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Gaining Competitive Advantage from Digital Data Genesis Dynamic Capability: the Moderating Role of Environmental Turbulence

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Abstract. Dynamic Capabilities are often considered as the factor justifying the different degrees of success of organizations in turbulent environment. In this paper we investigate whether companies that have achieved a Digital Data Genesis dynamic capability hold an IT-based competitive advantage. Further, we evaluate whether environmental turbulence has a moderating effect on this relationship. We based our findings on a survey of 92 Italian companies gathering data in 2011 and 2012. We find that Digital Data Genesis Dynamic Capability has a positive influence on IT-based competitive advantage and that environmental dynamism moderates such relationship.

Keywords. Digital Data Genesis; dynamic capabilities; IT-based competitive advantage; environmental turbulence.

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1. Introduction

Explaining the variation in the degree of success of business organizations is an evergreen issue in management research, including information systems and strategic management. Dynamic Capabilities (DC) have been linked to firm performance, particularly in turbulent environment [1]. However DC remain a debated and at times unclear research construct. As a consequence, research in this area is clearly important. In this article we seek to contribute to the emerging literature on Information Technology (IT) DC and their impact on competitive advantage. We do so in the context of a particular DC: Digital Data Genesis (DDG). We define DDG as the coming into being of digital data. Thus, DDG is a phenomenon (an

observable fact or event) that pertains to the generation of new data natively in digital form. That means that the timing of digital data generation is concurrent with the event that gave rise to the data. For example, when a waiter takes an order, table-side; using a palm device an informational representation of the customer wishes is created in real-time in digital form.

Since dynamic capabilities allow organizations to reconfigure organizational capabilities in response to turbulence in the business environment, and since data is a precursor to many organizational processes, including sensing turbulence in the environment to make strategic corrections, we decided to study DDG dynamic capability. Indeed, we believe that data can really provide a competitive advantage, due to the fact that nowadays ICT (Information and Communication Technologies) are pervasive and ubiquitous and all business or social activities are now generating a corresponding digital data event. Specifically, we look at whether DDG dynamic capability determines a competitive advantage in firms, looking at the moderating effect of environmental turbulence, and investigating these research questions: Does DDG dynamic capability provide a firm with an IT-based competitive advantage (ITCA)? Does industry environmental turbulence moderate this relationship between DDG dynamic capability and ITCA? To investigate the above-mentioned questions, this study formulates eight hypotheses grounded in the resource based view of the firm. The hypotheses are tested on a sample of 92 Italian companies.

2. Theoretical background and hypotheses

2.1 The Resource-based view

The resource-based view (RBV) has been adopted in Information Systems research to theoretically ground studies on firm level competitive advantage and its sustainability [2]. This perspective highlights the importance of the firm's internal resources for the evaluation of its competitive advantage [3].

Resources that are valuable and rare can provide temporary competitive advantage, and the extent to which these resources are also inimitable, immobile and non-substitutable between firms explains the sustainability of that competitive advantage over time [4]. While this perspective pays considerable attentions to the firm's internal resources, it has the weakness of excluding the socio-economic environment beyond the firm's boundaries. Environmental conditions could change and make the firm's resources far less valuable, so the RBV has had to be extended to better explain firm competitive advantage in turbulent environments [3].

2.2 DDG Dynamic Capabilities

In turbulent environments, organisations need to constantly match or create market changes and DC are "the firm's processes that use resources - specifically the processes to integrate, reconfigure, gain and release resources - to match and even create market change" [3]. Hence, DC have the potential to create, to evolve and

to recombine internal existing resources to adapt to turbulent environments [5]. This adaptability is especially required in fast-paced technological environments, as it has been theorized that adaptability can lead to improved customer value.

The RBV foresees a direct relationship between DC and the firm's process performance [6]. Hence, in today's competitive environment characterized by increasing IT intensity organizations should be capable of integrating new or established IT. A number of DC have been documented in the literature, in this study we focus on an emerging dynamic capability based on DDG [7].

We define DDG dynamic capability as the three-fold organizational process of: (1) **choosing IT** in order to unobtrusively generate and capture data in digital form; (2) **integrating IT** in the appropriate business processes; (3) **managing digital data** so produced.

We theorize DDG dynamic capability as a dynamic capability because it consists of deploying new configurations of operational competencies relative to the competition [8] in the context of DDG. In other words, a firm with a developed DDG dynamic capability is able to identify opportunities for digital data generation and to recombine internal existing resources and data to adapt to changing environmental conditions. The scope of possibilities in deploying new configurations depends also on the degree of **reconfigurability** of the ineffective DDG process into more promising one that better match the environment, better, faster, and cheaper than the competition [3]: the higher the degree of DDG reconfigurability and the more dynamic is DDG dynamic capability. Exemplars for its DDG dynamic capability is Harrah's corporation which, over time, systematically integrates IT, such as computerized slot machines or RFID chips, to gain unobtrusively valuable digital data on customers' behaviour at the Harrah's casinos and it exploits these data to profile and reward customers [7].

