STRATEGIC INFORMATION SYSTEMS PLANNING AS A DYNAMIC CAPABILITY: INSIGHTS FROM AN AGENT-BASED SIMULATION STUDY

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ABSTRACT

Strategic information systems planning (SISP) helps companies to align their IT systems with their business plans. It claims to enable companies to gain competitive advantages. The resource-based view (RBV) of the firm might help to understand how and why. Drawing on prior research we believe that strategic IT planning is a dynamic capability, enabling a firm to reconfigure its resource configuration as theorized by Eisenhardt and Martin. However, this assumption has not been tested sufficiently yet. Using an agent-based simulation (ABS), this study tests to what extent strategic IT planning as a dynamic capability enables a firm to gain competitive advantages. We model an industry of companies striving for competitive advantages by optimizing their IT resources using dynamic capabilities. Given our operationalization of Eisenhardt and Martin's framework, we however cannot support the notion of SISP as a dynamic capability. Interestingly, companies in the simulation fail to realize competitive advantages because they do not anticipate competitors' moves and environmental uncertainty, an aspect deserving more attention in the resource-based view. These results and further research it may encourage demonstrate the potential of ABS for refining theories.

1 INTRODUCTION

Strategic IT planning claims to enable companies to realize competitive advantages (cf. Newkirk and Lederer 2006). By aligning the IT strategy with the corporate strategy, strategic IT planning leverages a company's IT-enabled resources. We investigate to what extent strategic IT planning acts as a dynamic capability allowing organizations to learn from previous IT investments. This sheds light on the open question how to employ IT-enabled resources to sustain competitive advantages (Tanriverdi et al. 2010). Our study is relevant for research on business and organizations as we believe that "inconclusive" evidence (Ward 2012, p. 165) on the sustained competitive advantage quest is strongly caused by methodological challenges of today's qualitative and quantitative methods. We therefore propose an alternative method of investigation for theory elaboration: An agent-based simulation.

ABS' innovative possibilities strongly influence our approach to investigate strategic IT planning as a dynamic capability: An ABS is well-equipped to formalize prior theorizing on the subject and to enable original insights on the question whether strategic IT planning acts as a dynamic capability. We propose to use ABS based on the theory building potential of simulation modeling in social science in general and in IT-related research in particular (Gilbert and Troitzsch 2011). To formulate the rules of a simulation model, the researcher has to use a set of explicit assumptions guided by theory (Axelrod 1997; Gilbert and Terna 2000; Marks 2007). This formalization process clarifies the theoretical mechanisms and boundary conditions of existing theories (Davis et al. 2007).

The contributions described in this article are theoretical as well as methodological. We link the resource-based conception of dynamic capabilities from Eisenhardt and Martin (2000) and strategic IT planning using an ABS. We move toward our theoretical objective – to underpin that strategic IT planning is a dynamic capability - by drawing on several strategic IT planning studies (refer to Ward and Peppard 2009 for general background) to formulate explicit hypotheses on the expected outcome for sustained competitive advantage. We work toward our methodological objective – to demonstrate the potential of ABS for theory building – by constructing an industry model, which is then used to test whether the simulation enables us to support the theoretical link between strategic IT planning and sustained competitive advantage. Finally, we discuss the findings of the model, theoretical implications, limitations and future research directions.

2 THEORY AND APPROACH

2.1 SISP as a Dynamic Capability

Drawing on the strategic management literature (e.g., Barney 1991; Porter 1985; Schendel 1994; Sirmon et al. 2010), our work is most closely related to dynamic capability theory from Eisenhardt and Martin (2000). The authors examine how a firm's dynamic capabilities affect its ability to achieve a sustained competitive advantage. Dynamic capabilities enable firms to alter their existing resource configuration; the more flexible resource configurations of a firm become once dynamic capabilities are present, the better the firm is able to achieve competitive advantages. We adopt Eisenhardt and Martin's (2000) definition that dynamic capabilities

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are “a set of specific and identifiable processes such as product development, strategic decision making and alliancing” that "create value for firms within dynamic markets by manipulating resources into new value-creating strategies" (Eisenhardt and Martin 2000, p. 1106). Dynamic capabilities enable firms to *integrate resources*, i.e. to combine different resources to achieve a specific end, to *reconfigure resources*, i.e. to apply resource combinations successfully used in one scenario to new challenges, and to *gain and release resources*, i.e. to acquire complementary resources and shed resources that are no longer needed.

