

On e-business strategy planning and performance evaluation: An adaptive algorithmic managerial approach

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Adaptive algorithmic modelling, e-business, performance evaluation, strategy management methodologies, strategy planning, quantitative methods

Abstract

A new e-business strategy planning and performance evaluation scheme based on adaptive algorithmic modelling techniques is presented. The effect of financial and non-financial performance of organizations on e-business strategy planning is investigated. The relationships between the four strategic planning parameters are examined, the directions of these relationships are given and six additional basic components are also considered. The new conceptual model has been constructed for e-business strategic planning and performance evaluation and an adaptive algorithmic modelling approach is presented. The new adaptive algorithmic modelling scheme including eleven dynamic modules, can be optimized and used effectively in e-business strategic planning and strategic planning evaluation of various e-services in very large organizations and businesses. A synoptic statistical analysis and comparative numerical results for the case of UK and Greece are given.

The proposed e-business models indicate how e-business strategic planning may affect financial and non-financial performance in business and organizations by exploring whether models which are used for strategy planning can be applied to e-business planning and whether these models would be valid in different environments. A conceptual model has been constructed and qualitative research methods have been used for testing a predetermined number of considered hypotheses. The proposed models have been tested in the UK and Greece and the conclusions including numerical results and statistical analyses indicated existing relationships between considered dependent and independent variables. The proposed e-business models are expected to contribute to e-business strategy planning of businesses and organizations and managers should consider applying these models to their e-business strategy planning to improve their companies' performances. This research study brings together elements of e-business strategy planning, strategy planning and performance management. The proposed models can be used by practitioners who may use them for increasing their organization's performance and by theoreticians for academic purposes by developing e-business strategic management, strategic planning and performance evaluation.

1. Introduction

During the last decades traditional business modelling research, belonging to the organizational management field, has been gradually redirected to the e-business modelling research of e-business technologies and their applications. It has been noticed in the variety of used models there is a comparatively lack of theoretical understanding and knowledge of suitable tools in e-business modelling (Clark, 2010; Zillman, 2005-2012; Yunus et al., 2010; Brynjolfsson and Hitt, 2003; Rust and Kannan, 2003). The impact of e-business on traditional business practices, the exploitation of opportunities enabled by e-business technological innovations and related business modelling complex applications including Internet business models, business models on the Web, business models in e-commerce and generally business models for e-markets have been investigated (Zott et al., 2011; Koellinger, 2008). It has been reported that contemporary businesses, organizations and industries

may be able to increase their financial and non-financial performances by using the new proposed e-business strategies (Forrester Research, 2012; ONS, 2011; Mesenbourgh, 2004). E-business strategy, sourcing and governance are critical issues in modern private and public organizations, requiring efficient planning, use and control of information technology by managers (Gottschalk, 2006). Several research quality evaluation methodologies have been recently applied for the improvement of e-business performance evaluation methods (Lipitakis and Lipitakis, 2012-2013; Wirtz, 2011; Zeng and Luo 2011; Zhang et al., 2010).

This research work is aiming to establish whether exist relationships between e-business planning and organization's performance formalizing these relationships between the two. The effects of planning effectiveness parameters on e-business strategic planning and performance relationships are examined and the performance categories measures of both financial and non-financial dimensions of performance are considered. The proposed adaptive model can be used as benchmarking tool for measuring e-business strategy planning and performances, and businesses and organizations can assess their capabilities examining if any e-business strategy planning parameters need to be adjusted to optimize their performance. The proposed adaptive algorithmic modelling techniques are effectively used in e-business strategic planning and performance evaluation of selected e-services for solving e-business problems of large organizations and businesses in local, national and international levels.

2. Related E-Business Models

In recent years considerable research has been focused on the development, strategic planning and efficient use of e-business models on multidimensional applications by considering certain strategy planning aspects of businesses and organizations and related measure parameters (Demil and Lecocq, 2010; Caniato et al., 2009; Koellinger, 2008; Coltman et al., 2008; Sanders, 2007; Zhu et al., 2003; Hackbarth and Kettinger, 2000). Note that the adaptation of traditional business model for application to e-business follows an evolutionary process with the following stages: e-business, e-commerce, e-enterprise, external and internal communications, appropriate transformations (Demil and Lecocq, 2010; Petrovic et al., 2001).

