Model-driven Alignment: An Empirical Study

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Abstract. Current advancements in the business arena necessitate more than ever before the alignment of *The Business* and *IT* in organizations, which has been acknowledged as a complex issue to address. Our research is aimed at systematically addressing the linkage between *business strategy* and *information systems* (IS). We propose a model-driven approach for alignment, by leveraging the influence of established business strategy formulations from Strategic Management, and model-driven principles used within IS. The objective of this paper is to present the results of an empirical investigation carried out in Sweden on the linkage seeking to obtain insights from practitioners about the relevance of the problem, as well as of our model-driven proposal to address it.

Keywords: Business Strategy, Alignment, IS, Models, UBSMM

1 Introduction

Information technology (IT) is a fundamental factor for business strategy enactment [1], because it pervades all sectors of organizations regardless of the organization's business, and hence influences the strategy itself. IT comprises the essential information needed to build executable information systems (IS) to support and facilitate business operations for delivering offerings to customers.

Business strategy should be understood and communicated in an organization to define the means required for its successful execution, also making clear for IT what business stakeholders need. This is expressed through business strategy formulations such as the Value Chain [2], Strategy Maps and Balanced Scorecards (SMBSC) [3]). Organizations aligning their business strategy to IT tend to outperform those that do not [4] and increase their performance and profits [5]. While there exist proposals addressing alignment [6–8], it is still acknowledged as an open issue for top-management [9], as well as for IT executives [10].

Despite this acknowledged importance of aligning strategic initiatives and plans with IS, this linkage suffers from shortcomings of existing approaches. Established business strategy formulations are typically overlooked and business strategy is abstractly linked to IS models when it comes to IS requirements and other Enterprise Models (EM) [11, 12]. While Enterprise Architecture (EA)

proposals such as TOGAF [13] and the Zachman Framework [14], as well as Business Architecture proposals [15] include business elements or layers that affect IS, they lack on linking them to business strategy formulations [11, 12].

These shortcomings are indicative of the ambiguity of business strategy for this alignment linkage, which makes even more difficult to grasp strategic initiatives and facilitate the development of IT solutions. Our model-driven proposal for alignment is based on the Unified Business Strategy Meta-model (UBSMM), which is an integration of the conceptualizations of established business strategy formulations from Strategic Management [11,12]. More specifically, UBSMM integrates business strategy formulations covering three complementary types of strategy-shaping logic; the resource-based type with Strategy Maps and Balanced Scorecards [3], the competition type with the Value Chain [2], the Value Shop and the Value Network [16], and the innovation type with Blue Ocean Strategy [17], which altogether constitute adequate coverage of strategic notions [11,12]. Leveraging properties of meta-modeling and model-driven development, UBSMM links business strategy with IS models used for IS requirements, with EM and with EA [11, 12].

The objectives of this paper are: to empirically validate that the linkage between business strategy and IS is an issue of concern, and collect insights from the industry about the appropriateness of our model-driven approach, and highlight the benefits offered by UBSMM with respect to the linkage. For the the first, an empirical study is conducted, and for the second, an illustrative case using strategic notions from UBSMM is presented.

The section following includes related work motivating the need for our study. Thereafter, the background and design of the study is presented in section three; section four presents the results of the study and section five discusses our findings. The paper concludes with section six on future research steps.

2 Related Work

Despite the acknowledged importance of business-IT alignment, during the past decade a strong empirical motivation for business-IT alignment has been put forward focusing primarily on: (i) the relation between alignment and business performance or (ii) the relation between types of business strategies (such as conservative or innovative) and (iii) the degree of alignment [18].

However, minimal empirical basis seems to exist specifically for the linkage between business strategy and IS. Such empirical work would investigate the need for, and the existence of a formal business strategy formulation and its potential for the use of models for reinforcing alignment. A common type of empirical work found in the business-IT alignment literature is Luftmans highly cited work, with the annually published CIO survey results [10]. However, the focus is mostly on alignment maturity. Moreover, the linkage between business strategy and IS is not only relevant to CIOs but also to all those affecting it, or being affected both from *the Business* or *IT*.

