The impact of firm-level and project-level it capabilities on CRM system quality and organizational productivity

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A B S T R A C T

While CRM technology implementation initiatives frequently end up as failures, most research has focused on user related reasons for understanding low success rates. This study extends CRM research backwards into the system implementation phase to improve understanding of the hitherto unexplored technical antecedents of CRM success. We advance a resource-based theory of CRM system capability (CRMSC) to explain how firm- and project-level capabilities act to influence organizational performance. Empirical findings from a survey matching 148 IT manager and 474 end-user responses support the conceptualization of CRMSC as a project-level capability, and suggest that CRMSC and system quality mediate the effects of firm-level IT capability on organizational productivity gains and productivity gain discrepancy. The study complements extant understanding about the link between strategic and operational IT capabilities by offering actionable insight on the combination of resources firms need to deliver a CRM system that enhances performance.

1. Introduction

Customer Relationship Management (CRM) technology enables firms to capture, store, access, share, and analyze large amounts of customer data. The anticipated benefits of using CRM technology include increased customer loyalty, more effective marketing, improved customer service, and cost reductions through improved efficiency (Dalla Pozza, Goetz, & Sahut, 2018; Jayachandran, Sharma, Kaufman, & Raman, 2005; Mithas, Krishnan, & Fornell, 2005; Payne & Frow, 2005). Still, despite the technology's potential to help firms effectively organize their operations around customer-centric processes, CRM initiatives often do not meet firm expectations and the majority of them end up in failure, with self-reported success rates as astonishingly low as 20–30% (Ahearne, Rapp, Mariadoss, & Ganesan, 2012; Chang, Park, & Chaiy, 2010; Reimann, Schilke, & Thomas, 2010). Recent papers indicate that low adoption rates among system users remain a widespread problem for the CRM systems investments (Chen, Ou, Wang, Peng, & Davison, 2020; CSO report, 2018).

More recently, CRM technology initiatives have begun to shift from a CRM-on-Premise model to a CRM-on-demand model (i.e., to a cloud-based, software as a service or SaaS model). Despite the many benefits

of SaaS applications, such as heightened cyber security and lower development costs (Khorraminia et al., 2019), the fundamental challenges of implementing CRM systems remain the same. Regardless of whether deployed on-premise or in the cloud, CRM technologies pose notable *integration challenges* between different information systems and data sources (application siloes - Chen & Popovich, 2003). The integration needs have further increased by the rapid development of novel technologies related to CRM, such as social media applications (Trainor, Andzulis, Rapp, & Agnihotri, 2014), marketing automation technologies (Mero, Tarkiainen, & Tobon, 2020), as well as artificial intelligence and big data (Ghazaleh & Zabadi, 2020). Second, CRM systems present *cross-functional user challenges,* as they serve a diverse set of end-users across functions, ranging from senior executives to customer service agents (functional siloes - Chen & Popovich, 2003; Fjermestad & Romano, 2003). Overcoming these challenges remains a difficult task.

While studies have addressed broad organizational CRM implementation issues (see Dalla Pozza et al., 2018), only limited attention has been directed toward understanding the impact of CRM system implementation on system quality and, ultimately, the success of CRM initiatives (see Chatterjee, Ghosh, & Chaudhuri, 2020). This is surprising given the long-standing recognition that firms need wide-ranging

resources and capabilities, unrelated to the technology itself, to successfully implement CRM systems (Kim, Shin, Kim, & Lee, 2011). As a result of this omission, understanding of how best to leverage available IT-related resources to achieve CRM success is limited (see Avlonitis & Panagopoulos, 2005). Importantly, this same limitation applies to the broader IT capability and critical success factor literature (cf. Ali & Miller, 2017). While IT capability research has focused on explaining organizational outcomes based on an a priori possession of strategic, firm level IT resources (Bharadwaj, 2000; Bhatt & Grover, 2005), the operational-level mechanisms that link firm IT capabilities to firm performance remain less understood (cf. Ashrafi & Mueller, 2015).

To begin to remedy these important knowledge gaps, the present research advances a resource-based theory of CRM system capability (CRMSC) that considers the relationship between firm- and project- level capabilities, CRM system quality and, ultimately, user-level organizational productivity. The study builds on both CRM system implementation research in marketing (Chen & Popovich, 2003; Zablah, Bellenger, & Johnston, 2004) and studies grounded in the IT capability paradigm (Bharadwaj, 2000; Mithas, Ramasubbu, & Sambamurthy, 2011). Specifically, we leverage the concepts of resource-picking (Makadok, 2001) and resource complementarity (Barney, 1991) to posit that project-level CRM system capability mediates the effects of firm-level IT capability on system quality as well end-user productivity gains and gains discrepancy. We employ a matched, multi-informant field study design to test hypotheses regarding the mediated impact of organizational IT factors (data provided by managers) on end user productivity outcomes (data provided by multiple employees).