Conceptual and evaluation e-business strategic planning models with key characteristics, such as design/methodology/approach, measures/variables, data sets, purposes, hypotheses, findings, Internet and performance, various research model methodologies have been recently presented. Several contributions on business model concepts, e-business strategy planning and performance concerning related fields such as e-business strategy, business models, strategy planning and performance have been also investigated (Lipitakis, 2013).

Various multidimensional approaches have been proposed and implemented by considering performance models with strategic planning variables and basic constructs improving the strategic performance of e-business strategic planning of selected organizations (Phillips, 2003-2010; Clark, 2010; Jarzabkowski and Balogun, 2009; Ocasio and Joseph, 2008; Coltman et al., 2008; Nordqvist and Melin, 2008; Rudd et al., 2008; Johnson et al., 2007).

3. Development of Conceptual Strategic Planning

Several pilot studies and statistical analyses including sampling, data handling, context, various variable definitions and principal component analyses have been presented supporting proposed e-business strategy planning and performance models in various countries and national regions (Lipitakis, 2013). Data collections, samples, correlations of various business sectors affected by different variables and corresponding analyses including related questionnaires, combinations of e-mail surveys, conferences relevant to chosen sectors through business and trade associations have been considered.

The proposed e-business models and corresponding hypotheses have been statistically tested by using explanatory and confirmatory factor analysis, correlation between independent and dependent variables and regression analysis. In such cases the application of regression analysis it has

been found that the independent variables of basic components can be used for predicting the dependent variables of financial and non-financial performance (Lipitakis, 2013).

A class of adaptive algorithms for solving e-business problems has been recently presented (Lipitakis and Lipitakis, 2013). The basic components for estimating the strategic planning parameters of Formality, Participation, Sophistication and Thoroughness can be defined as follows:

Formality: the explicit and systematic procedures, policies and goals.

Participation: the involvement of senior and middle management. Improvement of communication and development of a shared vision for the direction of the firm.

Thoroughness: the extent to which a firm uses internal and external experience, and ensures adequate time is devoted to the strategic planning process.

Sophistication: use of a wide range of managerial techniques. Having a short or long-term approach. Coordination of e-business across the organisation and having an appropriate budget for e-business.

These independent strategic planning variables are accompanied with the dependent variables of finance and non-finance. In this research work a new adaptive algorithmic modelling for e-business strategic planning and evaluation, based on an e-business performance model (Lipitakis, 2013), is presented.

The proposed e-business strategic planning model is based on a modified version of the LP e-business model, using a predetermined number of independent and dependent variables, and can be efficiently used for computing the best performance measurements and solving a wide class of e-business and strategic management problems under uncertainty conditions. Furthermore, a predetermined number of independent strategic planning variables and two dependent variables of financial and non-financial performance of organizations are also considered.

4. An Adaptive Algorithmic Scheme for Performance Evaluation

The adaptive algorithmic modelling (ADAM) scheme using a set of dependent and independent variables, given in eleven computational modules, can be described in the following pseudo algorithmic form:

Algorithm ADAM-1 (FNFP, FPST, ϵ_{ST} STR, ϵ_{LE} LEA, ϵ_{PC} PCU, ϵ_{CO} COH, ϵ_{KN} KNO, ϵ_{AL} ALL, ϵ_{AD} ADM, ϵ_{UN} ADAMS)

Purpose: describes an Adaptive Algorithmic Modeling Scheme, the so-called ADAM methodology, for computing the best performance measurements and solving a wide class of e-business and strategic management problems under uncertainty conditions.

Input: Formation FORM, Participation PART, Sophistication SOPH, Thoroughness THOR, Finance Performance FINP, Non-Finance Performance NFIP, Structure STR, Leadership LEA, People and Culture PCU, Coherence COH, Knowledge KNO, Alliances ALL, Agility & Decision-Making ADM, sp-parameters ϵ_{FO} , ϵ_{PA} , ϵ_{SO} , ϵ_{TH} , ϵ_{FP} , ϵ_{NF} and ϵ_{ST} , ϵ_{LE} , ϵ_{PC} , ϵ_{CO} , ϵ_{KN} , ϵ_{AL} , ϵ_{AD} , and uncertainty factor parameter ϵ_{UN}

Output: The (optimized) Adaptive Algorithmic Model Solution (ADAMS)

Computational Procedure:

Module 1-estimate the independent variables FPST (FORM, PART, SOPH, THOR)

Step 1.1: determine the input parameters ϵ_{FO} , ϵ_{PA} , ϵ_{SO} , ϵ_{TH}

Step 1.2: estimate the variable of Formality (ϵ_{FO} FORM)

Step 1.3: estimate the variable of Participation (ϵ_{PA} PART)

Step 1.4: estimate the variable of Sophistication (ϵ_{SO} SOPH)

Step 1.5: estimate the variable of Thoroughness (ϵ_{TH} THOR)

Module 2- estimate the dependent strategic planning variables FNFP (FINP, NFIP)

Step 2.1: determine the input parameters ϵ_{FP} , ϵ_{NF}

Step 2.2: estimate the variable of Finance Performance (ϵ_{FP} FINP)

Step 2.3: estimate the variable of Non-Finance Performance (ϵ_{NF} NFIP)

Module 3-determine input sp-parameters

Step 3.1: determine input parameters $\varepsilon_{ST}, \varepsilon_{LE}, \varepsilon_{PC}, \varepsilon_{CO}, \varepsilon_{AL}, \varepsilon_{AD}$

Module 4-Design Structure STR (MRE, POR, SAR, DBF)

Step 4.1: Managing Relationships (MRE)

Step 4.2: Process Orientation (POR)

Step 4.3: Strategic Architecture (SAR)

Step 4.4: Demand based Flexibility (DBF)

Module 5: Improve Leadership LEA (TCH, LAD, LAC, LEIS)

Step 5.1: Transformation Champion (TCH)

Step 5.2: Leadership Advocacy (LAD)

Step 5.3: Leadership Accountability (LAC)

Step 5.4: Leadership Empowerment & Idea Synthesis (LEIS)

Module 6: Focus on People and Culture PCU (REW, RCR, LRE, RTR, ICO)

Step 6.1: Rewards (REW)

Step 6.2: Rapid Customer Responsiveness (RCR)

Step 6.3: Learning & Renewal (LRE)

Step 6.4: Respect & Trust (RTR)

Step 6.5: Involvement & Commitment (ICO)

Module 7: Emphasize on Coherence COH (MPE, III, SIN, DDS, CCS)

Step 7.1: Measurements & Performance Evaluation (MPE)

Step 7.2: Integrated Information Infrastructure (III)

Step 7.3: Standardisation & Interoperability (SIN)

Step 7.4: Decentralised Differentiated Services (DDS)

Step 7.5: Common Centralised Services (CCS)

Module 8: Comment on Knowledge KNO (KDA, KFO, KEM, KAC, KSH)

Step 8.1: Knowledge Development Applications (KDA)

Step 8.2: Knowledge Focus (KFO)

Step 8.3: Knowledge Exchange Meetings (KEM)

Step 8.4: Knowledge Accessibility (KAC)

Step 8.5: Knowledge Sharing (KSH)

Module 9: Determine Alliances ALL (ART, APE, CRI)

Step 9.1: Alliance Respect & Trust (ART)

Step 9.2: Alliance Performance Expectations (APE)

Step 9.3: Complexity & Risk (CRI)

Module 10: Focus on Agility & Decision-Making ADM (IRE, MSR, TRTO, PMA, MSA, ADE)

Step 10.1: Intent Realisation (IRE)

Step 10.2: Matching and Speed & Risk (MSR)

Step 10.3: Tempo/Reliability Trade off (TRTO)

Step 10.4: Project Management (PMA)

Step 10.5: Market Space Awareness (MSA)

Step 10.6: Agility & Decision Edge (ADE)

Module 11: Form the e-business solution

Step 11.1: Determine the uncertainty parameter ε_{UN}

Step 11.2: Form the solution (ε_{UN} ADAMS)

The values of the sp-parameters affecting the corresponding input variables of the optimized algorithm ADAM-1 can be determined experimentally or approximately from corresponding appropriate mathematical model. In the special case that the sp-parameters take the values

$$\varepsilon_{FO} = \varepsilon_{PA} = \varepsilon_{SO} = \varepsilon_{TH} = \varepsilon_{FP} = \varepsilon_{NF} = 1 \quad \text{and} \\ \varepsilon_{ST} = \varepsilon_{LE} = \varepsilon_{PC} = \varepsilon_{CO} = \varepsilon_{AL} = \varepsilon_{AD} = 1 \quad (4.1)$$

a simplified form of the algorithm, while the selection of the appropriate sp-parameters leading to (nearly) optimized solutions is dependent on the nature of the considered problem and

often requires extensive experimentation. Multiple iterative applications of the proposed adaptive algorithm on a set of selected e-business strategic planning performance evaluation scheme, using multiple-point Likert scale measurement in every iterative step, can lead to comparable numerical results for evaluating the performance of the adaptive algorithmic application for the strategic planning performance of each organization/business at national/international region levels for comparative purposes.

