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Identifying and assessing the scales of dynamic capabilities: a systematic literature review

Cíntia Cristina Silva de Araújo
Administration Graduation Program, Universidade Nove de Julho, Sao Paulo, Brazil
Cristiane Drebes Pedron
Universidade Nove de Julho, Sao Paulo, Brazil, and
Claudia Bitencourt
Universidade do Vale do Rio dos Sinos, Sao Leopoldo, Brazil

Abstract

Purpose – The purpose of this paper is to identify the existing measure instruments for dynamic capabilities (DCs) in order to understand the tendencies of quantitative studies on DCs as well as to evaluate the reliability and validity of these scales.
Design/methodology/approach – To accomplish this objective, the authors conducted a systematic review of literature on DCs.
Findings – Main findings indicate that quantitative research works on DCs have focused on the relationship between DCs, innovation, organization performance, knowledge management and absorptive capacity. Findings also show that efforts to measure DCs quantitatively are recent and lack reliable methodology.
Research limitations/implications – One limitation of this research is that the authors conducted the systematic review on two databases. However, the authors conducted the research on the two most used databases in management research.
Practical implications – Findings show that academicians have plenty of room to work on quantitative research works on DCs as well as to develop robust scales to measure this construct in diverse business sectors.
Originality/value – This paper is the first to analyze the existing scales that measure DCs.

Keywords Quantitative, Systematic literature review, Scales, Dynamic capabilities, Measure instruments
Paper type Research paper

1. Introduction

In today's dynamic and highly competitive context, organizations should be "active actors" and capable to adapt to environmental changes "at least to some extent, mainly within the limits of its resources and capabilities" (Makkonen *et al.*, 2014, p. 2707). Sensing and seizing opportunities, as well as taking initiatives to avoid potential threats, is imperative (Teece, 2007). To do so, organizations need to overcome the inertia and to promote the continuous change of their resource base (Makkonen *et al.*, 2014).

Based on the resource-based view (RBV) framework, the perspective of dynamic capabilities (DCs) has emerged to explain how organizations can develop valuable, rare,

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inimitable and Nonsubstitable attributes (VRIN) resources on dynamic environments (Eisenhardt and Martin, 2000; Teece *et al.*, 1997).

The DCs view focuses on the capacity to survive in dynamic environments by creating new resources and by renewing or changing the resource base (Bowman and Ambrosini, 2003). DCs involve routines and processes that are implemented to reconfigure the resource base in order to adapt to markets as they evolve (Eisenhardt and Martin, 2000). DCs enable organizations to integrate, reconfigure, and recombine their resources in timely manner in order to adjust to environmental changes and demands (Teece *et al.*, 1997).

Despite the increasing relevance of the concept of DCs on strategic management research field and the great amount of theoretical studies on the subject, various authors have criticized this theory for being tautological, difficult to operationalize (Priem and Butler, 2001; Williamson, 1999) and difficult to be measured empirically (Easterby-Smith *et al.*, 2009). As a result, there are few reliable empirical studies regarding dynamic capabilities. Authors plead that empirical studies on DCs are too abstract (Ali *et al.*, 2012).

We defined two research questions:

RQ1. What is the context in which quantitative studies on dynamic capacities are developed?

RQ2. Which criteria are considered to ensure the reliability and validity of the scales?

For this reason, this research aims to identify the existing measure instruments for DCs in order to understand the context of quantitative studies on dynamic capabilities as well as to assess the reliability and validity of these scales. To accomplish this objective, we conducted a systematic review of literature on dynamic capabilities.

As literature indicates, DCs is a fundamental asset to get and sustain competitive advantage, as they allow organizations to rearrange their resources and process according to environment changes and demands (Eisenhardt and Martin, 2000; Teece *et al.*, 1997). Based on these arguments, we believe that this research is relevant for strategic management research field, as it identifies and valuate the reliability of measure instruments that have been used to measure DCs.

Main findings indicate that quantitative researches on DCs have focused on the contexts of innovation, knowledge (other related aspects of knowledge such as absorptive capacity and organizational learning), strategic alliance, relationship with stakeholders (partners, customers, suppliers), organizational capacity and brand.

Findings also show that the initiatives to measure DCs are very recent: out of the 42 analyzed instruments, 38 were published in the 2010's.

Regarding the reliability and validity of the scales, results indicate that quantitative researches on DCs lack more rigorous methodological procedures regarding scale development. As we analyzed the methods of the 42 articles according to the study of Slavec and Drnovesek (2012), we realized that the majority of quantitative studies have not accomplished all recommended steps for scale development.

Even though researchers are aware of the importance of measure reliability and validity, findings show that the majority focused more on the amount of the sampling data than on building an accurate and reliable instrument to measure the object of study.

This research can help researchers as it provides an extensive analysis of existing scales on DCs which can be adopted in future studies. Besides, researchers can make use of research findings by focusing on perspectives of DCs that still lack reliable quantitative studies. Results show that academicians have opportunity to develop rigorous and more accurate empirical studies.

Besides this introduction, this paper presents the theoretical background on DCs, a chapter describing the methodology adopted in this research, the analysis and discussion of research findings and authors' final considerations.

2. Theoretical basis

DCs can be understood as an extension of the RBV on strategic management (Eisenhardt and Martin, 2000). Teece *et al.* (1997) apply the influence of the dynamism of markets in the theory of RBV perspective. In their view, resources evolve over time in order to adapt to market changes.

The perspective of DCs has emerged to explain how organizations are able to survive and to keep leadership in unstable environments by rearranging competences, assets and abilities, which was not covered by the RBV perspective. For this reason, the framework of DCs can be considered an extension of RBV as it addresses some of the limitations of its antecessor (Ambrosini and Bowman, 2009; Bowman and Ambrosini, 2003).

For Teece *et al.* (1997, p. 515), a DC "refers to the capacity to renew competences so as to achieve congruence with the changing business environment." These authors emphasize that DCs play a fundamental role on strategic management as they enable organizations to adapt, to integrate and to reconfigure their internal and external resources to respond to changes in the environment.

Teece *et al.* (1997) and Eisenhardt and Martin's (2000) highlight the impact of environment on organization performance as well as the necessity to adapt to environment in order to sustain competitive advantage. Both papers attest that DCs are related to unstable environments; while other authors, such as Ambrosini and Bowman (2009), point out that DCs can also be developed in stable environments, as they are not about the dynamism of the environment, but about organization's capacity to adapt to environmental changes.