Our study makes three contributions to the CRM and IS literature. First, we extend current CRM research in marketing backwards into the system implementation phase, thus providing new knowledge on how firm- and project- level IT resources influence CRM success (see Kim et al., 2011). Second, we extend the CRM literature by advancing a parsimonious conceptualization of CRM system capability (CRMSC) that specifies the combination of resources firms need to deliver a system that enhances organizational productivity (see Chen & Popovich, 2003; Fjermestad & Romano, 2003). Third, our study extends the IT literature by creating a conceptual bridge between the strategic and operational IT capability perspectives (Karim, Somers, & Bhattacherjee, 2007; Mikalef, Krogstie, Pappas, & Pavlou, 2020; Mithas et al., 2011) by offering detailed insight into the hierarchical relationships that exist between firm-level IT capabilities, operational-level capabilities, system quality and productivity.

2. Theoretical foundations - RBV

This study investigates how firm-level and project-level IT resources and capabilities influence CRM system quality and, ultimately, firm performance. To theoretically inform our study, we rely on the resource-based view of the firm (RBV; Wernerfelt, 1984) and subsequently detail the aspects of the theory that are most germane to our investigation. We support this exposition with Table 1, which summarizes how different aspects of RBV inform and are manifest in our study.

RBV considers firm resources as the basic unit of analysis and proposes that resource heterogeneity across firms accounts for differential performance (Barney, 1991; Peteraf, 1993). A resource may have value-creating properties, commonly referred to as rent (Barney, 1991). However, resources seldom lead to differential performance in isolation; the value of a resource is ultimately determined by its contribution in the production process when combined with other resources into capabilities (Barney, 1991; Bharadwaj, 2000; Pavlou & El Sawy, 2006). Importantly, for capabilities to become a source of competitive advantage for a firm, they must be leveraged in organizational processes that create value for the firm (Barney & Hesterly, 2012).

2.1. Firm-level versus project-level IT capabilities

Building on RBV, the strategic IT capability literature[1] assumes that various IT-related resources can be combined into unique resource bundles – an IT capability – that enhance firm performance for a competitive advantage (Bhatt & Grover, 2005; Melville, Kraemer, & Gurbaxani, 2004). Specifically, superior performance results from *a priori* possession of firm-level IT resources and capabilities (Santhanam & Hartono, 2003). Studies in this tradition tend to adopt *firm-level IT resources*, i.e., the resource capacity controlled by the firm, as the basic unit of analysis (Kraaijenbrink, Spender, & Groen, 2010) and define *firm-level IT capability* as "a firm's ability to mobilize and deploy IT-based resources in combination" to meet business needs and objectives (Bharadwaj, 2000, p. 171).

IT capability research increasingly notes the role of operational capabilities as a means of explaining why strategic capabilities impact performance (e.g., Karim et al., 2007; Mikalef et al., 2020; Pavlou & El Sawy, 2006). Studies grounded in the operational capability perspective posit that IT resources and capabilities are utilized at the operational level (in our case, the IT project-level) rather than firm-level to achieve desired outcomes (Ray, Muhanna, & Barney, 2005). *Project-level IT resources* thus refer to context-specific factors at the operational level, which are used to perform specific tasks, and combine to form operational IT capabilities that impact IT-related outcomes (Kraaijenbrink et al., 2010; Ray et al., 2005). Studies find that operational performance ultimately leads to firm performance (Kim et al., 2011; Kohli & Grover, 2008; Sambamurthy, Bharadwaj, & Grover, 2003).

2.2. The resource-picking mechanism

The *resource-picking mechanism* refers to rent creation that is obtained through the effective selection of resources from strategic factor markets (İpek, 2018; Makadok, 2001; Shafeey & Trott, 2014). Resource-picking leads to rents when a resource is acquired for a lower cost than its value, especially in tandem with other resources. Information regarding how valuable a resource is when it is combined with other resources is a prerequisite for rent creation and thus information asymmetry and bounded rationality partly explain performance heterogeneity (Barney, 1986). That is, a firm's capability to choose the right resources in the right combinations depends on its information gathering capability and how well it uses such information to guide decision-making (Bamel & Bamel, 2018; Makadok, 2001; Wang, Liang, Zhong, Xue, & Xiao, 2012).

