thompson and Iacovou, 1993).

Framework for Alignment

The proposed framework for business IT alignment intends to overcome, in several respects, some of the limitations of models developed by scholars and highlighted in the previous section.

The framework is the result of a quantitative and qualitative research that involved 48 case study analyses on Italian manufacturing SMEs over the period 2006 – 2010. Each company was subject to a structured questionnaire and an interview to collect data on several aspects: competitive position of the company, organization structure, supply chain and sales network, turnover and evolution of the market in recent years, application portfolio and IT architecture and their evolution in recent years, processes and performance measures, IT decision process and budget formulation.

Results of the analyses were presented to the interviewed to verify the quality of the indications suggested by the framework. The framework was therefore tested and applied to 8 companies that were starting a process of renovation of their Information Systems. One case study is discussed at the end of the paper.

The following principles have been adopted in the framework's design:

a) The framework focuses on process alignment, through the assessment of parameters that are easily collectable and measurable.
b) While the majority of previous research considers the whole Information System, the framework adopts a more granular approach centring on the application portfolio (Farrel, 2003; Chan and Reich, 2007; Taskin and Varville, 2010). An Information System strategy that enhances company's business value should be application based, according to Ward and Peppard (Ward and Peppard, 2007).
c) The framework leverages on existing approaches to collect business needs and aims at the definition of the target application portfolio. The approach is straightforward, easily applicable by companies to identify appropriate configuration of application portfolio regardless of the presence of structured IT decision processes.
d) Clearly identifies flexibility as a design parameter (Sopelana et al., 2012, Taskin, 2010) to define the target application portfolio.

The framework is based on two domains of analysis:

- Assessment of Business Needs, present and future.
- Assessment of the capacity of Information System to support business needs and guarantee flexibility, through an Information System Maturity Model.

Results of the two assessments show alignment gaps and provide indication on how to identify the target application portfolio.

Identification of Business Needs

Business needs are derived from the assumptions on the role of the Information System in a company. IS should: (i) automate information-based processes and enhance management efficiency, by providing completed and integrated information for decisional purposes (Hirschheim and Klein, 1989); (ii) improve competitive advantage through the opportunity to reorganize and renovate the way of doing business (Taskin, 2010; Ward and Peppard, 2007); (iii) be adaptable to support new business needs, caused by changes in internal processes, as well as being necessary to face external pressures (Duncan 1995; Kamoun, 2013).

Business needs associated with automation, and decision support can be formalized through the assessment of three types of company's complexity: product, process, and organizational complexity (Table 2). This formulation of complexity extends the information intensity matrix originally proposed by Porter and Miller (Porter and Miller, 1985), introducing the role of the organization, in terms of needs, to support interoperability among different partners in the networked enterprise.

A product or service is complex according to the quantity and heterogeneity of information necessary to describe and manage it during its lifecycle, from design to post-sale, in a company. Drivers of product complexity comprise: number and variability of finished product, bill of material, number of technologies embedded in the product, number rules and constraints related to the combination of components within the product. The need of more sophisticated applications to manage complex products is related not only to the necessity to store higher volumes of data, but mostly to the need of elaborating, transforming, sharing complex data with different actors, inside and outside the company.

Process complexity is related to the articulation of phases necessary to realize a product. Drivers of process complexity are: number of processes managed, number of phases, heterogeneity of phases, number of workers involved in each phase, combination of different process management strategies (e.g. Make to Stock to Design to Order). The higher the process complexity the more sophisticated the application portfolio should be in terms of completeness of functionalities and capacity to support different processes.

Organization complexity denotes the need to support diverse information flows through a network of actors, which may change during the life of the company. Drivers of organization complexity comprise: number of business units and plans, number of target markets, suppliers, third parties, and number of clients, heterogeneity of the actors in terms of technology evolution, nationalities, capacity to manage information, structure of supply chain. Complex organizations need an application portfolio capable of adapting to different interfaces, supporting diverse communication channels and data exchange formats.

Table 2. *Complexity Indicators*

Complexity types	Drivers
Product complexity	• Number and variability of finished product • Complexity of the Bill of Material • Number of technologies embedded in the product • Number of rules and constraints related to the combination of components within the product
Process complexity	• Number of phases • Number of actors involved in the phases • Heterogeneity of phases • Combination of different process management strategies
Organization complexity	• Number of business units and plans • Number of target markets • Number of suppliers, third parties, and clients • Heterogeneity of actors (dimension, technology evolution, nationalities, IT experience, structure of supply chain)

Business needs associated with company's necessity to face changes and unexpected events can be summarized using the notion of uncertainty. Uncertainty may arise both from inside the company as well as being an external environment condition. All dimensions of complexity can be affected by uncertainty. The following indicators can be identified and assessed exploiting Volberda's analysis on the sources of uncertainty, (Table 3):

- Variability, which derives from the frequency and intensity of corporate changes (product, process, organization) and of changes in competitive environment (e.g. variability of competitive position, variability of sales).
- Intricacy, which derives from the number, and interconnectedness between company's business and factors that cause change (product or process dependence on technology, competition in regulated markets such as Food and Beverage, Pharmaceutical Intricacy).
- Knowledge, awareness and quality of data, which derive from the availability and clarity of data to make affordable predictions and take effective decisions.