The works of [19, 20] also follow a modeling approach, however without employing established business strategy formulations. On the other hand, the work of [21] shares our motivation of natural language-based ambiguity of business strategy formulations, and they strive for a conceptualization of Balanced Scorecards (BSC), which aims at reducing practice variability due to interpretations of publications and reports. The purpose of this conceptualization is to become becoming a basis for building tools that are capable of capturing, analyzing and explaining strategic initiatives and intend.

Another effort also aimed at decreasing the ambiguity of business strategy is the Strategy Markup Language (StratML) solely for document management i.e. focused on providing XML-based specifications for strategic and performance plans and reports [22]. This initiative is not concerned directly with business strategy formulations.

3 Empirical Study Design

Designing, conducting and reporting an empirical study constitutes a complex operation involving several steps. For our study, we have adopted Oppenheim's 14-stage framework [23].

Stages one through four refer to going through literature, reflecting upon it, and choosing an appropriate form for the study. Our study aims at empirically validating the relevance of addressing the linkage between business strategy and IS in today's enterprise terrain and collecting insights about using models as an appropriate way of addressing it. Due to the need for reach to practitioners, the design of study selected has been a self-administered online questionnaire. The assumption to be investigated (stage five) is expressed through the three questions formulated in the Introduction.

For the design (stage six) guidelines include establishing objectives, measures and scales, as well as types of questions, layout, wording, flow of questions, and validity concerns. The following objectives have been set for the questionnaire:

Obj. 1: Identify to whom and why is the linkage between business strategy and IS a concern for the Business and IT actors within a company.

Obj. 2: Identify gaps between strategy and systems development hindering the alignment linkage.

Obj. 3: Confirm the use of models as a relevant solution to address such gaps.

The questionnaire has been built with the free online tool *Survey Gizmo* (*http://www.surveygizmo.com*), and consists of 29 questions spreading across six sections. Sections have been derived from the aforementioned objectives; section one focuses on the first objective by capturing whether the linkage between business strategy and IS is a concern and whether this concern is being currently addressed, how, etc. Sections two and three focus on the second objective by capturing respondents' familiarity with strategic formulations, how they are used in their company, and they are used in relation to information systems requirements. Sections four and five focus on the third objective by capturing

respondents' familiarity with models and how they are used in their company, as well as their views on the utility of a model-driven proposal for alignment. Section six captures demographic information.

All sections include explanations and examples of core concepts and terms used (i.e. *information system, requirements, strategy, model*), together with information motivating some questions. Types of questions used, include open-ended, multiple choice, checkboxes, and *Likert* scale questions. Options offered cover possible alternatives relevant to the questions without overlapping, while units and scales have been consistently used, and double-barreled questions have been avoided [23]. Questions have been neutrally formulated to avoid bias, and questions for consistency checking across answers have been used.

A pilot study has been conducted (stage seven) to assess the questionnaire's validity and understandability [24]. This included a group of four academic experts on business-IT alignment for conformance to the hypothesis defined (construct validity), and sufficient domain coverage (content validity). Additionally, a convenience sample of 52 professionals from around the world has also been used to simulate the realistic setting of the study allowing to test the questionnaire by providing input on all functional aspects (language, structure, layout, etc.). Apart from language, structure and layout improvements, the pilot study resulted a refined set of questions, from 41 down to 29. The questionnaire can be tested at: *http://www.surveygizmo.com/s3/1305947/Strategy-IT-Alignment* and questions are available at: *http://goo.gl/8rfgf0*.

The sample has been designed (stage eight) following quota sampling, where mutually exclusive sub-groups have been identified. The selection of companies has been stratified across medium and large profit-driven companies registered in Kista, Sweden, based on information provided by the Swedish Agencies Registration Office (http://www.bolagsverket.se). Medium and large companies (more than 50 but less than 250, and more than 251 respectively) have been selected because small and micro companies (less than 50) are typically considered agile and due to size the issue of alignment is not relevant. Also, profit-driven companies have been selected over charity organizations and state-owned companies because the vast majority of business strategy formulations has been defined based on profit-driven companies. Invitation for participation (stage nine) took place via email, stating the objectives of the study, the form and the ethical considerations of handling the data.

The data collection process lasted four weeks (stage eleven) during the late spring and early summer of 2013. Processing the data and statistically analyzing them has been done with the assistance of the aforementioned survey tool (stages twelve and thirteen). This paper constitutes reporting on the questionnaire results and testing of the hypothesis (stage fourteen).