Particularly important to our study is Wernerfelt (2011) conceptual work which suggests that the resource-picking mechanism can be used to explain the relationship between resources at different levels within firm boundaries (Kraaijenbrink et al., 2010). This research implies that the firm's existing IT resource base provides the information necessary for acquiring necessary project-level IT resources from strategic factor markets. Firm-level IT resources facilitate the acquisition of critical project-level IT resources from the firm's own resource pool (Maritan & Peteraf, 2011). This line of theorizing thus affirms that a firm's capability to choose and acquire necessary project-level IT resources is a function of existing firm-level IT resources (Wernerfelt, 2011).

2.3. Resource complementarity

RBV's *resource complementarity* argument holds that resources should be considered jointly rather than independently because the presence of one resource commonly enhances the value of another (Barney, 1991;

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[1] For the purposes of this study, we use the term "IT capability literature (Petter et al., 2006)" broadly to refer to all resource-based IS research including "strategic IT capability perspective", "operational IT capability perspective" (Karim et al., 2007) as well as the "IT business value research (Dalla Pozza et al., 1991; Ho et al., 1996)" discourse.

Table 1
RBV Theory and Relevance to the Current Study.

RBV terminology	Definition	Considered by Strategic IT capability perspective?	Considered by Operational IT capability perspective?	Considered by this study?	RBV construct in this study	Key references
Firm-level IT resources	Resource capacity owned or controlled by the firm. Categorized into technology, IT human and IT relationship resources	Yes	No	Yes	5 firm-level IT resources identified in RBV research representing technological, human and relationship elements	Bhatt & Grover, 2005; Bharadwaj, 2000; Feeny & Willcocks, 1998; Mata, Fuerst, & Barney, 1995; Melville et al., 2004; Ross, Beath, & Goodhue, 1996; Sambamurthy et al., 2003; Santhanam & Hartono, 2003; Tippins & Sohi, 2003; Ravichandran, Lertwongsatien, & Lertwongsatien, 2005
Firm-level IT capability	A firm's ability to deploy IT-based resources in combination for the purpose of meeting business objectives	Yes	No	Yes	Firm-level IT capability	
Operational IT resources	Resources deployed to carry out specific operational tasks. No general taxonomy, context-specific	No	Yes	Yes	5 project-level IT resources identified in marketing literature as context-specific to CRM system project to predict system quality	*RBV studies*: Ethiraj, Kale, Krishnan, & Singh, 2005; Henderson & Cockburn, 1994; Karim et al., 2007; Pavlou & El Sawy, 2006; Ray et al., 2005; Schroeder, Bates, & Junttila, 2002 *CRM studies*: Chen & Popovich, 2003; Fjermestad & Romano, 2003; Zablah et al., 2004
Operational IT capability	A firm's ability to deploy contextually relevant IT resources in combination to perform a business process	No	Yes	Yes	CRM system capability	

RBV action mechanisms	Definition	Strategic IT capability perspective	Operational IT capability perspective	This study	RBV implication for this study	Key references
Resource-picking	Rent creation through the effective selection of resources from strategic factor markets and/or the firm's own pool of resources	Acquisition of firm-level IT resources, differences between firms not explained	Acquisition of project-level IT resources, differences between firms not explained	Acquisition of firm-level IT resources, differences between firms not explained. Acquisition of project-level resources explained by current stock of firm-level IT resources	Firm-level IT resources serves as a proxy for the firm's information gathering capability and its effectiveness in the use of such information to guide resource allocation decisions regarding the CRM project	Makadok, 2001; Makadok & Barney, 2001; Maritan & Peteraf, 2011; Wernerfelt, 2011
Resource complementarity / configuration	Combinations of synergisitcally interacting resource configurations that commonly occur together to predict an outcome of interest	Interacting firm-level IT resources combine into firm-level IT capability to predict an outcome	Interacting project-level IT resources combine into project-level IT capability to predict an outcome	Interacting IT resources combine into IT capabilities at different organizational levels to predict an outcome	Interacting IT resources combine into IT capability at firm level (Firm-level IT capability) and project level (CRM system capability) to form an ideal pattern of resource configurations to predict system quality	*RBV studies*: Barney, 1991; Clemons & Row, 1991; Kraaijenbrink et al., 2010; Melville et al., 2004 *Configuration studies*: El Sawy, Malhotra, Park, & Pavlou, 2010; Meyer, Tsui, & Hinings, 1993