Variability and intricacy increase uncertainty, while knowledge, awareness and quality of data improve company's capacity to face uncertainty.

Table 3. *Uncertainty Indicators*

Uncertainty indicators	**Drivers**
Variability	Frequency of corporate changes in organization (product, process, organization) Frequency of changes in competitive environment Intensity of internal changes Intensity of environment changes
Intricacy	Number of causes of change Dependency on un-controllable causes of change (e.g. technology, regulation)
Knowledge, awareness and quality of data	Historical datasets Market forecasts Capacity to influence and determine intricacy parameters

Information System Maturity Model

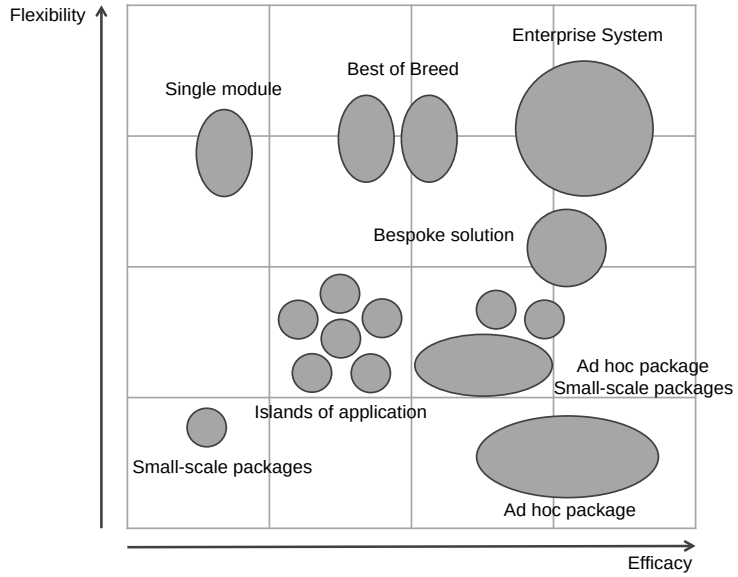
The evolution of the company's Information System in terms of its capability to match business objectives and readiness to evolve can be measured according to two dimensions:

- The efficacy, which measures the integrated support provided by the application portfolio to business processes in an integrated way. The higher the number of processes supported by applications and their integration, the higher the efficacy of the Information System. Several strategies can be obtained to enhance efficacy, such as the introduction of applications dedicated to specific processes, customization and development of applications, development of connectors among applications, introduction of middleware or enterprise service buses, development of connectors, database integration or use of database integration functionalities (e.g. ETL, Extraction, Transaction and Loading).
- The flexibility, which is related to agility, the capacity to reorganize ICT resources to achieve adaptation to new business needs, and speed, measure the ability of the assets to expeditiously implement adjustments (Power and Reid, 2005). Technological properties that affect agility and speed include the native functional coverage of the applications, modularity, connectivity and openness of application (in terms of access to source code and tables in databases), and compatibility (in terms of adoption of standard interfaces).

The higher the two dimensions the higher is the Maturity of the application portfolio.

According to the two dimensions, several configurations of the application portfolio exist (Figure 1).

Figure 1. *Information System Maturity Model*



Small-scale packages dedicated to specific processes. They are characterized by simplicity, support basic needs of departments (e.g. administrative functionalities which are localized in each country), and are often developed by small software companies.

"Islands of applications" (Lam, 2007). The company can enhance the coverage of its needs through the adoption of several small-scale packages integrating them at different degrees. The degree of integration influences the efficacy of the application portfolio, while the technology adopted for integration affects the flexibility of the portfolio.

Ad hoc developed packages, they can be developed in-house or realized by software companies on the basis of detailed requirements of the company. They perfectly fit the needs of the company. They are often characterized by proprietary technology and limited scalability.

Enterprise Systems. They are large-scale packages (such as ERP, CRM, SCM), organized into modules and potentially capable of supporting a wide range of business needs. From a technological perspective they are characterized by a single database, based on up-to-date developing languages, adoption of standards. They often provide interfaces or middleware to support integration with other packages. From a business perspective, they are generally business neutral and general purpose, and implementation in companies requires analysis and customization. The higher the customization, the lower the flexibility of the package. Functionalities and peculiarities for specific industries have been collected into bespoke modules (or vertical modules).