2.3 The impact of DDG DC on ITCA

Firms use DC in order to respond quickly to environmental changes, and to respond to new opportunities. Indeed, contributions of dynamic capabilities can occur in several ways. First of all, DC can affect directly and positively firm performance by allowing them to respond to opportunities by developing new processes, products and services [9], which can determine a potential revenue increase. Secondly, dynamic capabilities can improve the speed, the effectiveness and efficiency with which firms respond to environmental changes. Thus firms can achieve a competitive advantage. Indeed, if a firm uses dynamic capabilities more than its direct competitors, the relative performance should be higher. Therefore, we propose that DDG dynamic capability positively affects the ITCA. In particular:

H1: DDG Dynamic capability's process of choosing IT positively affects ITCA.

H2: DDG Dynamic capability's process of integrating IT positively affects ITCA.

H3: DDG Dynamic capability's process of managing digital data positively affects ITCA.

H4: DDG Dynamic capability's reconfigurability positively affects ITCA.

2.4 The moderating effect of environmental turbulence

Environmental turbulence refers to the rate of instability in an industry (i.e., changes in the preferences of customers, development of new products and technology) [10]. These environmental features impact differently on the development of ordinary and dynamic capabilities [11]. Looking at dynamic capabilities, they can provide a competitive advantage since they can extend and modify other routines by ensuring that the firm can change its overall operations and have new sets of decisions options [12]. Hence, firms operating in turbulent environments can gain greater benefits due to their ability of reconfiguring their dynamic capabilities to environmental changes. Therefore, we propose the following relationships (Figure 1):

H5: The higher the degree of environmental turbulence, the higher the contribution of DDG Dynamic capability's process of choosing IT to ITCA.

H6: The higher the degree of environmental turbulence, the higher the contribution of DDG Dynamic capability's process of integrating IT to ITCA.

H7: The higher the degree of environmental turbulence, the higher the contribution of DDG Dynamic capability's process of managing digital data to ITCA.

H8: The higher the degree of environmental turbulence, the higher the contribution of DDG Dynamic capability's reconfigurability to ITCA.

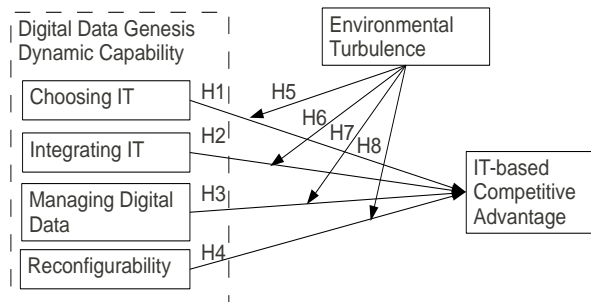


Fig. 1. Research model

3. Methodology

We conducted a questionnaire-based survey to test our hypotheses. To improve generalizability, data have been collected in 2011 and 2012 in different Italian regions. We proposed to our informants structured interviews and online questionnaire. Given that the best approach to measure DC is the process-oriented view [13], our key informants were sales managers. Sales department appeared as one of the departments more advanced in DDG for the improvement of the customer relation [7].

Existing and tested measurement scales operationalized all the constructs of the model, with one exception: DDG dynamic capability's process of choosing IT construct. We did not find any tested scale for this construct in the literature. As a

consequence, we preliminary tested it through a pilot study using the four indicators available in the literature [14], but never empirically tested. 35 managers in different industries, in United States SME and big enterprises participated to the test. We included the four indicators in a set of 26 other questions to reduce common method bias (the scale's reliability had a Cronbach's Alpha equal to 0.837). For all the other constructs, we exploited the already tested scales and we did not pilot studied further:

- Choosing IT: it measures the ability to choose emerging/enabling IT to gain unobtrusively valuable digital data [14].
- Integrating IT: IT Business process integration category of the IT Capability construct [16] measures the ability to integrate in the business processes such IT.
- Managing digital data: it adapts the information management dimension of the information capability measurement scale [15], to measure the ability to manage digital data.
- Reconfigurability: the adaptation of the reconfigurability measurement scale [8] estimates the potential to reconfigure DDG.
- ITCA: it is operationalized by considering an adaptation of the existing Likert scale [17]. It measures the ability of the company to achieve competitive advantage from the use of DDG.
- Environmental turbulence: it was assessed using national accounting data from Istat for each industry segment (defined at a 3-digit level of NACE codes). It was measured as the standard error of the regression slope coefficient of annual industry sales divided by the industry mean for the 5 year period [10]. Finally, it was standardized.