Dependent variable	Strategic impact of IT	Considered by Strategic IT capability perspective?	Considered by Operational IT capability perspective?	Examples	DV in this study	Key references
Operational performance	Enables more efficient and effective business processes	No	Yes	Business process outcomes; New product development success; Performance of customer service; Manufacturing effectiveness	CRM system quality Organizational productivity	Ethiraj et al., 2005; Henderson & Cockburn, 1994; Karim et al., 2007; Pavlou & El Sawy, 2006; Ray et al., 2005; Schroeder et al., 2002
Financial performance	Supports non-IT firm capabilities	Yes	No	Profitability; Sales volume, Sales growth, ROS, ROA, ROI, Cost-based measures	Not applied. Measures IT's strategic impact across all firm activities	Bhatt & Grover, 2005; Bharadwaj, 2000; Ravichandran et al., 2005; Santhanam & Hartono, 2003

Ho, Plewa, & Lu, 2016; Shin & Lee, 2019). In fact, IT resources may even be co-specialized such that one resource has little or no value without the other, a situation that occurs with hardware and software (Clemons & Row, 1991). Thus, resource complementarity provides a basis for differentiating resources from capabilities on the basis of strategic potential, which is commonly inferred by evaluating the value, rarity, imperfect imitability, and organizational exploitation (VRIO) of firm resources or resource bundles (Barney & Hesterly, 2012; Lim, Celly, Morse, & Rowe, 2013). For example, stand-alone resources may be valuable or rare but they are seldom inimitable since they can be freely traded in strategic factor markets, as happens, for example, in the case of human resources (Barney, 1986, 1991). In contrast, capabilities are comprised of different resources and skills integrated in organizational processes (Black & Boal, 1994). As a consequence, capabilities are path-dependent (Kogut & Zander, 1992), causally ambiguous (Reed & DeFillippi, 1990), and embedded in an organizational context (Granovetter, 1985), and therefore costly or impossible to trade, imitate, or substitute (Dierickx & Cool, 1989).

3. Conceptual model

Fig. 1 offers a visual depiction of conceptual model of the study and summarizes the study constructs and the hypothesized relationships between them. To aid in the understanding of the model, we formally define these constructs and their sub-dimensions in Table 2. Given its importance to our model, and the fact that it represents a new addition to the literature, we detail the domain of CRM system capability hereafter referred to as CRMSC below.

3.1. The CRM system capability construct

At the operational level, IT resources are project-specific (Ray et al., 2005). In this study, we identify IT resources that: (1) are valuable in the specific context of the CRM system implementation project, and are (2) expected to work together to shape the quality of the resultant system (Karim et al., 2007; Ray et al., 2005). We refer to these factors as project-level IT resources that combine to form a CRM system capability (CRMSC), defined here as a firm's ability to assemble, integrate and deploy the resources necessary to successfully implement a purchased CRM application (Bharadwaj, 2000; Chen & Popovich, 2003).[2] Drawn from conceptual and qualitative studies in marketing are five critical factors that underlie CRMSC: project management resources, consultant resources, training resources, top management support, and user involvement.

Because of the boundary-spanning nature of customer processes, *project management resources* are critical for coordinating cross-functional project teams in order to align the CRM technology with different client departments. Furthermore, CRM technologies are used at the customer interface where the reactions of end-users can be only partially predicted in advance. As a result, project managers play a critical role in CRM projects by responding decisively to unexpected events and driving changes while also acting as an intermediary to persuade top management to support such changes (Chen & Popovich, 2003).

Consultant resources are external specialists who transform user needs into technological CRM solutions (Ryals & Payne, 2001). Inexperienced

consultants are often the primary reason for CRM project failures because they perform the crucial task of needs and requirements analysis that is used to guide system design and identify system attributes that are likely to engender resistance among targeted end-users (Fjermestad & Romano, 2003).

Training resources, increasingly in the form of online learning, ensure that employees develop the skills necessary for using CRM systems and provide employees with an understanding of how the system benefits them in their work roles (Chatterjee et al., 2020; Navimipour & Zareie, 2015; Pullig, Maxham, & Hair, 2002). User training also decreases user resistance by reducing uncertainty associated with adopting the new CRM system (Navimipour & Soltani, 2016; Zablah et al., 2004).

Top management support not only secures the provision of adequate resources but also plays a key role in addressing the cross-functional challenges associated with implementing CRM systems and in selling the system to users (Chen & Popovich, 2003; Dalla Pozza et al., 2018; Rigby, Reichheld, & Schefter, 2002). Top executive sponsorship may improve end-user perceptions of system usability and reduce resistance toward it, critical to realizing CRM's benefits (Fjermestad & Romano, 2003).