The main advantage of the proposed algorithmic approach is twofold. Firstly, the adaptive algorithms can be efficiently used for solving a wide class of e-business and strategic management problems, and secondly the dynamical choice of the σ -parameter values, which can be related to both quantitative and qualitative nature of the input parameters (data) of the given problem, can lead to (near) optimum solutions. The evaluation of a firm e-business performance as a time-dependent problem the investigation of the performance stability over a certain period, seems to be a challenging future research problem (Coltman et al., 2008; European Commission, 2004).

5. On Comparative Studies of e-business strategy planning and performance in the UK and Greece

A case study on e-business strategy planning and performance with a comparative study of the UK and Greece has been recently presented (Lipitakis, 2013). In this research work the managerial implications in the UK and Greece are discussed and the proposed e-business model by considering four e-business strategy planning variables (formality, participation, thoroughness and sophistication) is examined as managerial tool investigating the relationships between e-business strategic planning and performance, the directions of these relationships and existing similarities/differences in the UK and Greece. The improved Lipitakis-Phillips (LP) model can be used as a benchmarking tool to measure e-business strategy planning and performance and to examine if any e-business strategy planning set of parameters need to be adjusted to optimize its performance. Similar investigations have been presented in related research work (Lipitakis, 2013; Caniato et al., 2009; Coltman et al., 2008; Johnston, 2007).

It should be noted that in other multidisciplinary fields, such as the applied computing science and adaptive algorithmic theory, where e-business performance may be evaluated using adaptive algorithms and perturbation techniques, e-business problems and strategy management methodologies may be algorithmically treated. The algorithmization of the model, or in part, allows it to be transferable and applied to wider theoretical areas. This opens a whole host of scientific fields and research topics to which the research may be applied. Indicatively, among them are: Digital Information Management, Computer Modelling and Simulation. The proposed model may also be adapted for Knowledge Management and e-Learning, by adaptive computational modelling for solving e-business and knowledge management problems as well as in business intelligence, financial engineering business intelligence and financial engineering applications.

The dependent variables of financial and non-financial performance of organizations can be influenced by e-business strategy planning and performance, and existing relationships between the independent variables and dependent variables as well the directions of these relationships have been investigated by using quantitative research methods in the case of UK and Greece for testing the considered hypotheses (Lipitakis, 2013). Related numerical results and statistical analysis have shown that in UK participation and formality had positive relationships with financial performance and non-financial performance respectively. Elements of e-business strategy planning, strategy planning and performance management have been considered and it has been shown that strategy planning components have positive relationship with e-business strategy and performance, while the proposed model is extendable, valid and easily adaptable in several national environments (Lipitakis, 2013).

In the following several numerical results and statistical analysis for e-business strategy planning and performance concerning the case of comparative studies of the UK and Greece are given. In

the framework of comparison of UK and Greece management techniques many management techniques have been considered and the outcome is given in figure 5.1. Note that the four most used techniques were performance benchmarking, customer surveys, SWOT analysis and knowledge management (Lipitakis, 2013).