Insight into the idea of *strategic information systems planning* (SISP) *as a dynamic capability* is limited (Tanriverdi et al. 2010). It can be assumed that the majority of IT assets actually add value to the company so that they are not a source of competitive disadvantage (Mata et al. 1995). Owning IT assets is rather a "strategic necessity" (Powell and Dent-Micallef 1997, p. 378). If an IT asset is rare and provides an advantage, competitors will copy, acquire or substitute it (Dierickx and Cool 1989). In the case of IT assets, this usually succeeds, so that the advantage from the IT assets themselves is at best short-lived (Ross et al. 1996) and hardly the source of sustained competitive advantage. SISP as a dynamic capability, complementing IT assets, may however explain varying levels of competitive advantage among firms.

The idea that IT/IS capabilities – bundles of IT resources, competencies and practices – affect competitive advantage has attracted much research (e.g., Melville et al. 2004; Mithas et al. 2011; Mithas et al. 2012; Nevo and Wade 2010; Piccoli and Ives 2005; Wade and Hulland 2004). For instance, Bharadwaj (2000) found that some companies did not merely implement new IT, but learned lessons from past experiences and applied them in subsequent projects. Using this capability allowed them to distinguish themselves in a way that is hard to imitate and substitute. They thus achieved superior firm performance. This highlights the path dependency of IT capabilities: Companies need to develop IT capabilities and cannot copy a given capability from competitors. If a company has built IT capabilities and uses them to modify its resource configuration, this combination can prove to be immobile and consequently the source of a sustained competitive advantage and increased firm performance (Bharadwaj 2000). SISP is a process that can help companies doing so. Similarly, it was argued that IT capabilities complement IT assets and reinforce each other mutually to achieve superior firm performance (Aral and Weill 2007).

From this brief literature review, it is clear that the thrust of the existing work has been to document the impact of IT/IS capabilities on competitive advantage and performance. Unless firms do not implement SISP as a complementary learning process, however, we consider it probable that they will fail to sustain competitive advantages. Indeed, we assert that in most markets, an intermediate step – if not necessary a palliative one – linking IT investments and firm performance is the learning process requiring strategic IT planning as a dynamic capability. Yet, despite many earlier investigations directly relating IT/IS capabilities to performance, we are not aware of empirical studies modeling the effects of SISP as a dynamic capability on competitive advantage.

2.2 Strategic IT Planning as a Dynamic Capability

One major assumption is that companies expect strategic information systems planning (SISP) to provide a competitive advantage (e.g., Galliers 1991; Kearns and Lederer 2003; Newkirk and Lederer 2006; Segars and Grover 1998). To the limited extent that existing literature demonstrates the direct performance outcomes of strategic IT planning processes, it suggests that strategic IT planning may precipitate better alignment of existing resource configurations (King and Teo 1997). There seems to be ample evidence that a systematic synchronization of a firm’s business goals and IT assets can assist in outmaneuvering competitors. For instance, Deutsche Bank currently uses its superior strategic IT planning capabilities to manage a major enterprise transformation (Gartner 2012; Deutsche Bank 2012). Costs are reduced by utilizing a core banking platform integrating both Deutsche and Postbank; in turn Deutsche is expected to become more cost efficient than its competitors in the German market. Additionally, only companies performing strategic IT planning regularly are able to adapt plans timely and sense crucial changes early on. Therefore, treating strategic IT planning as a dynamic capability should explain why regular strategic IT planning users enjoy more competitive advantages. If the assumptions of the resource-based view modeled in the simulation lead to this phenomenon, this indicates that the RBV can indeed explain this core assumption of SISP research. We therefore predict:

Hypothesis 1: If a company regularly uses SISP, it will perform better.

Since higher performance is desirable and regularly applied SISP is expected to increase performance, we can extend our first hypothesis by relating the strategic planning of a firm to the usage of SISP. According to Brews and Hunt (1999), evidence suggests that formal, strategic planning increases performance, especially in dynamic environments. Given the positive effects of SISP, companies that tend to plan ahead longer should thus be eager to use SISP to increase their competitive standing. After all, the SISP process requires substantial amounts of financial and non-financial resources, and only companies that expect long-term benefits will invest adequately (Segars and Grover 1998). When a firm plans ahead further than its competitors, it should thus be more aware of the importance of the SISP process to achieve strategic goals. Consistent with these prior lines of work, we therefore anticipate:

Hypothesis 2: If a company plans ahead further than competition, it will also use SISP techniques to a greater extent.