Finally, *user involvement* helps identify end-user needs and links the CRM system to business objectives. Frontline employees often prefer a deeper, face-to-face involvement in the system design process that may also lead to stronger end-user approval of CRM when their requests are configured into the system (Gefen & Ridings, 2002). The diversity of end-users additionally accentuates the need to know them and the tasks that they perform, better than in the case of other enterprise systems (Fjermestad & Romano, 2003).

The five project-level IT resources identified here are valuable in the sense that they have the potential to enhance the implementation of CRM systems. Based on RBV's notion of resource complementarity, however, we stress that a realistic representation of CRMSC requires that we look at how combinations of project-level IT resources jointly predict variance in system quality. For example, consultants cannot satisfactorily identify user requirements without adequate end-user involvement and project managers need support from top management to secure the resources necessary to achieve CRM project objectives. Given the preceding exposition, it is the interplay of project-level IT resources (manifested in our construct CRMSC), not individual resources themselves, that is expected to ultimately determine the success of CRM system implementation efforts (Karim et al., 2007; Pavlou & El Sawy, 2006). As such, CRMSC represents a valuable, rare, and costly to imitate operational IT capability (Dierickx & Cool, 1989; Peteraf, 1993) that can lead to a competitive advantage if the firm adequately leverages the CRM system to support customer-focused processes (Barney & Hesterly, 2012).

3.2. Hypothesis development

3.2.1. CRMSC mediating the effect of firm-level IT capability on system quality

Research establishes that firm-level IT capability has a positive effect on IT system implementation outcomes (see Gu & Jung, 2013). Accordingly, we expect that a firm-level IT capability positively influences *CRM system quality*, i.e., the extent to which the CRM application reliably supports an organization's customer-focused processes (Barki, Rivard, & Talbot, 2001; Wallace, Keil, & Rai, 2004).

Notably, our study complements prior research by positing that CRMSC – a project-level capability – mediates the influence of firm-level IT capability on system quality (see Fig. 1). Specifically, we theorize that while firm-level IT capability has an effect on IT-related performance, a firm-level analysis is too general to adequately explain the relationship between IT resources and firm performance (see Pavlou & El Sawy, 2006) because such outcomes initially manifest themselves at the project-level (see Ashrafi & Mueller, 2015; Chen, 2012; Karim et al., 2007; Mikalef et al., 2020; Mithas et al., 2011; Ray et al., 2005).

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[2] CRM software is a highly specialized technology, typically purchased from CRM vendors. Although small firms often adopt CRM technology out-of-the-box, the majority of firms initiate a software implementation project to better implement and integrate the CRM system into the organization. In addition, CRM software as a service (SaaS) tools, like Salesforce.com, have grown far beyond their roots as simple implementations that take only days or weeks to implement, requiring substantial implementation capabilities and use of external consultants from firms (see Herbert, 2013).
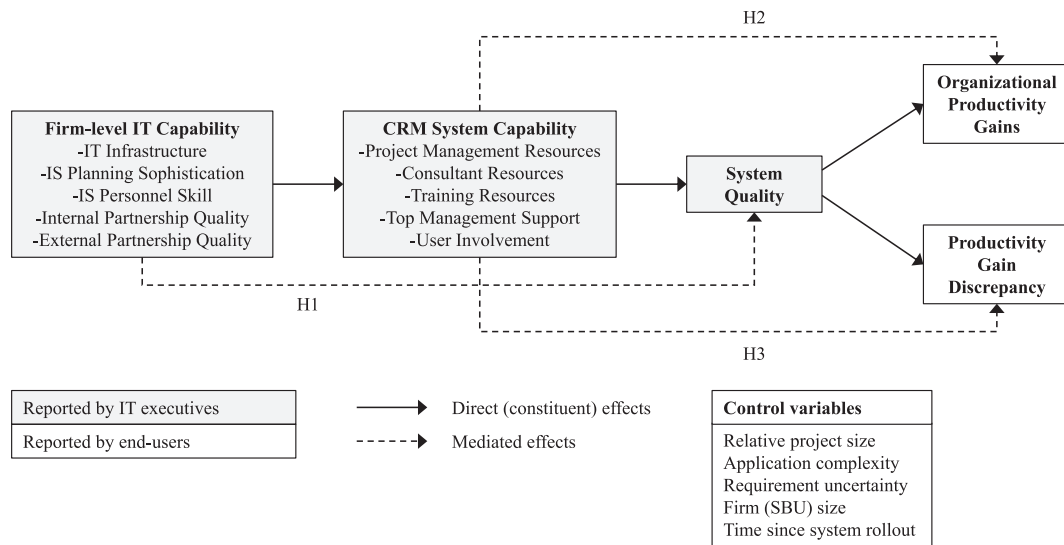
Fig. 1. A Mediated, Resource-Based Model of CRM System Capability.