For Eisenhardt and Martin (2000), DCs are sufficient to achieve sustainable competitive advantage. Teece (2007, p. 1344) corroborates this position as he affirms that "if an enterprise possesses resources/competences but lacks DCs, it has a chance to make a competitive return (and possibly even a supra-competitive return) for a short period; but it cannot sustain supra-competitive returns for the long term except due to chance" (Teece, 2007, p. 1344). To sustain competitive advantage, organizations need to pursue the constant renewal of DC's as well as to be able to identify valuable resources faster than its competitors (Collis, 1994). This constant renewal of DCs and organization's resource base can be factors leading to innovation (Teece, 2007).

3. Methodology

This paper follows a qualitative methodological process with the objective to explore scales of DCs. As mentioned above, the objective of this research is to identify the existing measure instruments for DCs in order to understand the context of quantitative studies on DCs as well as to evaluate the reliability and validity of these scales.

To accomplish this objective, we conducted a systematic review of literature regarding DCs. Systematic (literature) review consists of using systematic methods to review studies on a specific theme in order to identify and evaluate the relevant studies on a specific theme (Petticrew and Roberts, 2006).

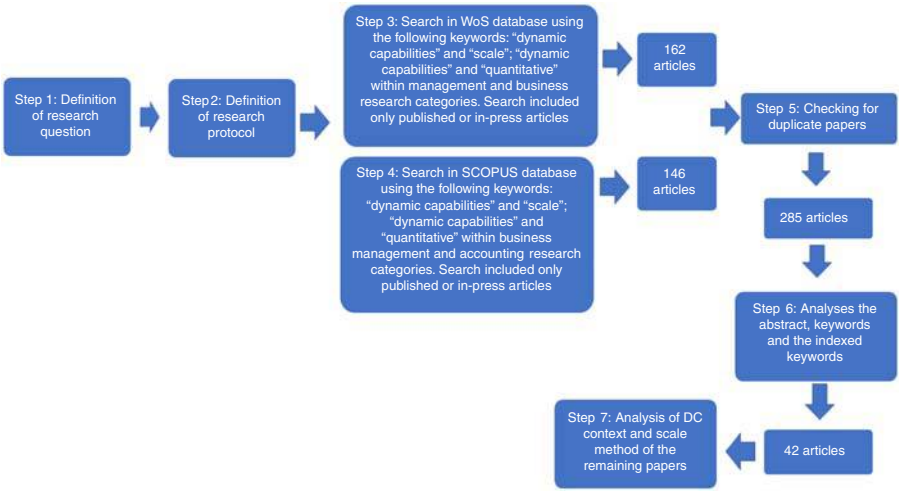
Following Tranfield *et al.*'s (2003) proposed model of systematic literature review (SLR), we did a set of steps to conduct the SLR in three proposed stages: planning the review; conducting the review; reporting and disseminating. Figure 1 shows the main steps of our protocol.

We defined two research questions to be answered by the SLS:

RQ1. What is the context in which quantitative studies on dynamic capacities are developed?

RQ2. Which criteria are considered to ensure the reliability and validity of the scales?

In this SLR, we extracted data from two databases, Web of Science (WoS) and Scopus. To extract articles on DCs from WoS (step 3), we used the keywords "DCs" and "scale."



Source: Authors

Figure 1.
SLR main steps

Then, we filtered the search result using research categories. In this filter, we kept only the articles from management and business research categories. Then, we did another extraction on WoS using keywords "DCs" and "quantitative." To filter this result, we did the same procedure as we did on the first extraction. After this refinement process, it remained 146 articles on the extraction from WoS. On Scopus (step 4), we performed a similar process as we did on WoS. We did two extractions; one using keywords "DCs" and "scale," and the other using keywords "DCs" and "quantitative." To refine the search result on Scopus, we filtered it by selecting articles from "business, management and accounting" research area. In total 162 articles were extracted from Scopus database. It is important to note that both searches included only published or "in-press" articles.

After the extraction, we searched for possible duplicate papers. In this step, 23 papers were excluded from analysis.

Afterwards, we analyzed the abstract, keywords and the indexed keywords of these remaining 285 articles (step 6). In addition, we analyzed their methodology (step 7) to evaluate the methods applied in development of the measure instruments.

To assess the reliability and validity of these scales on DCs, we chose Slavec and Drnovesek's (2012) paper in which we found a consistent and detailed review of scales published in entrepreneurship journals during the years 2009 and 2010. We, then, used the steps of scale development described by Slavec and Drnovesek (2012) to assess the procedures authors used to develop their measuring instruments.

Founded on the classical Churchill (1979) article, Slavec and Drnovesek (2012) propose a ten-step procedure to develop a new scale. These then steps were grouped into three stages: "(1) theoretical importance and existence of the construct, (2) representativeness and appropriateness of data collection, and (3) statistical analysis and statistical evidence of the construct" (Slavec and Drnovesek, 2012, p. 53). Figure 2 illustrates the three-stage procedure for scale development.

In the stage of theoretical importance and existence of the construct, there are three steps: content domain specification (CDS), item pool generation and content validity evaluation (CVE). As you can see in Figure 2, the stage of representativeness and appropriateness of data collection consists of four steps questionnaire development and evaluation, translation and back-translation of the questionnaire, pilot study (PS) performance, and sampling and

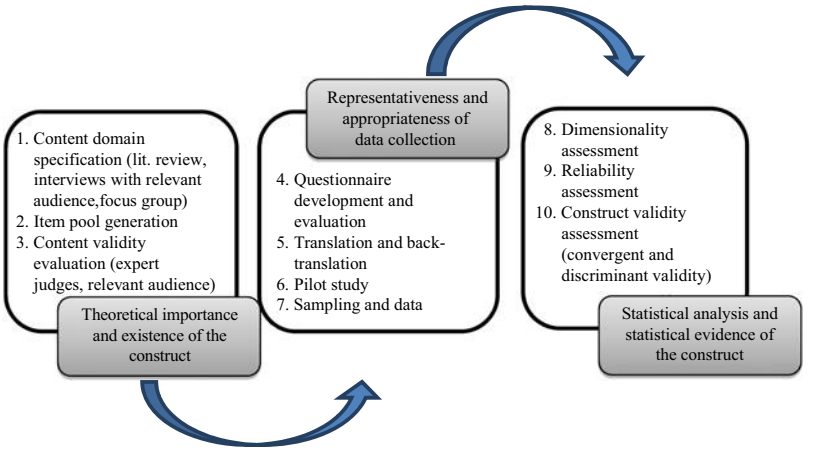


Figure 2.
Ten steps and three stages for scale development

Source: Adapted from Slavec and Drnovesek (2012, p. 43)

data collection (Slavec and Drnovesek, 2012). Finally, the stage of statistical analysis and statistical evidence of the construct contains four steps: dimensionality assessment, reliability assessment and construct validity assessment (CVA).