Although guidelines and recommendations on how to perform SISP exist (e.g., Pant and Hsu 1999; Ward and Peppard 2009), successful SISP takes more than just a step-by-step procedure. Segars and Grover (1998) and King and Teo (1997) argue that an SISP process will improve over time and will become increasingly better at integrating business and IT. For example, Premkumar and King (1994) have identified three stages of IS planning evolution. Companies more experienced in SISP should thus enjoy better performance, allowing them to realize competitive advantages at lower costs.

Hypothesis 3: If a company is more adept in SISP, it will outperform less adept competitors.

Finally, we expect that the link between SISP skills and performance is strongest in an uncertain environment. As uncertainty increases, companies should be more sensitive to their SISP capabilities and hence be more responsive to SISP capability investments, increasing the effect of SISP capability on performance. If there is little environmental uncertainty, the amount of information required for planning is lower and adapting to changes might not play an important role. In uncertain environments, however, SISP can provide advantages by helping companies to anticipate and learn about environmental dynamics (Sabherwal and Kirs 1994). Thus, companies that expertly use SISP should outperform companies with limited SISP expertise even more in uncertain environments (Newkirk and Lederer 2006).

Hypothesis 4: The higher environmental uncertainty, the greater the effect of SISP skill on performance.

3 OUR MODEL OF AN INDUSTRY

We used an ABS to create a model of an industry with competing companies. ABS allows us to control variables that cannot be influenced in reality, such as environmental uncertainty or companies' strategies.

The companies modeled as agents behave according to a set of rules, the program code. Our aim is to determine whether SISP can be considered a dynamic capability in the sense of the RBV. We thus used the assumptions of the RBV to create rules for our simulation. If our agents exhibit a behavior expected based on empirical findings of the SISP literature (similarity of simulated data and collected data, cf. Gilbert and Troitzsch 2011, p. 17), our hypotheses can be confirmed.

Modeling the regular business planning process adopted by most organizations (Teubner 2007), the simulation is turn-based. Every turn, companies choose their course of action; environmental uncertainty may alter the market, and companies having a competitive advantage will be rewarded by a score of points. Table 1 gives a high-level overview of the events occurring once at the initialization and repeatedly throughout the turns.

RBV scholars posit that to attain competitive advantage not a single resource but a specific combination of resources is necessary (e.g., Amit and Schoemaker 1993; Barney 1991). In the simulation, this is represented by several competitive advantage optima (CAO).

Table 1. Simulation Mechanisms

Seq.	Action
I.	Randomly generate competitive advantage optima (CAO) resource configuration
II.	Randomly generate companies' resource configuration
1.*	Randomly change CAO resource configuration, depending on environmental uncertainty
2.*	Agents compare different options and select the "best" one
3.*	Agents execute the "best" option
4.*	After all agents have executed their options, the winner(s) of this round are determined
* Step repeated each turn	

As depicted in Figure 1, a CAO is a vector of randomly determined resources, e.g. (4, 7, 8). If a company is the only one that manages to fit its own resource portfolio to the CAO, it gains a competitive advantage and is rewarded with a set score. Referring to Schumpeter (1934), Barney (1991) points out that as demands and innovations shift, the resources necessary to stay ahead of competition change too. As shown in Figure 1, this environmental uncertainty is reflected in changes in the CAO's resource portfolio. Every turn, a random resource might be replaced by another, forcing the companies to adapt to stay competitive. For example, the CAO's changes from (4, 7, 8) to (4, 5, 8).