Preliminary to the main data collection we operate two different methods: expert panel, involving 7 Sales managers, and Q-sorting, involving 119 people.

4. Results and Analysis

We collected 92 questionnaires, but only 78 were usable to test the research model. The remaining 14 questionnaires contained missing data, which prevent us from exploiting them (see Table 1 for sample composition).

Table 1. Sample composition concerning industry and size

Industry	Size				Total
	2 to 9	10 to 49	50 to 499	> 500	
Manufactory industry	1.27%	25.32%	27.85%	11.39%	65.82%
Construction	2.53%	8.86%	3.80%	2.53%	17.72%
ICT service	0.00%	0.00%	2.53%	0.00%	2.53%
Communications, Public Administration and other services	1.27%	7.59%	5.06%	0.00%	13.92%
Total	5.06%	41.77%	39.24%	13.92%	100.00%

Two chi-squared tests did not reveal any statistically significant difference for the presence of DDG across companies' size, industry and data gathering time. We ran a confirmatory factor analysis and deleted problematic variables and items for the four measures of DDG dynamic capability and for the competitive advantage measure. Collinearity analysis, through the observation of the correlation matrix and the computation of the tolerance values did not highlight any risk of multicollinearity, given that the correlation coefficients are lower than 0.9 and the tolerance values above 0.19. We measured reliability through Cronbach's Alpha and all the values are above the 0.7 threshold, except for DDG dynamic capability's process of integrating IT, which as a consequence was excluded in the following tests.

We performed a multiple regression analysis, on the companies with DDG, to test firstly our hypotheses about the immoderate relationship between DDG dynamic capability and ITCA (Figure 2). In this first step, we tested the positive relationship between reconfigurability, choosing IT and managing digital data, with the ITCA. Since all the coefficients were positive and significant we fully supported hypotheses 1, 3 and 4. The adjusted R-Squares were respectively equal to 66.24%, 71.49% and 64.88%.

Subsequently, we measure the moderating effect of Environmental Turbulence on the relationship between DDG dynamic capability and ITCA (Figure 3).

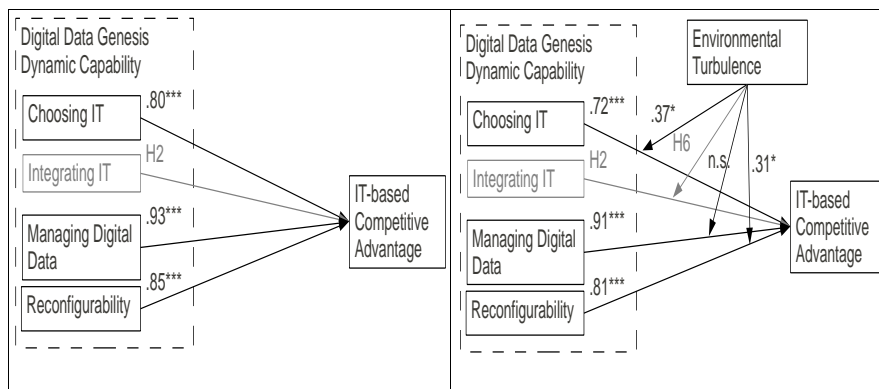


Fig. 2. Results of the tests of the direct relationship between DDG dynamic capability and ITCA (** p -value < 0.1%; * p < 5%)

Fig. 3. Results of the tests of the moderating effect of Environmental Turbulence on the relationship between DDG dynamic capability and ITCA (** p -value < 0.1%; * p < 5%)

We found a positive and significant relationship for the interaction between environmental turbulence with reconfigurability and choosing IT, but it was not significant for managing digital data. Thus hypotheses 5 was supported, 7 not support-

ed, and 8 was supported. The adjusted R-Squares were respectively equal to 69.11%, 70.33% and 69.30%.

5. Discussions and conclusions

All these results open up discussion concerning: (1) the impact of DDG dynamic capabilities on the ITCA; and (2) the mediating effect of environmental turbulence between DDG dynamic capability and the ITCA. Specifically, in this study, we theorized and examined two central research questions: Does DDG dynamic capability provide an ITCA to firms? Does environmental turbulence moderate this relationship between DDG dynamic capability and ITCA? We come up with two main results.

First of all, we found a positive impact of DDG dynamic capability on the ITCA. This means that the development of DDG dynamic capabilities, leveraging on digital data, is a firm opportunity for creating value and for profiting from their usage. Secondly, we found that environmental turbulence moderates the relationship between Dynamic Capability and ITCA. This underlines that in turbulent environments, companies with the DDG dynamic capability are able to recombine existing resources for achieving an ITCA.

By a managerial point of view, managers should be more aware about the importance that digital data are acquiring nowadays and about the competitive advantage that they can gain by collecting and managing them.

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