4. Results and discussion

As mentioned above, we analyzed the abstract, keywords, introduction and methodology sections of the selected articles. It is important to mention that in some instances this analysis also included reading the theoretical background and references sections, since occasionally keywords and abstracts did not depict overall content of the papers. For example, even though some articles contained the construct of DC, authors preferred to refer to DCs as the "dynamic perspective on RBV." In this analysis processes, we found 42 measure instruments for DCs.

We divided our analysis into two parts. The first half is related to the first research objective: to understand the context of quantitative studies on DCs. The second half refers to the assessment the reliability and validity of these scales. Table I presents the 42 selected articles and details regarding their context and research objective.

It is important to mention that even though articles were grouped into one specific context, many of them address more than one context. However, to facilitate readers' visualization of findings tabulation, we chose the context which got more emphasis in the study. On top of that, there is a strong interrelation within these contexts which implies that the multidimensional role of DCs on rearranging organizations resources (Teece, 2007; Teece *et al.*, 1997).

As we can see in Table I, quantitative studies on DCs have gained importance on different contexts of organizational life. Within the most cited papers, we find quantitative studies on absorptive capacity (Camisón and Forés, 2010 with 411 citations), knowledge (Jantunen, 2005 with 368 citations), and strategic alliance (Lin and Wu, 2014 with 231 citation). It is worth mentioning that the article of Lin and Wu (2014) has gained a great amount of citations in a short period of time.

Regarding the context of DCs, findings shows that quantitative studies on DCs have focused more on four contexts of organizational life: governance (eight articles), innovation (eight articles), knowledge (seven articles), and relationship with stakeholders (ten articles distributed in relationship with customers, relationship with partners, and relationship with suppliers).

Context	Research objective	Details	Authors	Cit[a]
Innovation	To evaluate how technological governance affects dynamic capability of innovation and cooperation on Brazilian multinationals	The scale evaluates aspects of dynamic capabilities related to the organization's capability to rearrange existing resources and its capability to create new resources	da Costa and Porto (2014)	5
	To propose a model to identify the antecedents of radical product innovation	The scale measures the impact of dynamic capabilities on the transformation of product and services as well as on the transformation of markets on radical product innovation	Herrmann *et al.* (2007)	186
	To operationalize specific dynamic capabilities for service innovation, based on Teece's (2007) framework	The scale measures the dynamic capabilities and their impact on service innovation. The scale items are structured according to the three classes of dynamic capabilities (sensing, seizing, transformation) (Teece, 2007)	Janssen *et al.* (2015)	26
	To develop and test a theoretical framework that explains how information technology can contribute to service innovation performance. The framework is based on the dynamic capability theory of Teece (2007)	The scale measures how dynamic capabilities of sensing, seizing and transforming can influence service innovation performance. In this study, service innovation performance is considered a dynamic capability as well	Plattfaut *et al.* (2015)	11
	To study innovation capability in the context of export market. Authors also intend to develop a scale to measure innovation capability in exporting organizations. The name of the scale is the INNOVSCALE	In the scale focus on new product development. Authors designed the scaled base on the work of Calantone *et al.* (2002). The scale also strategic capability, technological capability and investments on R&D initiatives	Vicente *et al.* (2015)	28
	To examine the relationship between dynamic capabilities (DCs) and technological innovation capabilities as well as to analyze the impact of technological innovation capability on organization's competitiveness. The research was conducted among Iranian large public organizations	The scale measures the relationship between dynamic capabilities and innovation capabilities. The items that measure dynamic capabilities are based on Teece's (2007) framework. The items that measure innovation capability cover capabilities related to organizational learning, R&D, resource allocation, manufacturing, marketing, organizing and strategic planning	Shafia *et al.* (2016)	6
	To analyze and assess the cumulative effect of dynamics capabilities on service innovation	The scale evaluates dynamic capabilities on network environments. It also evaluates the DCs oriented toward organization's relationship with partners, the DCs for organizational learning and the DCs of innovation capability	Agarwal and Selen (2013)	24
	To examine relationship between dynamic innovation	Authors designed the research as well as the measurement instrument	Cheng and Chen (2013)	60

(*continued*)

Table I.
Measure instruments for DCs found in the systematic review with their respective context on DCs

Context	Research objective	Details	Authors	Cit[a]
	capabilities and open innovation activities in breakthrough innovation	from the absorptive capacity perspective and also based on organizational inertia theory, and open innovation. It is worth mentioning that authors set innovation capability as a dynamic capability		
Organizational learning	To examine the effect of organizational learning capability on export intensity and product innovation	The scale evaluates organization's interaction with the environment and the effect of this interaction on organizational learning capability	Alegre *et al.* (2012)	39
	To build a multidimensional instrument to measure strategic learning process	The scale measures strategic learning process which is divided in four sub-processes: strategic learning creation, distribution, interpretation and implementation. The scale measures strategic learning as a dynamic capability	Sirén (2012)	18
	To develop a measurement scale of dynamic learning capabilities	The scale measures dynamic capabilities on the perspective of dynamic learning capabilities. The scale also measures how the organization's capability to rearrange resources affects knowledge	Verreynne *et al.* (2016)	6
Brand	To develop a multidimensional scale to measure brand management systems in three dimensions: brand orientation, internal branding and strategic brand management. Besides, authors conceptualize brand management system as a dynamic capability	The scale measures brand orientation and brand management as a dynamic capability. Scale also measures the relationship between brand orientation, organizational innovation capability and customer and business performance	Santos-Vijande *et al.* (2013)	83
Relationship/ customer	The objective of the paper is to analyze and to identify the drivers of dynamic capabilities that improve CRM processes in order to achieve customer-oriented organizational performance	The scale measures aspects of organizational features (market orientation, resource configuration and social network) and their influence on customer relationship-oriented dynamic capabilities. Besides, the scale measures the indirect effect of these organizational features on CRM performance, as well as the direct effect of dynamic capabilities on CRM performance	Desai *et al.* (2007)	22
	To analyze the effects of export market exploitation and exploration on export performance	The scale measures the capability of scanning export market for opportunities and for new customers. It also measures the organization's capability of adapting to market turbulence as well as the organization capability of rearranging resources	Lisboa *et al.* (2013)	31
	To propose a scale to measure organization's capacity to introduce new products and	The scale measures the integrative and structural capacities in managing	Hakimi *et al.* (2014)	6

Table I.