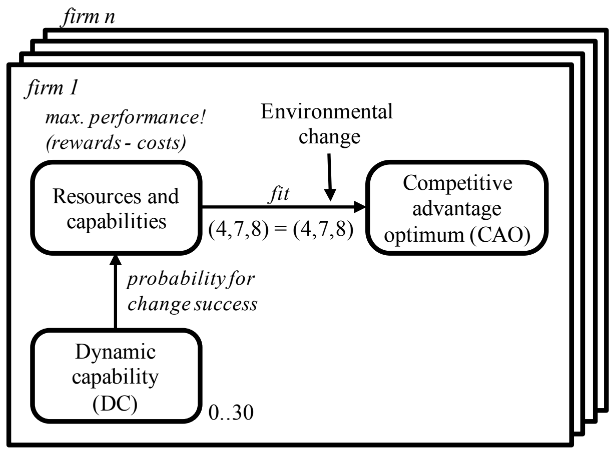

Figure 1. The model distilled

One of the most important characteristics of a dynamic capability is that it can be used to add, shed, or recombine resources (Eisenhardt and Martin 2000). In our simulation, we assume that SISP is a dynamic capability that helps companies adapt their IT and related resources to the needs of the market. Companies thus have a given SISP capability, measured on a scale from 0 to 30, and can use this capability to actively alter their resource configuration every turn, i.e. replace an existing resource with a new one. Like resources, dynamic capabilities are not distributed equally (Bharadwaj

2000). If a company is not experienced in SISP, the resource reconfiguration might go awry, and the company will not attain the desired configuration. As argued by Eisenhardt and Martin (2000), however, the company's dynamic capability will improve with exercise, even if the resource transformation is unsuccessful – in that case, the learning effect will be even greater as companies learn from small mistakes (Hayward 2002). For instance, a company might want to change its resource configuration from (4, 8, 1) to (4, 8, 5). The better the company is at a dynamic capability, the easier it is to "fit […] the pieces together" (Powell and Dent-Micallef 1997, p. 379) and recombine its resources. In the simulation, the success of a resource change increases with the company's dynamic capability (cf. Figure 1). In our example, if the company's dynamic capability is rather low, the company will likely fail and end up with an undesirable configuration of e.g. (4, 8, 2). However, due to the experience it gained, the failure increases the firm's dynamic capability.

Not every company will try to improve its IT resource portfolio in every turn. A company might already enjoy a competitive advantage and not feel that action is necessary. As changing the resource portfolio is usually associated with costs (financial or non-financial), the company might also expect this course of action to yield less return than it incurs expenses. In this case, the company might decide to take no action during a turn. While this incurs no costs, the dynamic capability will erode as it is not exercised (Holan and Phillips 2004).

Alternatively, the company might also find that it needs to change its resource configuration, but currently does not have the necessary SISP skills to do so. In this case, the company can decide to improve its dynamic capability by spending funds on learning (Newkirk and Lederer 2006). In the simulation, the dynamic capability will increase more than by applying SISP and changing the resource configuration.

Of these three possible actions, only one can be performed in each turn. The sole goal of the agents is to maximize their overall income (i.e. the score of 100 they receive for every turn they achieve a competitive advantage) while keeping their costs (i.e. the units spent on actions – 0 for doing nothing, 5 for learning, 50 for resource changes) as low as possible, thus improving what we define as their *performance*. Companies in our model do not interact directly but are aware of each other's resource configurations.

4 EXPERIMENTAL SETUP

To test our four hypotheses, we run 24 scenarios, each with 100 runs resulting in 2.400 experiments. To set up our experiments and to determine the necessary number of runs, we thereby followed the procedure described by Law (2007, pp. 500 - 504). This section outlines the setup of input variables for each experiment performed. Table 2 gives an overview of hypotheses and the independent variables manipulated to test them.

To test H1, we used a base scenario (cf. Appendix 1). We analyzed the results of the basic setup and assigned credits for every turn a company used strategic IT planning. If a company used strategic IT planning repeatedly, the credits increased exponentially as repetitive learning facilitates success. By using this credit assignment procedure, we determined how regular a company was using its dynamic capability.

To test H2, we increased one company's propensity to plan ahead. Three experiments were performed, with this company's planning horizon (how many future turns a firm includes in its decision making process) extended from 1 to 2 and then 3 turns. Depending on how many turns ahead a company plans, it evaluates the consequences a given action (e.g. replacing a resource) has in the next turns. It also considers that it again has different choices in future turns, rendering the decision rather complex.