4 Empirical study Results

The results of the study include the responses of 45 participants coming from seven large and medium profit-driven companies: two active in manufacturing

(8 and 6 participants), one active in software development (5 participants), one active in media and publishing (3 participants), and three active in telecommunications (7, 11, and 5 participants), which includes a global leader in networking and a Nordic leader in mobile and internet services. All the objectives of the questionnaire have been met in that the results provide answers along with insights from respondents. Results are presented for each of the objectives accompanied with discussions.

4.1 Objective 1

Results come from the first section of the questionnaire are summarized in Table 1. They indicate that the linkage between business strategy and IS is an issue of concern for the vast majority of respondents. Apart from the overall results, it is interesting to examine responses from different perspectives due to function served (*Business, IT, Both*), and size of the company (*Medium, Large*).

While those who have one distinct function share 100% the view that the linkage between business strategy and IS is an issue of concern, those serving both functions do no share the same absolute. This could be due to the fact that those serving both functions are expected to have a better understanding of both the Business and IT and thus do not consider the linkage between business and IS to be an issue of concern.

Table 1. Results answering: "*Is the linkage between business strategy and IS an issue of concern for your company?*".

Population	**Yes**	**No**
All	92.5%	7.5%
Business	100%	-
IT	100%	-
Both	89%	11%
Medium	90%	10%
Large	100%	-

Table 2. Responses on model types used.

Model types used	**Percentage**
Business Models	69.2%
Requirements Models	61.5%
Process Models	61.5%
Use Case Models	42,3%
Goal Models	23.1%
Enterprise Models	15.4%
Conceptual Models	15.4%
Simulation Models	15.4%
No Models	7.7%
I do not know	3.9%

Another grouping presented in Table 1 focuses on the size of the company and shows that the linkage between business strategy and IS is of concern for all large-sized companies (employing > 250 people) whereas it is for most medium-sized companies (employing between 50 and 250 people). This is anticipated and coincides with our assumption to focus on medium and large companies in this study. The larger the company, the more cumbersome it becomes to align all functions, especially when they are as pervasive across an organization as IT is.

Motivation for being an issue of concern (i.e. the why?) has been acknowledged by respondents due to strategy not being clear enough and due to lack of understanding how IS can enhance and support strategy.

In the same section, those that have acknowledged this linkage as a concern for their company, have also been asked to indicate methods and techniques practiced to address it; 30% answered that no method or technique is practiced, 15% answered that their company does not strive for alignment between business strategy and IS and 55% answered they do not know.

4.2 Objective 2

Results from sections two and three of the questionnaire focus on business strategy and how it relates to systems development within their company, particularly system requirements.

First of all, participants were asked in terms of strategy awareness within their company (Table 3). Those fully and partially aware were asked to identify all forms of communication used for business strategy dissemination (Table: 4).

Table 3. Strategy awareness levels.

Awareness	**Percent**
Fully aware	71%
Partially aware	14%
Not aware	6%
No strategy	9%

Table 4. Ways of disseminating strategy within companies.

Strategy Dissemination	**Percent**
Verbally	78%
In text (i.e. reports)	75%
Graphical (i.e. charts)	44%

When asked whether business strategy dissemination was timely understood and whether the business intent of the company was clearly expressed; 58% were positive, 9% negative, and 33% neutral.

When asked about alignment between business strategy and IS; whether IS requirements were utilized with respect to business strategy, whether there exists synchronicity and traceability between IS and business changes, as well as whether strategic objectives are utilized in IS development (directly or indirectly); 33% were positive, 31% negative, and 36% neutral.

Overall, 59% of respondents claim strategy is aligned with IT in their companies, and 41% claim it is not. Those who responded *no* identified reasons hindering the linkage between business strategy and IS in their companies:

For 73% not enough communication exists between *The Business* and *IT*,
For 37% strategy is not communicated at all,
For 37% IS is not related to strategy,
For 27% strategy is not understood at all,
For 27% strategy is not expressing the company's real strategic intent.

A significant conclusive observation from this section is that 85% answered they are fully and partially aware of their company's strategy suggesting that business strategy is disseminated. However, 41% claim strategy is not aligned with IS and the most significant reason for this gap seems to be the fact that there exists not enough communication between the Business and IT (73%).