Consistent with RBV's resource-picking mechanism, we expect that firm-level IT capability leads to rent creation through the effective selection of resources deployed at the project level, especially in the case of large projects such as a CRM system (cf. Mikalef et al., 2020). *Firm-level IT capability* represents an organization's capacity for gathering information, using such information to effectively guide decision-making, and its ability to leverage the right resources in the right combinations to achieve desired outcomes (Wernerfelt, 2011). For example, the skills of IS personnel affect system quality only to the extent to which these skills are used to select, acquire, and deploy appropriate project-level resources. In sum, we expect that the quality and availability of firm-level IT resources enhances the quality and availability of project-level resources (i.e., and thus enhance CRMSC) and, ultimately, system quality. Based on this logic, we hypothesize that:

H1 The positive effect of firm-level IT capability (ITC) on system quality (SQ) is mediated by CRM system capability (CRMSC).

3.2.2. System quality mediating the effect of CRMSC on organizational productivity gains

As alluded to in the development of our first hypothesis, a firm-level of analysis may obscure the relationship between IT resources and firm outcomes (Kraaijenbrink et al., 2010; Pavlou & El Sawy, 2006) and, for that reason, we posit that a project-level of analysis is preferable for understanding how firm-level IT ultimately enhances organizational productivity (Karim et al., 2007). Based on this line of reasoning, we propose that CRMSC – a project-level rather than firm-level capability – may have a measurable influence on organizational productivity. Consistent with this hypothesis, some RBV studies also suggest that IT's strategic impact should be examined at the specific IT asset level because it is at this level that IT's influence on firm performance is enacted (Aral & Weill, 2007; Nevo & Wade, 2010). In the context of this study, this notion implies that CRMSC may provide a strategic advantage and enhance organizational productivity by improving the quality (reliability, responsiveness, and functionality) of the CRM system intended to support the firm's customer-focused processes (Kozlenkova, Samaha, & Palmatier, 2014).

Jayachandran et al. (2005) suggest that CRM systems can enhance the execution of customer-focused processes by improving firms' ability to: (1) engage in two-way interaction with customers; (2) capture vast amounts of useful customer information; (3) integrate customer information derived from different sources and across functions; and (4) provide employees with on-demand access to customer information

necessary for strategic and tactical (e.g., during "live" interactions) decision-making. Each of these CRM system-enabled processes is vital to developing and keeping profitable customer relationships, and, thus an important determinant of both organizational effectiveness and efficiency (Chatterjee et al., 2020; Jayachandran et al., 2005; Mithas et al., 2005; Zablah et al., 2004). Consequently, we expect that, due to its impact on the quality of the CRM system implemented to facilitate firm relationship-building activities, CRMSC indirectly contributes to organizational productivity gains (See Fig. 1). Formally:

H2 The positive effect of CRM system capability (CRMSC) on organizational productivity gains (OPG) is mediated by system quality (SQ).

3.2.3. System quality mediating the effect of CRMSC on productivity gain discrepancy

Third, we expect that because CRMSC enhances CRM system quality, it will contribute to a reduction in *productivity gain discrepancy*, that is, level of variance in productivity gains across a firm. However, our rationale for why CRM system quality impacts productivity gain discrepancy differs from that used to substantiate the preceding hypothesis. Marketing and IS research shows that employee willingness to use CRM technology is a function of a myriad of individual difference variables (Avlonitis & Panagopoulos, 2005; Cascio, Mariadoss, & Mouri, 2010; Jones, Sundaram, & Chin, 2002; Keillor, Bashaw, & Pettijohn, 1997; Navimipour & Soltani, 2016; Schillewaert, Ahearne, Frambach, & Moenaert, 2005; Speier & Venkatesh, 2002). While overall computer literacy has improved notably during recent years – thus diminishing general IS ability and attitude-related challenges among end-users –individual differences related to job experience, age, gender, job role, and work motivation are still likely to impact end-user system usage. These differences are likely to manifest as variability in the gains employees realize from the technology.