(*continued*)

Context	Research objective	Details	Authors	Cit[a]
	services based on customer knowledge management	customer knowledge and their influence on product development		
Relationship/ supplier	To study the role of logistics capabilities on supply chain agilities under the dynamic capability perspective of RBV	The scale was designed to test the theoretical model proposed by the authors. It focuses on supply chain capabilities related to organization's ability to sense and seize opportunities in the market as well as within customers and partners	Gligor and Holcomb (2014)	39
	To analyze the relationship between supply chain flexibility, competitive performance and IT-enabled sharing capabilities. Authors denote that IT-enables sharing capabilities comprise the organization's capability to use IT infrastructure to deal with intangible information and to build a network to share information internally and externally	The scale measures the dynamic capabilities of IT-enabled sharing capabilities that allow organizations to adapt to dynamic context of supply chain	Jin *et al.* (2014)	65
	To analyze how organizations can increase customer value creation by exploring relationships with supply chain partners, by building internal integration and by developing the dynamic capabilities in order to respond to customer demands. Authors analyze this phenomenon by applying the theory related to relationship marketing and the dynamic capability perspective of RBV	The scale measures the dynamic capability of relationship-enabled responsiveness which is the organization capability to respond to environment demands by combining resources from multiple parties in supply chain	Kim *et al.* (2013)	46
	To study the role of business intelligence in supply chain agility context by analyzing the relationship between business intelligence, competence, agile capabilities and supply chain agility	The scale measures the dynamic capability of rearranging resources in order to achieve supply chain agility. It also measures the capability of sensing and responding to environmental changes and demands	Sangari and Razmi (2015)	28
	To theorize and validate a model that addresses the Triple-A (agile, adaptable, aligned) supply chain as an antecedent of supply chain performance, and supply chain performance as antecedent of organizational performance	The scale measures organizations' capabilities to sense and to adapt to market changes and the relationship between these capabilities with supply chain agility and organizational performance. In this scale, organizational performance was divided into two dimensions financial performance and marketing performance	Whitten *et al.* (2012)	110
	To examine the management of supply chain and innovation.	The scale measures strategic supply chain capability as a dynamic	Storer *et al.* (2014)	12

(*continued*)

Table I.

Context	Research objective	Details	Authors	Cit[a]
	Another objective is to analyze the relationship between strategic supply chain, supply chain capability and industry-led innovation	capability. It also measures supply chain performance, supply chain synchronization and industry-led innovation utilization. Supply chain capability was divided into two dimensions: reconfiguration and adaptation		
Relationship/ partners	This study proposes the construct of networking capability (NC) as a dynamic capability. To accomplish this goal, authors proposed and tested a model	The scale focuses on the capabilities related to the relationship between the organization and its business partners (suppliers and customers). Authors named these capabilities as networking capabilities	Mitrega *et al.* (2012)	131
Strategic alliance	To investigate the influence of dynamic capabilities on organization's capacity to develop valuable, rare, inimitable and non-substitutable resource in the pursuit of better performance. To achieve this objective, authors employed a survey with 1,000 Taiwanese companies	The scale measures four constructs: VRIN resources, non-VRIN resources, dynamic capabilities and performance. The items about VRIN resources focuses on organization's know-how, firm reputation and experience on cooperative alliance experience. To measure dynamic capabilities, authors adopted the studies of Teece *et al.* (1997) and Eisenhardt and Martin (2000)	Lin and Wu (2014)	231
	To demonstrate that organization's orientation to alliances can help it to scan the environment for better opportunities which can result on new partnerships and better alliance strategies	The scale was developed to measure the dynamic capabilities of alliance scanning, alliance coordination and alliance learning. The scale measures the relationship between these capabilities, market orientation and environment turbulence	Kandemir *et al.* (2006)	293
Knowledge	To study how absorptive capability of processing organizational knowledge impact innovative performance	The scale focuses on the organization capability of knowledge processing (which is divided into knowledge acquisition, knowledge utilization and knowledge dissemination). It also assesses the relationship between knowledge processing capabilities and environment dynamism, in order to evaluate the organization ability to adapt to the environment	Jantunen (2005)	368
	To analyze the role of knowledge management by focusing on knowledge management practices and on the dynamic capabilities oriented to knowledge management	The scale measures the constructs of knowledge management practices and knowledge management capabilities	Villar *et al.* (2014)	100
	To examine the impact of communication on network relationships and organization performance	The scale measures the capability of sharing information with partners and within organization members and as well as the capability of adapting to the environment	Karayanni (2015)	3

Table I. (*continued*)