4.3 Objective 3

Results come from sections four and five of the questionnaire, which focus on models and their utilization for alignment within respondents' companies.

Table 2 presents the types of models most widely used, as indicated by respondents: business , requirements, process, and use case are dominating.

While 81% of respondents have indicated they are familiar with models, for Objective 3 we have selected only those that have indicated a certain level of competency regarding models. The reason behind this selection is that a certain

level of knowledge and familiarity with models is needed to assess the use of models for model-driven alignment. The scale of familiarity included novice, experienced beginner, practitioner, knowledgeable practitioner and expert. We have selected the answers from those that have indicated they are practitioners on at least one of the model types shown in table 2. This filtering resulted into 19 respondents and results from their answers are presented along with results from answers coming from the total sample (Table 5).

Table 5. Positive responses on the use of models.

Statements	**IT**	**Total**
Our company has the know-how to use models for model-driven alignment	44%	32%
Modeling our strategy would improve alignment of strategies across units	72%	68%
Modeling our strategy would improve alignment towards partners	56%	52%
Modeling our strategy would bring value to our company	72%	50%
Modeling our strategy could improve the linkage between strategy and IS for our company	89%	84%

Table 6. Correlation between familiarity with models and the use of models improving the alignment linkage.

Familiarity with Models	ρ	R^2	$p < 0.05$
Enterprise Models	0.5474	29.96%	0.0001
Process Models	0.6518	42.48%	< 0.00001
Business Models	0.7112	50.58%	< 0.00001
Requirements Models	0.4157	17.28%	0.004513
Conceptual Models	0.3704	13.72%	0.012259
Information Models	0.5306	28.16%	0.000177
Simulation Models	0.3899	15.20%	0.000195
Goal Models	0.5278	27.86%	0.008106
Use Case Models	0.5817	33.83%	2.8E-05

Respondents have also provided motivation over their positive assertion on the improvement of the alignment linkage between business strategy and IS due to the use of models. The motivations mostly refer to benefits that models bring, such as structure, less ambiguity, understandability, automation, experimentation for possible alternatives and hypothesis testing.

Furthermore, results have shown that there exists a moderate positive correlation between respondents' familiarity with models and agreement that the use of models would lead to improvement of alignment between business strategy and IS. Correlation indicates the strength of the statistical relationship between questions (using Likert scales in this case) but cannot determine cause and effect as in which one is influencing the other.

Scatterplots of two such moderate positive correlations are presented in figure 1 for familiarity with Enterprise models (left) and Business models (right). The vertical axes is scaled 0-5 capturing familiarity with models: 0 for not familiar at all, 1 for novice, 2 for experienced beginner, 3 for practitioner, 4 for knowledgeable practitioner, and 5 for expert. The horizontal axes is scaled 1-5 capturing confidence for improvement of alignment through the use of such models: 1 for strongly disagree, 2 somewhat disagree, 3 I do not know, 4 somewhat agree, 5 strongly agree. This means there is a tendency among those with high familiarity with enterprise models and business models (practitioners and experts) to express higher levels of agreement with the use of models improving alignment.

Table 6 presents the correlation coefficient $\boldsymbol{\rho}$ (second column), the coefficient determination $\mathbf{R}^2$ (third column) and the statistical significance $\mathbf{p}$ (fourth column) between familiarity with models and agreement with the use of models improving alignment. For enterprise models, business models, process models,

information models, goal models and use case models the correlation is moderate positive as ρ is around +0.5 and moderate percentages of data close to the regression line (27%-51%). For requirements models, conceptual models and simulation models the correlation is weak positive as ρ is closer to 0 and low percentages of data close to the regression line (13%-18%). For all correlations reported there is a 5% likelihood they are a result of chance due to the probability threshold is set: $\mathbf{p} < 0.05$.