Bespoke Solutions. They are packages tailor made to the needs of individual businesses or departments. Despite ad hoc packages, they are usually based on standard and updated technologies, guaranteeing compatibility with other packages and higher flexibility.

Several combinations of the previous solutions can be implemented by companies, combining small-scale packages with ad hoc systems or bespoke solutions, enterprise systems with bespoke modules, or choosing and integrating modules from different enterprise system providers (attitude usually named Best of Breed approach) to determine a final application portfolio.

The final configuration is the result of a process of evolution that depends on the life of the company, on the turbulent unexpected events the company had to face, and on management and organizational changes.

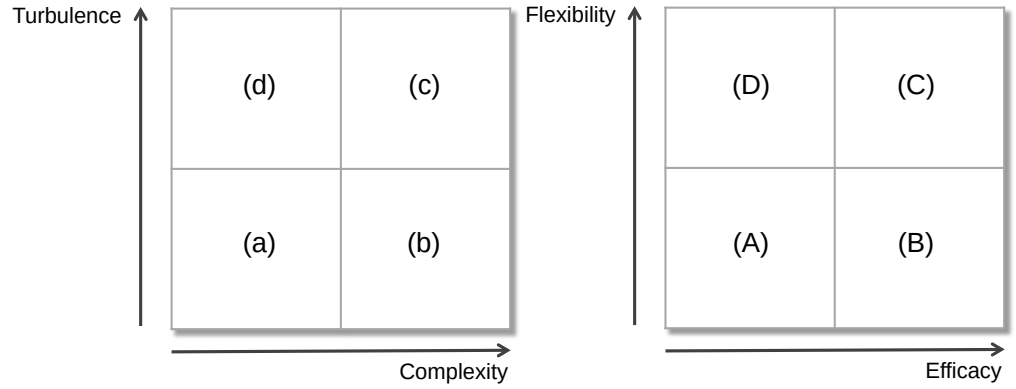
Considerations on Alignment

Company's business needs determine the requirement of Information Systems, present and future.

The Information System Maturity represents the capability of the Information System to match the actual requirements and the readiness to evolve, in case of turbulence.

The comparison between the two indications provides information on the business-IT alignment of the company as well as suggestions on how to fill the gap.

Figure 2. *Measure of Business Needs (left) and of IS Maturity (Right).*



Among the configurations of alignment, it is to be noted that:

- (a)-(A) is usually the case of simple companies, where applications have a marginal role.
- (d)-(D) is the case of small companies, usually recently established and IT intensive (e.g. high-tech start-ups);
- (c)-(C) represents the case of mature companies, IT-enabled, where IT perfectly matches current needs but is also capable of supporting future evolution;
- (b)-(B) represents an "alignment-trap" (Shpilberg et al., 2007), as it represents the case of an apparent alignment where company's managers have the perception of an IS perfectly tailored to the needs,

but, in case of sudden changes or unexpected events, which impact the business, it may threaten the company's survival.

Due to the natural path of evolution of the application portfolio which is characterized by a tendency to add and integrate new applications to support new business needs, endowing the efficacy of the application portfolio rather than its flexibility), horizontal misalignment, (a)-(B) or (d)-(C), is quite rare or is only a temporary condition during a process of evolution.

Among the misaligned configurations, it is to be noted that:

- (b)-(A) is easily recoverable, as in conditions of basic application portfolio its replacement has a limitedly impact on the company;
- (c)-(B) represents a critical and risky condition, where the company's application portfolio is not capable of satisfying the changeable and turbulent competitive environment. Alignment can be pursued only at the cost of a temporary, and expensive, horizontal misalignment.

Case Study

The framework has been successfully applied to a number of assessment studies, to support the definition of the evolution plan for company's Information Systems.

Baltur S.p.A. is an Italian family-run business that produces heating, burners and modular boilers, and markets cooling devices.

The company was established in 1950. After 60 years and a property transfer, in 2010 , with a turnover of around 42 million Euro, the company was facing an uncertain competitive environment. The local (Italian) market, which accounted for 60% of sales, was suffering purchases reduction due to the crisis, while foreign markets looked promising and quickly increasing. The company had one main production plant for heating systems in the north of Italy, while it was importing and selling cooling devices. In case of need, they could subcontract to third parties production of specific components of the heating systems. The company served the Italian market through a network of professionals and small shops (around 900 in total), and at international level it had agreements with importers and exporters in around 40 countries.

The Application Portfolio was the result of a long process of adjustments to business needs, as well as the fruit of the choices of different CEOs and managers.