Context	Research objective	Details	Authors	Cit[a]
	To analyze the relationship between dynamic capabilities and environmental crisis as well as to study how organizations use dynamic capabilities during unstable periods. This study was conducted under the perspective of the financial crisis of 2008	In this scale, dynamic capabilities are measured in different dimensions: reconfiguration routines, leveraging, learning, knowledge creation, sensing and seizing and knowledge integration	Makkonen *et al.* (2014)	109
	To analyze the manufacturing strategy process (MSP) under the perspective of RBV	The scale measures dynamic capabilities as organization's resource-based orientation. This scale measures organization's capabilities to manage knowledge in order to rearrange its resources in order to sustain competitive advantage	Paiva *et al.* (2012)	11
	To develop of a multidimensional scale to measure the individuals' market-oriented behavior in organizational settings	The scale measures market-oriented behavior through the lens of dynamic capability perspective. The construct of market-oriented behavior is divided into three dimensions: information acquisition, information sharing and strategic response	Schlosser and McNaughton (2009)	34
	To understand the concept of dynamic capabilities from a knowledge-based perspective and to assess the impact of dynamic capabilities on innovation performance	The scale measures dynamic capabilities divided into three dimensions: knowledge acquisition capability, knowledge generation capability and knowledge combination capability	Zheng *et al.* (2011)	118
Absorptive capacity	To analyze the relationship between absorptive, innovative and adaptive capabilities on project and portfolio performance of R&D projects on pharmaceutical and biotechnology organizations	Scale assesses absorptive capabilities distributed on categories: knowledge recognization, knowledge assimilation, knowledge maintenance, knowledge reactivation, knowledge transformation and knowledge application. It also assesses innovation and adaptation capabilities	Biedenbach and Müller (2012)	100
	To measure the impact of absorptive capabilities on knowledge management	The scale is divided into two categories potential absorptive capacity and realized absorptive capacity	Camisón and Forés (2010)	411
	To examine the relationship between organization's openness, absorptive capacity and innovation capability in the in-bound open innovation environment	In their scale, authors focus on innovation success based on the theory of absorptive capacity and dynamic capabilities	Nitzsche *et al.* (2016)	6
Operational capability	To validate an instrument that measures second-order competences (capabilities). The scale is based on the tripod of	The scale evaluates the dynamic capability of assessing new markets and the dynamic capabilities related to R&D. It also assesses the	Danneels (2016)	30

(*continued*)

Table I.

Context	Research objective	Details	Authors	Cit[a]
	sensing, seizing and reconfiguring proposed by Teece (2007)	relationship between dynamic and operational capabilities		
	To study the role and definition of operational capabilities as well as to identify the difference between operational and dynamic capabilities. Authors also aimed to develop a measurement instrument of operational capabilities	The scale measures the relationship between operational and dynamic capabilities. The scale focuses on the capabilities related to innovation and product. The scale also measures the capabilities related to organization's capacity to respond to and to take advantage of environmental changes	Wu *et al.* (2010)	175
Governance	To measure the mediating role of organizational capabilities on the relationship between middle managers, middle managers' autonomy and organizational performance	The scale measures the organizational capabilities under the perspective of dynamic capabilities by including statements regarding organization's capability to respond and to adapt to environmental changes	Ouakouak *et al.* (2014)	44
	To propose technical turbulence as a primary contingency factor in the relationship between strategic orientation and firm performance. Author analyzes thy phenomenon under the perspective of resource-based view (RBV)	The scale measures the organization's capability to respond to technological turbulence as well as the influence of this capability on performance. It also measures the influence of strategic orientation on organizational performance	Pratono (2016)	9
	To analyze the process of capability development in project management settings	The scale measures the capability to create and rearrange resources in the context of project and portfolio management	Rungi (2015)	4
	To propose the idea that individual, managerial and team-related initiatives directly impact dynamic capabilities	The scale measures sensing capabilities on organizations, teams and individuals	Sprafke *et al.* (2012)	25
	To measure the impact of the chief marketing executives' mindsets on marketing capabilities as well as the impact of marketing capabilities on performance	The scale measures cross-functional and dynamic marketing capabilities. The scale also measures chief marketing executives' mindsets regarding marketing capabilities. The items are based on Teece's (2007) framework	Tollin and Schmidt (2015)	5
	To evaluate if portfolio management governance enhances firm performance. Authors conduct the study based on the dynamic capability perspective of resource-based view	The scale combines some items from existing scales. Authors added other items to measure portfolio management governance. The instrument measures portfolio management as a dynamic capability even though scale items do cover some basic aspects of the dynamic capability theory	Urhahn and Spieth (2014)	16
	To examine whether the heterogeneity in alliance capability development can be attributed to some specific	Author designed the scale for dynamic capabilities based on literature review. He divides dynamic capabilities into seven dimensions:	Schweitzer (2014)	31

Table I.

(*continued*)

Context	Research objective	Details	Authors	Cit[a]
	leadership behaviors. The research also intends to confirm that transformational leadership has positive influence on the development of some strategic dynamic capabilities. Besides, the research aims to test if transformational leadership allows organization to sustain operational capabilities	proactiveness, innovativeness (innovation capability), risk taking, competitive aggressiveness, relational capital, knowledge, and learning. The scale also measures the capabilities of task control and task proficiency		
	To study how dynamic capabilities of sensing, seizing and reconfiguring are developed in organizations and how they relate to each other	The scale measures the sensing, seizing and reconfiguring capabilities in organizational context. The scale is based on the Teece's (2007) framework. It also measures the relationship between these capabilities and change performance in work units	Maijanen and Jantunen (2016)	1

Note: [a]Number of citations according to Google Scholar – updated on June 4, 2018
Source: Authors

Table I.

An important insight provided by the analysis is that knowledge has a strong correlation with DCs. Besides the eight articles that focused on the context of knowledge, we found other contexts which are very connected with knowledge: absorptive capacity (three articles) and organizational learning (3). That corroborates the argument found in the seminal work of Teece *et al.* (2007) that says that the ability to recognize opportunities depends on organization's and its members knowledge and learning capacity.

The number of scales (42 out of 285 articles) can be explained by the fact that DCs are difficult to be measured empirically (Easterby-Smith *et al.*, 2009). The difficulty to measure DCs are comprehensible as DCs are strongly related to internal organizational processes (Helfat and Peteraf, 2003; Teece, 2007) which, in turn, are complicated for researchers to identify and to measure empirically.

As we analyzed the main objective of the articles, we noticed that a great amount of the instruments aim to measure the relationship between DCs and some sort of innovation (12 out of 42 articles). This finding is corroborated as we counted the words contained in the abstracts of these articles. In total, the word "innovation" is mentioned 86 times. Figure 3 illustrates the word frequency of the 42 abstracts.

Another interesting finding is that a considerable amount of the select articles (14 out of 42) aim to measure the influence of DCs on some aspect of organization performance – i.e. portfolio performance (Biedenbach and Müller, 2012), customer-oriented organizational performance (Desai *et al.*, 2007), innovation performance (Plattfaut *et al.*, 2015). Even though some argue that the relationship between DCs and organizational performance is difficult to measure (Easterby-Smith *et al.*, 2009), we could observe an increasing interest of researchers on investigating this perspective of DCs. This finding is corroborated by the word frequency of the abstracts - word "performance" is mentioned 94 times (see Figure 2).