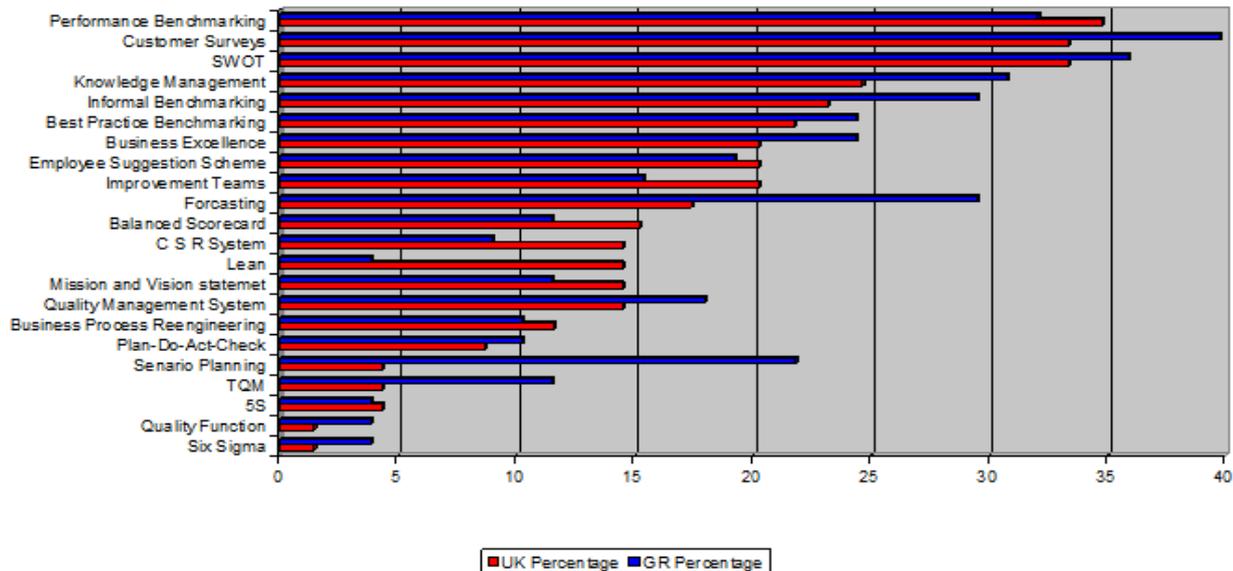


Figure 5.1: Comparison of Management Techniques used in the UK and Greece
 The bivariate correlations of the independent and dependent variables in the UK and Greece (Nat. Stat. Service of Greece, 2012) are summarised in Table 5.1.

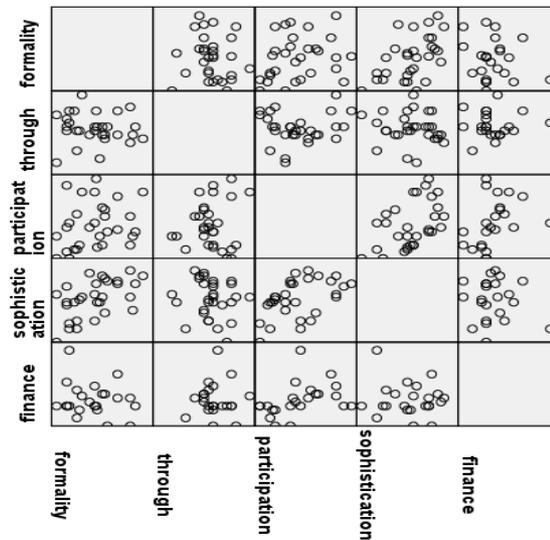
			Formality	Thoroughness	Participation	Sophistication
GR	Financial	Pearson's r	0.565**	0.409**	0.631**	0.679**
		R ²	0.319	0.167	0.398	0.461
		p-value	<0.001	<0.001	<0.001	<0.001
	Non-Financial	Pearson's r	0.469**	0.433**	0.524**	0.586**
		R ²	0.219	0.187	0.274	0.343
		p-value	<0.001	<0.001	<0.001	<0.001
UK	Financial	Pearson's r	.041	.093	.196*	.015
		R ²	.002	.009	.038	.0002
		p-value	.657	.310	.032	.867
	Non-financial	Pearson's r	.210*	.052	.103	.130
		R ²	.044	.0027	.010	.016
		p-value	.021	.571	.261	.158

** . Correlation is significant at the 0.01 level (2-tailed).

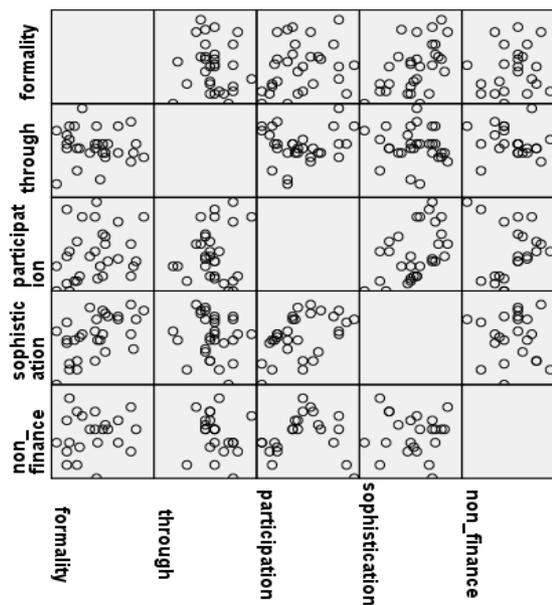
* . Correlation is significant at the 0.05 level (2-tailed).