The application portfolio was composed of several packages: one package strongly customized which supported all main internal processes (administration, production management, warehouse, Account Payable, Account Receivable); a plethora of packages dedicated to specific processes (e.g. logistics, production control, Reporting and Business Intelligence, Design

and PDM, quality tests, Web orders entry). The packages were partially integrated using heterogeneous technologies.

The Application Portfolio was reaching the limit and the framework for alignment was applied to define the necessary target configuration and identify gaps (Figure 3, Figure 4).

Figure 3. *Company's Assessment of Business Needs*

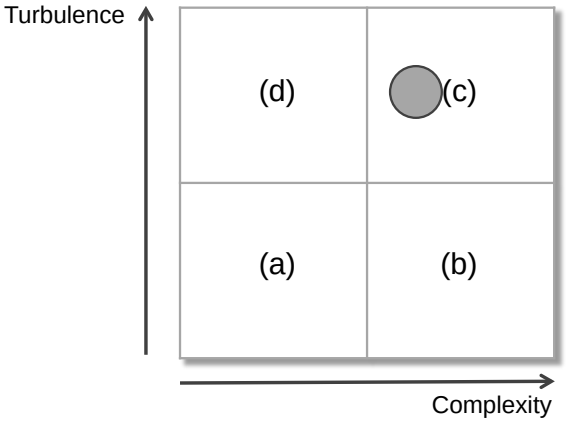
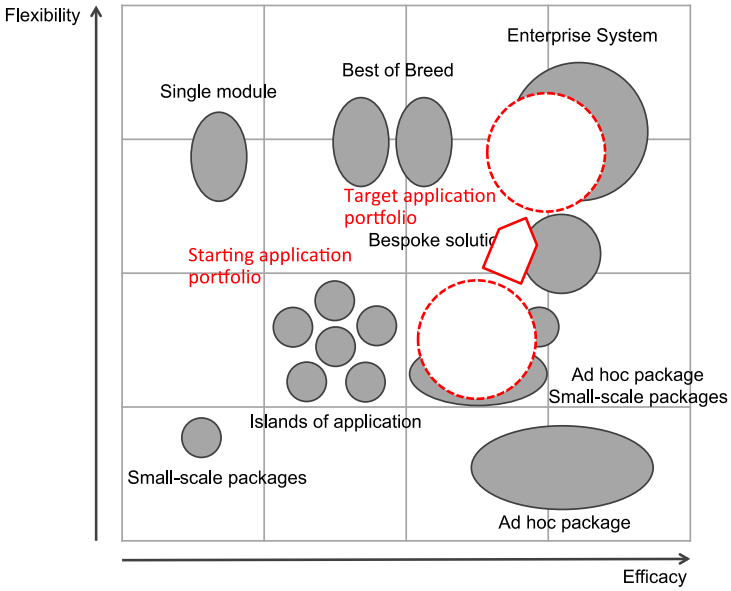


Figure 4. *Company's Information System Maturity*



After the assessment, an Enterprise System configuration based on a market-leader ERP package was chosen. Only a small number of packages (which were strongly customized or not critical for the business) remained and have been integrated with the ERP. The ERP project was completed in one year at the end of 2012.

In 2013 the company faced some unexpected and relevant changes: growth in foreign sales in markets previously limitedly served, which impacted the product lines and brought the necessity to re-organize the sales structure,

replacement of the CAD system with a PDM solution, creation of a completely new post-sales service department.

The Information System supported all changes without evident limitations or hindering company's performances.

Conclusions and Future Research

Company's business IT alignment is the result of a process of harmonization of several domains: corporate strategy, IT strategy, processes, and organizational infrastructure. Most of the literature focused on the analysis of the alignment from a strategic perspective and generated a number of models. Several authors argue that the models proposed don't possess the required characteristics for application to companies' decision processes. Some arguments include: broad definition of Information System, lack of measurable indicators to guide the alignment, focus on the methodology rather than on the target Information System configuration.

Furthermore, literature analyses the relationship between uncertainty and company's performance, but flexibility requirements for the Information System have not been yet considered as a design parameter.

The research papers analyses business IT alignment from the operational and target oriented perspective taking into consideration the role of flexibility in the Information System design.

The framework proposed encompasses two dimensions of analysis: business needs, actual needs and uncertainty on one hand, and the capability of the Information to match the needs through the definition of the Information System Maturity.

The framework proved to be a useful and operational instrument that can guide companies in ICT choices and was successfully applied to 10 case studies.

However, the framework captures only some facets of the alignment problem and ignores aspects which could drive the need of ICT, such as ICT 'culture' or ICT 'skills", the role of ICT in the business (ancillary, operational, key) in the business and in the product or service of the company. These aspects represent the base for future research.

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