Table 2. Independent and dependent variable(s)

	Hypothesis	Dep.	Indep.
H1	If a company regularly uses SISP, it will perform better.	Perf.	Use of SISP
H2	If a company plans ahead longer than competition, it will also use SISP techniques to a greater extent.	Use of SISP	Planning horizon
H3	If a company is more adept in SISP, it will outperform less adept competitors.	Perf.	SISP skill
H4	The higher environmental uncertainty, the greater the effect of SISP skill on performance.	Perf.	Uncertainty in environment SISP skill

To test H3, we implemented two approaches to manipulate a company's dynamic capability. In approach 1, the company received a given initial dynamic capability, which was increased from a medium to a very high skill level over the course of five experiments. If the company decided not to apply the dynamic capability, its strategic IT planning skill would subsequently deteriorate. A high initial strategic IT planning capability was thus not guaranteed to continue throughout the simulation. In approach 2, we forced the company to use strategic IT planning in a percentage of its decisions, modeling e.g. the use of strategic IT planning to be dictated by a corporate directive. In this case we did not provide the company with a pre-determined initial strategic IT planning skill, but through subsequent application the company increased its skill. We performed three such experiments, increasing the number of cases in which the company had to choose SISP - i.e. change the resource configuration or learn - from 60% to 80% and finally 100%.

We used these alternative approaches to set up experiments for H4 as well. In this case, however, we also manipulated environmental uncertainty, i.e. the probability that a competitive advantage optima will change in a turn. Approach 1 was similar to the test of H3:

Three experiments increasing the initial SISP skill of one company from a medium to a very high level. We then performed these three experiments twice, with a 30% vs. an 80% chance of competitive advantage optima change. We used the same structure on approach 2, replicating the three experiments conducted for H3 twice, with a 30% vs. an 80% chance of competitive advantage optima change.

5 RESULTS

H1 proposed that companies using strategic IT planning more often would perform better. *Performance*, the dependent variable, is equal to the score accumulated throughout the simulation run, minus costs incurred. Using regression analysis, we found a significant link between the use of the dynamic capability and performance, but it was negative rather than positive. Companies that used strategic IT planning tended to perform worse than their counterparts. The use of strategic IT planning explained 18.8% of the difference in the dependent variable, performance.

Our experiments for H2 were evaluated using ANOVA. We analyzed the choices made by each company each turn and recoded them, with 1 standing for the use of SISP, and 2 standing for doing nothing (no SISP used). By calculating the mean of those recoded values, we can determine to what extent the companies used SISP. A mean value of 1.5 for example would indicate that the company used SISP and the "do nothing" option to a similar extent across the runs. We could confirm that companies that plan ahead longer used SISP techniques to a greater extent. However, we only found significant differences between group 1 (companies that plan ahead one turn) and groups 2 and 3 (companies that plan ahead two respectively three turns). With p=0.495, there was no significant difference between groups 2 and 3.

Evaluating approach 1 to test H3, we could not find a significant performance difference between those companies with an average and those with an above-average SISP skill (p=0.411). Approach 2 to H3 did not exhibit a significant influence of SISP skill on performance either, as our ANOVA showed (p=0.193): we had to reject H3 with a confidence of 95% for both approaches.

Using 2-way ANOVA, we could partially accept H4 for approach 1: As in H3, there was no significant link between SISP skill and performance as the test of between-subjects effects revealed. Neither did the covariate of the independent variables have a significant influence on the dependent variable. However, environmental uncertainty did have a significant effect on performance, in that higher environmental uncertainty led to lower performance. A 2-way ANOVA of approach 2 revealed similar results: There was a significant difference between groups with high and low environmental uncertainty, but there was no significant influence of SISP skill. The interaction effect between environmental uncertainty and SISP skill was not significant, either. Appendix 2 includes the complete set of results for detailed analysis.

6 CONCLUDING REMARKS

We tested whether companies competing in an industry modeled after the ideas of the resource-based view of the firm achieve outcomes claimed in the strategic IT planning literature. We had to reject nearly all hypotheses. Thus we conclude that SISP did not display the characteristics of a dynamic capability in our simulation. However, we gained valuable insights into how a company's resource configuration and its dynamic capabilities link to competitive advantage.

6.1 Limitations of the Study

The non-positive effect of a higher strategic IT planning skill on competitive advantage in our simulation might have several reasons. One reason may be that the simulation model was not correctly specified. Important aspects of the resource-based view and dynamic capabilities according to Eisenhardt and Martin (2000) might have been overlooked. We might have tilted the balance of realism and simplicity too far towards the latter in some aspects. For example, agents systematically evaluate all possible courses of actions, sometimes across multiple turns. Depending on how many resources are available, this can amount to the rational evaluation and scoring of hundreds of actions every turn, not unlike a *homo oeconomicus*. In the real world, intuition and thereby limited rationality might also influence decision making. Furthermore, there are clearly settings where the accumulation of resources is important too. We held resources abstract to focus on the influence of the dynamic capabilities, which might have been an oversimplification. However, we tried to mitigate concerns about possible deduction errors by following a transparent and comprehensible procedure to derive our hypotheses. We also did our best to set the parameters guiding the companies' behavior to realistic levels. Still, more extensive calibration methods could increase the validity of our results.