In fact, findings indicate that initiatives to develop measure instruments for DC's are recent. Out of the 42 selected measure instruments, 38 were published in the 2010s.

Note: To design the Wordcloud, we used the website www.wordclouds.com/
Source: Author

Figure 3.
Wordcloud designed based on the abstract of the 42 selected articles

This finding is understandable, since the seminal works of this theory were published between the end of the 1990s and the beginning of the 2000s (i.e. Eisenhardt and Martin, 2000; Teece *et al.*, 1997; Winter, 2003).

As mentioned in the methodology section, to evaluate the validity and reliability of the scales on DCs, we adopted the criteria proposed by Slavec and Drnovesek (2012). We analyzed the methodology adopted by the authors according to the three stages of scale development: theoretical importance and existence of the construct, representativeness and appropriateness of data collection and statistical analysis, and statistical evidence of the construct (Slavec and Drnovesek, 2012).

As we analyze Table II, we can see that only 12 articles (out of 42) followed all the steps of scale development according to Slavec and Drnovesek (2012).

Again, we analyzed the methodological procedures according to our interpretation of Slavec's and Drnovesek's (2012) study. Another important point is that as we analyzed the process of scale development, we verified if the step of translation and back-translation was applicable or not. In most cases, this step was not necessary. Besides that, some studies do not clearly mention the procedures regarding specific steps of scale development. For instance, in the study of Agarwal and Selen (2013), authors do not report the procedures they conduct to develop and evaluate the questionnaire.

Within the 12 reliable and valid instruments, five received at least 60 citations according to Google Scholar: Kandemir *et al.* (2006), Lin and Wu (2014), Mitrega *et al.* (2012), Jin *et al.* (2014) and Cheng and Chen (2013).

Within the 42 scales, there are 15 with more than 60 citations. An intriguing finding shows that, within these highly cited papers, ten are not completely reliable and valid according to Slavec and Drnovesek's (2012) criteria. Yet, the scale development process found on these papers follows most of the needed steps for scale development. For instance, Camisón and Forés (2010) only omitted the step of CVE; Herrmann *et al.* (2007), the step of CDS and PS; Santos-Vijande *et al.* (2013) and Zheng *et al.* (2011), the step of conducting a PS.

Authors	Scale validation and statistical tests	Theoretical importance and existence of the construct			Representativeness and appropriateness of data collection				Statistical analysis and statistical evidence of the construct		
		CDS	IPG	CVE	QDE	TBT	PS	SD	DA	RA	CVA
Agarwal and Selen (2013)	Authors validate the scale by applying exploratory and confirmatory factor analysis. This scale is an improved version of the one designed by Agarwal and Selen (2013)	Y	NR	N	NR	na	Y	Y	Y	Y	Y
Alegre *et al.* (2012)	Authors applied multivariate analysis to assess the scale's reliability and its content, discriminant and convergent validity. Authors applied confirmatory factor analysis	Y	Y	N	NR	na	Y	Y	Y	Y	Y
Biedenbach and Müller (2012)	The proposed model and scale were validated through multiple regression analysis. Canonical correlation analysis was also used to evaluate the relationship between innovative, absorptive and adaptive capabilities and project performance	Y	Y	Y	Y	na	Y	Y	Y	Y	N
Camisón and Forés (2010)	The scale is based on the research of Zahra and George (2002). Then, the scale is validated by applying confirmatory factor analysis based on structural equations modeling (SEM)	Y	Y	N	Y	na	Y	Y	Y	Y	Y
Cheng and Chen (2013)	To validate the instrument and the hypotheses proposed on the research, authors collected 218 valid responses. Authors assessed the construct validity and reliability by assessing the Cronbach's α. To identify the factor structure, they used the varimax rotation. They also assessed the convergent and discriminant validity. Finally, they validated results by performing the confirmatory factor analysis (CFA)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
da Costa and Porto (2014)	The scale was validated by applying the multiple regression analysis and other statistical tests (e.g. Cronbach's α)	Y	NR	N	NR	N	N	Y	Y	Y	N
Danneels (2016)	The scale was validated by applying confirmatory factor analysis and multiple regression analysis	N	Y	N	NR	na	N	Y	Y	Y	Y
Desai *et al.* (2007)	The scale items were adapted from existing scale on market orientation, CRM, and dynamic capabilities. Then, the scale was evaluated by experts. On the sequence, authors conducted a pilot test with 82 executives. The final version of the scale was used in a survey that collected 334 responses from executives of 29 Indian companies from banking, telecom and retail sectors. To assess the reliability of the instrument, authors used EFA and tested the Cronbach's α. In order to confirm the proposed hypotheses, they use the least square regression	Y	Y	Y	Y	na	Y	Y	Y	Y	N

(*continued*)

Table II.
Measure instruments for DCs with the analysis of their validity and reliability according to Slavec and Drnovesek (2012)

Table II.