Since CRM technology typically caters to a diverse, cross-functional user base engaging in different customer-facing tasks, a superior CRM system is able to meet the heterogeneous, collective requirements of the organization (Fjermestad & Romano, 2003). The integration of CRM technology into customer processes should result in productivity gains depending on task-technology fit, i.e., a system's functionalities complement specific task requirements of the job at hand (Barki, Titah, & Boffo, 2007; Goodhue & Thompson, 1995; Speier & Venkatesh, 2002). CRM system quality helps mitigate the influence of individual employee differences and task diversity by inducing uniformity in the way

Table 2
Main Constructs and Sub-Constructs.

Main Construct / Sub-Construct	Definitions	References
Firm-level IT Capability (ITC)	The firm's ability to mobilize and deploy IT-based resources in combination for the purpose of meeting business needs and objectives.	Bharadwaj (2000), Pavlou and El Sawy (2006), Ross et al. (1996)
IT Infrastructure (INF)	The firm's technology platform encompassing physical and intangible IT assets.	Bhatt and Grover (2005), Mata et al. (1995), Ross et al. (1996)
IS Planning Sophistication (ISP)	Planning activities prior to IS initiatives to ensure appropriate alignment with business objectives.	Powell and Dent-Micallef (1997), Ravichandran et al. (2005), Segars and Grover (1998)
IS Personnel Skill (PS)	Training, experience, relationships, and insights of the firm's employees in the IT function.	Bharadwaj (2000), Ravichandran et al. (2005), Mata et al. (1995)
Internal Partnership Quality (IPQ)	Relationships between the IT department and the firm's business units.	Ravichandran et al. (2005), Ross et al. (1996)
External Partnership Quality (EPQ)	Relationships between the IT department and external IT software vendors and IT service providers.	Feeny and Willcocks (1998), Ravichandran et al. (2005)
CRM System Capability (CRMSC)	A firm's ability to assemble, integrate and deploy the resources necessary to successfully implement a purchased CRM application.	Bharadwaj (2000), Chen and Popovich (2003), Fjermestad and Romano (2003), Karim et al. (2007)
Project Management Resources (PMR)	Expertise, experience, skills, and methodologies needed in managing IS projects throughout its lifecycle.	Chen and Popovich (2003), Karim et al. (2007), Wallace et al. (2004)
Consultant Resources (CR)	Experience and competence of external consultants to deliver a technological CRM solution that meets client requirements.	Fjermestad and Romano (2003), Zablah et al. (2004), Zmud (1980)
Training Resources (TR)	The degree to which the firm has instructed target users in using the CRM technology in terms of quality and quantity.	Fjermestad and Romano (2003), Morgan and Inks (2001), Pullig et al. (2002), Zablah et al. (2004)
Top Management Support (TMS)	Emotional and actual involvement of the firm's top executives in the CRM initiative.	Armstrong and Sambamurthy (1999), Chen and Popovich (2003), Fjermestad and Romano (2003)
User Involvement (UI)	User influence and actual participation in system implementation project.	Barki and Hartwick (1989), Boynton, Zmud, and Jacobs (1994), Gefen and Ridings (2002), Zablah et al. (2004)
System Quality (SQ)	The degree to which the CRM application performs reliably in its support of an organization's customer-focused processes.	Barki et al. (2001), Wallace et al. (2004)
Organizational Productivity Gains (OPG)	The extent to which CRM system use improves the collective effectiveness and efficiency of employee efforts directed toward customers.	Chan (1998), Glick (1985)
Productivity Gain Discrepancy (PGD)	The extent to which the effectiveness and efficiency benefits employees realize from using the CRM system vary within a firm.	Bliese (2000), Chan (1998); Schneider, Salvaggio, and Subirats (2002)

individual employees experience the system. In particular, CRM system quality levels the playing field such that employees are able to derive similar benefits from using the system regardless of their technology-related abilities and experience, and regardless of their specific job role and related tasks; this, in turn, should lead to similar productivity gains across employees and a decrease in productivity gain discrepancy (see Fig. 1). Hence, we posit:

> **H3** The negative effect of CRM system capability (CRMSC) on productivity gain discrepancy (PGD) is mediated by system quality (SQ).