6.2 Using ABS for Theory Building

We conclude that our example illustrates how the use of ABS helps theory building in several regards. On the one hand, creating a model to implement a simulation requires the explicit statement of a range of rules describing agents' actions. These rules may be formulated as testable hypotheses, too, if they cannot be clearly derived from existing research. On the other hand, implementing and running a simulation can lead to surprising results. Based on the emergent properties of agent based simulations, these results cannot be foreseen before the simulation program is actually run. Once they are analyzed, reflection both on the model and on the tested hypotheses should occur. If the hypotheses tested are falsified as described here, this does not necessarily provide direct insights into the real-world problem. Rather, it shows that there appears to be no working link between the model and the expected outcome. This may be due both to modeling assumptions and to the assumptions stated in the hypotheses. Only after careful consideration of alternative modeling and testing approaches can we consider a final rejection of the hypotheses. For this deliberate analysis, the agent based simulation has been shown to be a valuable tool.

6.3 Interpretation

We gained insights on how companies achieve and sustain competitive advantages. H1 could not be confirmed: Firms that used strategic IT planning more often performed worse. The simulation rules make sure that organizations only choose options that they expect to have a positive impact on performance. Their inability to capitalize investments may have three reasons: Their strategic IT planning capability is too low to allow them to realize the desired resource changes; due to environmental uncertainty next turn's competitive advantage situations will be different from the current to which they tried to adapt; competitors might have acquired a better or similar resource configuration.

Concerning H2 we were able to confirm that companies that plan further ahead also use strategic IT planning to greater extents. They obviously anticipate that changing their resource configuration will lead to higher performance in subsequent turns. The rejection of H1 shows that they cannot realize these expectations.

Both approaches of testing failed to support H3. Companies that are more adept in strategic IT planning (had a pronounced dynamic capability) did not outperform their competitors. Further analysis revealed that companies with high strategic IT planning skill seldom failed to improve their resource configuration. It is surprising that this improvement did not help them to gain a competitive advantage. The reasons for their inability to realize a higher performance appear to be external rather than internal. In the majority of cases, companies could not gain a competitive edge because they did not anticipate their competitors' moves or environmental uncertainty.

The experiments for H4 revealed that environmental uncertainty plays an important role in our simulated industry. If the market place changes frequently, mean performance decreases drastically.

6.4 Opportunities for Future Research

In addition to the replication and extension (the model we created is highly configurable) of our approach by peers, we see three promising ways to proceed further. First, although our model has considerable complexity, it is easy to imagine more complex interactions among agents. In particular, we find that focusing on the own resource configuration is insufficient to gain a competitive edge. The resource-based view strongly emphasizes the resources of the focal organization, following the "swings of a pendulum" (Hoskisson et al. 1999) as the currently predominant theory in strategic management after Industrial Economics. Our findings suggest that future research may benefit from considering the competitive situation of a company, which is often influenced by factors outside the focal company's sphere of control. Two additional next steps may be to link the notion of strategic IT planning as a dynamic capability more tightly to models of complexity (Porter and Siggelkow 2008; Tanriverdi et al. 2010) and path dependence (Schreyögg and Kliesch-Eberl 2007) and also to increase the artificial intelligence of the agents in the simulation.

We conclude with first sketches how to extend dynamic capabilities theory in the light of our findings.

Our analysis finds that an easier reconfiguration of resources, following from higher strategic IT planning skills, was not able to explain a better performance, even in dynamic environments (i.e., refer to H3 and H4). This finding conflicts with Eisenhardt and Martin's theory. We derived it on a purely analytical level; future research might attempt to empirically clarify the boundary conditions of the relationship. Our results let us suspect that the costs for building a dynamic capability, or more specifically investments in strategic IT planning, could easily exceed performance gains. Empirically grounded data on relative cost differences between improving a dynamic capability, employing it, and not using it could help investigating this aspect further. The trade-off between investing in building a dynamic capability and the benefits from more flexibility through this dynamic capability deserves more research. How, for example, can the optimal level of investment in strategic IT planning be determined? We suspect that a more formal definition of a company's abilities to integrate, reconfigure and gain or release resources is a prerequisite for a thorough test of Eisenhardt and Martin's theory and to increase its empirical ability to predict performance differences across companies. The results of our model thus suggest that a healthy skepticism should guide future empirical studies about the extent to which strategic IT planning as a dynamic capability helps gaining a competitive advantage.