Authors	Scale validation and statistical tests	Theoretical importance and existence of the construct			Representativeness and appropriateness of data collection				Statistical analysis and statistical evidence of the construct		
		CDS	IPG	CVE	QDE	TBT	PS	SD	DA	RA	CVA
Gligor and Holcomb (2014)	The scale was validated by applying exploratory and confirmatory factor analysis (CFA)	Y	Y	Y	Y	na	Y	Y	Y	Y	Y
Hakimi *et al.* (2014)	The scale was validated by applying exploratory and confirmatory factor analysis. Initially the scale contained 57 items. The final version of the scale contains 16 items	Y	Y	N	Y	na	Y	Y	Y	Y	Y
Herrmann *et al.* (2007)	In the first phase, the model was tested by using partial least square modeling (PLS). In the second phase, the scale was tested by applying the confirmatory factor analysis	N	NR	Y	Y	na	N	Y	Y	Y	Y
Janssen *et al.* (2015)	The scale was tested by performing exploratory and confirmatory analysis. Authors also performed structural equation modeling (SEM) to assess the construct correlation	Y	Y	Y	Y	na	Y	Y	Y	Y	Y
Jantunen (2005)	The scale was validated by applying exploratory factor analysis. The innovative factor was assessed by performing hierarchical linear regression analysis	N	Y	N	NR	na	N	Y	Y	Y	N
Jin *et al.* (2014)	The authors performed confirmatory factor analysis (CFA) to validate the scale and also performed structural equation modeling (SEM) to validate the model and hypotheses	Y	Y	Y	Y	na	Y	Y	Y	Y	Y
Kandemir *et al.* (2006)	The scale was validated by performing confirmatory factor analysis (CFA)	Y	Y	Y	Y	na	Y	Y	Y	Y	Y
Karayanni (2015)	The scale was validated by applying confirmatory factor analysis; the proposed model, by performing structural equation modeling (SME)	N	Y	N	Y	na	N	Y	Y	Y	Y
Kim *et al.* (2013)	The scale was validated by performing confirmatory factor analysis (CFA)	Y	Y	Y	Y	na	Y	Y	Y	Y	Y
Lin and Wu (2014)	In order to assess data validity, authors tested the Mahalanobis distance, which checks outliers in a sample. To assess the validity of the constructs, authors assessed the Cronbach's α value of these constructs. Authors also validate the model and the instrument, by using the analysis of variance (ANOVA) and structural equation modeling (SEM). LISREL was the SEM technique adopted by the authors	NR	Y	Y	Y	na	Y	Y	Y	Y	Y
Lisboa *et al.* (2013)	The instrument was validated by applying confirmatory factor analysis (CFA)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Maijanen and Jantunen (2016)	The scale was validated by applying multivariate analysis. To test the hypotheses, authors performed ANOVA tests	N	Y	N	Y	na	N	Y	N	Y	N
Makkonen *et al.* (2014)	Authors validated the instrument by applying confirmatory factor analysis (CFA)	N	Y	N	Y	na	Y	Y	Y	Y	Y

(*continued*)

Authors	Scale validation and statistical tests	Theoretical importance and existence of the construct			Representativeness and appropriateness of data collection				Statistical analysis and statistical evidence of the construct		
		CDS	IPG	CVE	QDE	TBT	PS	SD	DA	RA	CVA
Mitrega *et al.* (2012)	Authors adopted a three-stage process of scale development, which included qualitative and quantitative phases. First, the items emerged based on literature and interviews. Second, authors validated the scale items by conducting focus groups, and finally, after applying a online survey, authors validated the scale by performing exploratory and confirmatory factor analysis. Initially, the scale contained 41 items. After the confirmatory factor analysis, only 17 items remained	Y	Y	Y	Y	na	Y	Y	Y	Y	Y
Nitzsche *et al.* (2016)	Authors wrote the items of the scale based on literature review. Then, they got feedbacks from experts about the scale. On the sequence, authors conducted a pre-test. Afterwards, authors applied a survey using the scale. To test the validity and reliability of the instrument, they applied the exploratory factor analyzed (EFA) on the collected data	N	Y	N	NR	na	N	Y	Y	Y	Y
Ouakouak *et al.* (2014)	The scale is based on previous studies on innovation capability. Authors applied discriminant and convergent validity tests, and checked the values of KMO (Kaiser–Meyer–Olkin) and Cronbach's α	N	Y	N	Y	na	N	Y	NR	Y	N
Paiva *et al.* (2012)	Scale was applied to Brazilian and Spanish participants. The scale was validated by applying confirmatory factor analysis (CFA)	N	Y	Y	Y	Y	Y	Y	Y	Y	Y
Plattfaut *et al.* (2015)	Authors used partial least squares (PLS) to validate the model	N	Y	N	Y	na	Y	Y	Y	Y	Y
Pratono (2016)	Author uses partial least squares (PLS) for data analysis and statistical validation	N	Y	N	Y	na	N	Y	Y	Y	Y
Rungi (2015)	Authors wrote the scale items based on previous literature. After collecting data through a survey, to assess the collected data authors performed the Levene test and checked Cronbach's α values. Authors do not mention a specific statistical process to validate the scale	Y	Y	Y	Y	na	Y	Y	N	Y	N
Sangari and Razmi (2015)	The instrument was validated by applying confirmatory factor analysis (CFA)	N	Y	Y	Y	na	N	Y	Y	Y	Y
Santos-Vijande *et al.* (2013)	The scale was validated by applying confirmatory factor analysis (CFA)	Y	Y	Y	Y	na	N	Y	Y	Y	Y

(*continued*)

Table II.

Table II.

Authors	Scale validation and statistical tests	Theoretical importance and existence of the construct			Representativeness and appropriateness of data collection				Statistical analysis and statistical evidence of the construct		
		CDS	IPG	CVE	QDE	TBT	PS	SD	DA	RA	CVA
Schlosser and McNaughton (2009)	The scale was validated by applying exploratory (EFA) and confirmatory factor analysis (CFA). After performing the multivariate analysis, 20 items of the scale remained	Y	Y	Y	Y	na	Y	Y	Y	Y	Y
Schweitzer (2014)	The scale was validated by performing partial least squares (PLS)	Y	Y	Y	Y	na	Y	Y	Y	Y	Y
Shafia *et al.* (2016)	The scale was designed based on literature review. After writing the scale items, authors conducted a survey among technology organizations. To validate the instrument, authors used confirmatory factor analysis (CFA) under structural equation modeling (SEM) approach	Y	Y	Y	Y	na	Y	Y	Y	Y	Y
Sirén (2012)	Author validated the scale by performing exploratory and confirmatory factor analysis. After the statistical validation, the number of items reduced from 24 to 19	Y	Y	Y	Y	na	N	Y	Y	Y	Y
Sprafke *et al.* (2012)	To validate the scale, authors analyzed the component factor and factor loadings of the variables. To validate the internal consistency of the scale, they verified the Cronbach's α. To test the research hypotheses, authors used multiple regression analysis	Y	Y	N	Y	na	N	Y	NR	Y	NR
Storer *et al.* (2014)	To validate the instrument, authors used confirmatory factor analysis (CFA) under structural equation modeling (SEM) approach	NR	Y	N	Y	na	N	Y	Y	Y	Y
Tollin and Schmidt (2015)	To validate the model, authors compare the degree of variance of the constructs, their Cronbach's α and their correlation. Authors also perform a cluster analysis to validate the model. Authors do no mention if they applied statistical analysis to validate the scale specifically	Y	Y	N	Y	na	N	Y	NR	Y	Y
Urhahn and Spieth (2014)	The model was validated by applying structural equation modeling (SME)	Y	Y	N	Y	na	N	Y	Y	Y	Y
Verreynne *et al.* (2016)	To validate the scale, authors used exploratory (EFA) and confirmatory factor analysis (CFA), with structural equation modeling (SME) approach	Y	Y	Y	Y	na	Y	Y	Y	Y	Y
Vicente *et al.* (2015)	Authors wrote the scale items based on literature review. On the sequence, they applied a survey among 471 exporting manufacturing organizations. To test the validity and the reliability of the scale, authors performed structural equation modeling (SME)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Villar *et al.* (2014)	To validate the measurement instrument, authors performed structural equation modeling (SME)	N	Y	N	Y	na	Y	Y	Y	Y	Y

(*continued*)

Table II.