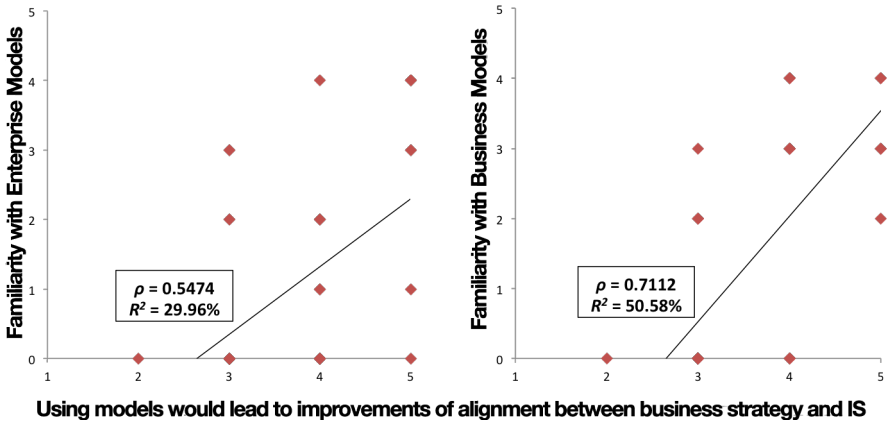


Fig. 1. Familiarity with Enterprise models (left) and Business models (right).

5 Discussion

Business strategy formulations are typically natural language-based, usually accompanied by schematic representations. The ambiguity of such formulations risks their dissemination to be subject of interpretation. The study's results have indicated the most significant hindering factor is insufficient communication between the Business and IT (objective 2 of the study). This difficulty can be overcome by conceptualizing notions of business strategy formulations and thereafter mapping them onto notions of techniques and methods used for IS requirements. Clear semantics are set for strategy notions which facilitate unambiguous understanding and dissemination of business strategy to IS. This does not leave space for interpretation and makes changes less prone to creating problems. Traceability makes the impact of changes in strategy traceable to IS (i.e. requirements, features, etc.)

The use of models has been acknowledged by respondents as a solution to improve the linkage between business strategy and IS (objective 3 of the study). Results have allowed the identification of correlations between familiarity with models and anticipation that the use of models for the linkage between business strategy and IS improves alignment. Particular types of models showed stronger correlations than others (e.g. business and process) suggesting that proposals like ours should focus on these model types for mapping business strategy to IS.

In a broader scope, conceptualizing business strategy promotes meaningful transparency of strategic initiatives across an organization, by making such information available. This enhances internal coordination within an organization as it establishes a shared vocabulary about customers, products, processes and activities, which creates a common base for understanding addressing the problem of business strategy and strategic initiatives being open to interpretation. Decreased ambiguity leads to improvements in automation of mappings towards IT solutions, and thus can ideally increase efficiency of business strategy implementation. Business strategy modeling can be the basis for building patterns when linking different strategy initiatives to IT solutions, which increases organizational agility to shift from one initiative to another.

Finally, with respect to the aforementioned benefits of business strategy modeling and the use of UBSMM, certain limitations should also be mentioned. An obvious limitation is the lack of the techniques and the tools to support development of UBSMM to facilitate mappings towards IS (i.e. process models, enterprise models, requirements models, etc. as well as EM and EA as it is the case with system development tools. Another limitation concerns the scope and extent of evaluation for UBSMM due to the fact that a full scale case study requires a long period of handling business sensitive information, thus being limited to small real-world case studies, published cases and reports [11] such as the one of Southwest Airlines.

6 Concluding Remarks & Future Work

In this paper, we have argued for the need to enrich the current body of knowledge on the alignment linkage by empirically validating that the linkage between business strategy and IS is still an issue of concern. In that line, we have conducted a social study in the form of an online self-administered questionnaire. We have presented the design steps taken and we have also reported on the results of the study by addressing each one of the three objectives set for the questionnaire.

The objectives of this paper has been met in that our findings, within their limitations, constitute a current empirical contribution that justifies the theoretical basis of our proposal for model-driven alignment. Results have validated that linkage between business strategy and IS remains an open issue of concern and addressing it methodically is still suffering. Moreover, results have also indicated business strategy is not utilized in IS development with insufficient communication being the major hindering factor. Finally, results regarding the use of models for the linkage between business strategy and IS are positively received by respondents.

Based on the findings of our study, succeeding steps of our future research have two main directions. One path includes conducting further empirical studies to gain more insights and examine larger populations. Another line of work is driven towards conducting case studies using UBSMM to further assess the utility and applicability of our proposal for model-driven alignment.

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