Table 5.1: Results of the bivariate analysis for the dependent and independent variables of the GR

Indicative statistical results concerning the correlations between independent variables and financial/ non-financial performances are next given. Specifically, the existence or non-existence of correlations is depicted in the following graphs:



Graph 1: Correlations between independent variables and financial performance



Graph 2: Correlations between independent variables and non- financial performance

Further related numerical results and statistical analysis can be found in a recent research work (Lipitakis, 2013).

The proposed adaptive algorithmic schemes can be efficiently used for solving complex e-business and strategic management problems by using special parameters related to quantitative and qualitative nature of the input parameters (large data sets) leading to (near) optimum solutions, a performance analogue to that of the genetic algorithmic approach (McGrath, 2016; El Karoui, 2013; Vose, 1999; Holland, 1975). Furthermore, for comparison studies of strategic planning performance evaluation of various large organizations and businesses by using a large scale iterative application of the proposed models a hierarchical evaluation table can be obtained and used for multipurpose tasks (financial services, stock market, stakeholders, commercial projects, leadership, management, public funding evaluation committees etc.)

The proposed e-business models for performance evaluation can be used by theoreticians for academic purpose and research and practitioners in commercial sphere for improving their large organization performance in complex e-strategic planning and various related e-services.

Limitations of the research work

Note that the obtained results may be affected by cultural differences between several countries, where the research models should be tested by using different samples. This research study used a single timeframe and many organizational factors related to e-business benefits could change over time and the time dependency may be of critical importance (Lee et al., 2007). The nature of empirical data used in such measure studies may be subject to random errors inherent in this type of data (Rudd et al., 2008) and to complexity of e-business strategy (Coltman et al., 2007). The organization performance is not always easily measurable and the efficient measurement of financial and operational dimensions can be achieved by using accurate e-business performance measurements. Note also that risk analysis and strategic risk, which would have significantly complicated this research work, have not been included in the financial performance part of the models.

6. Conclusions and Future Research Work

This research work was based on key-field concepts of four interrelated sciences, i.e. Computer Science (adaptive algorithmic theory), Applied Mathematics (singular perturbation theory and partial differential equations) and Management Science (strategic management and e-business). The proposed adaptive e-business model containing the adaptive dynamic algorithmic approach and singular perturbation concept have been applied for solving efficiently several e-business problems. A characteristic case study has been considered and its corresponding adaptive algorithmic scheme is given. Furthermore, the adaptability and compactness of the proposed algorithm through the choice of singular perturbation parameters can lead to an (near) optimum solution of the considered e-business performance case study.

The proposed e-business models indicate how e-business strategic planning may affect financial and non-financial performance in businesses and organizations, exploring whether models which were used for strategy planning can be applied to e-business planning and whether these models would be valid in different environments in various countries. A conceptual model was constructed and qualitative research methods were used for testing a predetermined number of the considered hypotheses. These models can be tested in several countries and national/international regions and the conclusions including numerical results and statistical analyses can show the existing relationships between the considered dependent and independent variables.

The appropriate choice of the singular perturbation parameters, leading to efficient solutions, is an interesting *open problem* of future research work. This choice is closely related to both quantitative and qualitative nature of the input parameters (data) of the given problems and their corresponding dynamical algorithms can lead to (near) optimum solutions of a wide area of e-business problems, e-services and related applications. The proposed e-business models are expected to contribute to future e-business strategy planning of businesses and organizations, and managers should consider applying these models to their e-business strategy planning to improve their companies' performances. It has not escaped our notice that the proposed e-business strategy planning methodologies can be applied in a wider spectrum of applications, such as enterprise information systems, computing information technology, financial engineering business intelligence, digital information management, knowledge management and e-learning services. It is envisaged that these will be interesting challenging research subjects of future research work.

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