Authors	Scale validation and statistical tests	Theoretical importance and existence of the construct			Representativeness and appropriateness of data collection				Statistical analysis and statistical evidence of the construct		
		CDS	IPG	CVE	QDE	TBT	PS	SD	DA	RA	CVA
Whitten *et al.* (2012)	To validate the scale, authors performed confirmatory factor analysis (CFA) with structural equation modeling (SME) approach	N	Y	N	Y	na	Y	Y	Y	Y	Y
Wu *et al.* (2010)	To validate the scale, authors performed confirmatory factor analysis (CFA) with structural equation modeling (SME) approach	N	Y	N	Y	na	Y	Y	Y	Y	Y
Zheng *et al.* (2011)	To validate the instrument, authors conducted a survey on China on which they obtained 218 valid responses. They validated the construct validity and reliability by assessing the Cronbach's α. They also performed the structural equation modeling (SME) using the AMOS 7.0 software	Y	Y	Y	Y	na	N	Y	Y	Y	Y

Notes: CDS, contain domain specification; IPG, item pool generation; CVE, content validity evaluation; QDE, questionanaire development and evaluation; TBT, translation and back-translation; PS, pilot study; SD, sample data; DA, dimension assessment; RA, reliability assessment; CVA, construct validity assessment; Y, yes; N, no; NR, not reported

Source: Authors

As we analyze the reliability and validity of these 42 instruments, we noted that the steps of scale development that are overseen or not reported more often are CVE (21 articles), CDS (15 articles), PS (16 articles) and CVA (7 articles).

CVE involves getting knowledgeable people to reviewing the scale items. Slavec and Drnovesek (2012) recommend researchers to ask experts (academicians, experienced practitioners) to evaluate the instrument to propose changes. According to research findings, half of authors (21) have neglected this important step. Getting advices from experts minimizes deviations and misconceptions of measurement items, especially regarding the construct of DCs which is too abstract and difficult to evaluate (Ali *et al.*, 2012; Easterby-Smith *et al.*, 2009).

CDS refers to defining what is going to be measured (DeVellis, 2003). Slavec and Drnovesek (2012) suggest researchers to conduct literature reviews and/or exploratory qualitative researches in order to define and delimitate the construct that will be quantitatively evaluated. The fact that many authors have missed this step can indicate a warning regarding empirical studies on DCs. As the construct of DCs remains ambiguous and difficult to identify on organizational settings (Ali *et al.*, 2012), researchers should be more careful as they develop scales to measure it. Otherwise, researchers may develop instruments that will not measure the phenomenon as expected.

PS refers to engaging on a PS with a sample of the target population in order to collect critics, suggestions and thoughts, as well as to prevent possible problems such as semantic issues or misspelling. As findings show, 16 papers authors did not conduct this step nor reported it on their methodology.

CVA refers to the extent to which the scale measures what it is intended to measure in the setting that it will be used (Slavec and Drnovesek, 2012). In our analysis, seven papers have not accomplished this requirement. In some cases, authors do not clearly describe the statistical procedures they conduct during scale development. In these cases, we considered that specific methodological step as "not reported." There are papers in which the description of the statistical procedures is ambiguous and insufficient. For instance, Biedenbach and Müller (2012) use the term unrotated factors analysis, but do not mention if they used exploratory factor analysis (EFA) or confirmatory factor analysis (CFA). In the same manner, Sprafke *et al.* (2012) present an obscure description of statistical procedures used in the research.

5. Conclusions

The perspective of DCs has emerged to explain how organizations can develop competitive advantage on dynamic environments (Eisenhardt and Martin, 2000; Teece *et al.*, 1997). Despite the increasing interest of the academia on DCs, the empirical studies on DCs are few, not as reliable, too abstract and limited to case studies (Ali *et al.*, 2012). For this reason, this research aims to identify the existing measure instruments for DCs in order to understand the context of quantitative studies on DCs as well as to assess the reliability and validity of these scales. To accomplish this objective, we conducted a systematic review of literature on DCs.

Main findings indicate that quantitative researches on DCs have focused on the contexts of brand innovation, knowledge (other related aspects of knowledge such as absorptive capacity and organizational learning), strategic alliance, relationship with stakeholders (partners, customers, suppliers), organizational capacity and brand.

Findings also show that the initiatives to measure DCs are very recent: out of the 42 analyzed instruments, 38 were published in the 2010's.

Regarding the reliability and validity of the scales, results indicate that quantitative researches on DCs lack more rigorous methodological procedures regarding scale development. As we analyzed the methods of the 42 articles according to the study of

Slavec and Drnovesek (2012), we realized that most of quantitative studies have not accomplished all recommended steps for scale development.

Even though researchers are aware of the importance of measure reliability and validity, findings show that the majority focuses more on the amount sampling data than on building an accurate and reliable instrument to measure the object of study.

Finally, results show that academicians have a good opportunity to develop rigorous and more accurate empirical researches on DCS. Academicians need to develop more reliable and valid instruments to measure this important aspect of strategic management.

A limitation of this research is that we have not analyzed in which perspective these 42 instruments were used. Another limitation is that the analysis of reliability and validity of these instruments is based on our interpretation of Slavec and Drnovesek's (2012).

For future studies, we suggest researchers to compare the relationship between qualitative studies and quantitative studies on DCs. By analyzing the similarities and differences of context on qualitative and quantitative studies on DCs researchers can identify the most used methods in both research approaches as well as which research approach is more appropriate according to the context that DCs is analyzed.

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Further reading

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Corresponding author
Cíntia Cristina Silva de Araújo can be contacted at: cintyaraujo@gmail.com