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Appendix 1 - Description of base scenario

No. of runs	100
No. of companies	10
No. of turns	30
Propensity to plan ahead (in turns)	1
All think ahead the same number of turns?	Yes
No. of distinct competitive advantages	3
No. of distinct resources	10
No. of resources in a company's resource configuration	3
No. of resources per competitive advantage optimum (CAO)	3
Maximum dynamic capability (DC)	29
Companies' choices cost restricted?	No

Maximum rent	51
Environmental uncertainy (prob. that CAO changes per turn)	30%
Probability of resource configuration change if DC max.	27%

Costs for…	
- changing resource configuration	50
- learning	5
- doing nothing	0

Effects of..	
- learning on DC	5
- doing nothing on DC	-2
Effect of changing resources on DC	
- if successful	1
- if failed	2

Force of SISP use c_0 in every case?	No
Force of SISP use *c0* in % of cases?	No

Appendix 2 - Descriptive statistics

Scenario	Independent variable 1	Value	Independent variable 2	Value	Dependent var.	Mean	St. dev.
1 (H1)	-	-	-	-	Performance	**-109.37**	546.06
2 (H2)	Propensity to plan ahead	1 turn	-	-	Chose SISP*	**1.53**	0.12
3 (H2)	Propensity to plan ahead	2 turns	-	-	Chose SISP*	**1.36**	0.17
4 (H2)	Propensity to plan ahead	3 turns	-	-	Chose SISP*	**1.34**	0.14
5 (H3[1])	Initial dynamic capability	15	-	-	Performance	**-87.30**	638.63
6 (H3[1])	Initial dynamic capability	19	-	-	Performance	**-61.30**	597.71
7 (H3[1])	Initial dynamic capability	23	-	-	Performance	**16.70**	578.02
8 (H3[1])	Initial dynamic capability	27	-	-	Performance	**-18.05**	609.48
9 (H3[1])	Initial dynamic capability	30	-	-	Performance	**65.45**	629.75
10 (H3[2])	Force use of SISP in % of turns	60	-	-	Performance	**-179.100**	591.38
11 (H3[2])	Force use of SISP in % of turns	80	-	-	Performance	**-208.70**	585.72
12 (H3[2])	Force use of SISP in % of turns	100	-	-	Performance	**-274.20**	607.79
13 (H4[1])	Initial dynamic capability	20	Environmental uncertainty	30	Performance	**-48.65**	504.74
14 (H4[1])	Initial dynamic capability	20	Environmental uncertainty	80	Performance	**-296.75**	516.83
15 (H4[1])	Initial dynamic capability	25	Environmental uncertainty	30	Performance	**4.55**	588.15
16 (H4[1])	Initial dynamic capability	25	Environmental uncertainty	80	Performance	**-353.85**	342.16
17 (H4[1])	Initial dynamic capability	30	Environmental uncertainty	30	Performance	**-43.75**	345.84
18 (H4[1])	Initial dynamic capability	30	Environmental uncertainty	80	Performance	**-352.65**	292.67
19 (H4[2])	Force use of SISP in % of turns	60	Environmental uncertainty	30	Performance	**-112.70**	504.89
20 (H4[2])	Force use of SISP in % of turns	60	Environmental uncertainty	80	Performance	**-234.20**	640.16
21 (H4[2])	Force use of SISP in % of turns	80	Environmental uncertainty	30	Performance	**-222.80**	709.63
22 (H4[2])	Force use of SISP in % of turns	80	Environmental uncertainty	80	Performance	**-400.25**	276.94
23 (H4[2])	Force use of SISP in % of turns	100	Environmental uncertainty	30	Performance	**-508.45**	328.56
24 (H4[2])	Force use of SISP in % of turns	100	Environmental uncertainty	80	Performance	**-636.45**	371.64

*The smaller this value, the more often SISP (learning or changing resource configuration) was chosen [1,2]Approach 1 and 2