We underscore that H2 and H3 are independent of one another. In the case of any given firm, it is theoretically possible for CRM system quality to have little or no impact on organizational productivity gains while simultaneously contributing to a decrease in productivity gain discrepancy. In other words, it is possible for productivity gains to be consistently low across organizational users, an outcome that is conceivable only if the proposed effects of system quality are independent of one another. However, although theoretically possible, low gain discrepancies and low productivity gains are unlikely to co-occur, given that CRM tools are likely to provide productivity gains to at least some members of the organization.[3]

3.3. Controls

Our model controls for the effects of five other factors. The risk and project management literatures identify three project-specific structural risks that affect IS implementation success and are thus a potential source of heterogeneity: (1) *project size*, (2) *application complexity*, and (3) *requirements uncertainty* (see Wallace et al., 2004; Gemino, Reich, & Sauer, 2007). Firm size has been controlled for in a number of related studies (e.g., Bhatt & Grover, 2005; Mithas et al., 2005) and, similarly, we also control for *firm/SBU size*. Larger firms typically have larger slack financial resources at their disposal to invest in CRM systems, which may cause divergent outcomes. Finally, *time since system rollout* is controlled for (Karim et al., 2007). Productivity gains and productivity gain discrepancy may change over time (Hendricks, Singhal, & Stratman, 2007; Maklan, Peppard, & Klaus, 2015; Speier & Venkatesh, 2002), and, thus, controlling for time since rollout may partial out noise in the variance.

4. Methodology

4.1. A matched design, multi-informant field study

Our study investigates how IT management factors (IT resources, system capability, system quality) influence user-level organizational productivity. We employ a matched, multi-informant field study design to examine the impact of organizational IT factors (reported on by managers) on end user productivity outcomes (reported on by multiple employees within each firm). This design reduces the risk of common method bias[4] as data for the independent and dependent variables are drawn from different sources (Podsakoff, MacKenzie, Lee, & Podsakoff,

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[3] We performed an independent samples T-test in which organizational gain discrepancy levels were compared across subgroups formed on the basis of the level of organizational productivity gains in firms (the subgroups represented the top and bottom third of firms based on organizational productivity gains). Organizational gain discrepancy levels are significantly lower (t = 6.07, p = .00) in the "high organizational productivity gains" group ($\overline{x} = 0.80$) than in the "low organizational productivity gains" group ($\overline{x} = 1.66$).

[4] To further assess CMB, a variant of multitrait-multimethod (MTMM) analysis was employed with reflective measures (Makadok, 2003) and a modified MTMM analysis with formative measures (Pullig et al., 2003). No violations of MTMM principles were found.

2003).

In the first phase of data collection, a cross-industry SBU sampling frame of N = 526 was identified using a commercial database and a list of the largest 2,000 firms and foreign-owned subsidiaries based in Finland (in terms of revenue). The sampling frame was limited to firms using CRM technology that employed 250 individuals or more. The unit of analysis was either the strategic business unit (SBU) or the firm itself if there were no distinct business units. We contacted a top IT executive of each organization (with titles such as CEO, CIO, CTO or IT Director), to (1) invite them to participate in the research, (2) identify the most knowledgeable person within the organization for the latest CRM project in the firm, and (3) attain a permission and support for the end-user survey. We ensured full anonymity for participants and offered a full report of findings as an incentive for participation. 207 executives agreed to participate in the study.

We sent the first management questionnaire to the 207 respondents identified in the first step of our sampling process. To ensure the informants possessed adequate knowledge, we assessed respondent competency through two separate questions in the instrument with respect to IT resources and CRM system development (Kumar, Stern, & Anderson, 1993). After two follow-up rounds, we received 189 responses. After removing responses with seemingly low respondent competency and a substantial number of missing values, our final sample size for the first questionnaire is N = 168, yielding an effective response rate (32%) similar to that of comparable studies.

In the second phase, we collected data on end-user performance gains using a separate questionnaire. To avoid selection bias, we randomly selected end-users for participation in the study using a commercial database. We focused on employees with titles of sales director, sales manager, sales assistant, marketing director, marketing manager, marketing assistant, customer service manager and customer service agent. The available contact information varied in database and led to the identification of 931 CRM end-users in the 168 participating firms (a minimum 2 and average of 5.5 end-users per firm).

After two reminders we received 474 usable responses (51% response rate) from CRM end-users (a minimum of two and average of 3.2 end-users per firm), with adequate responses from 148 firms. This outcome is consistent with Van Bruggen, Lilien, and Kacker (2002) recommendation that a minimum of two and, ideally, 3 to 4 respondents be collected per case. Finally, we aggregated the individual end-user data and matched it with respective organizational responses, resulting in a matched dataset of N = 148 for analysis purpose (with an overall response rate of 28%).

Table 3 summarizes the sample characteristics. The data were screened for possible non-response biases (Armstrong & Overton, 1977). The analyses supported that the sample adequately represented the firms using CRM software in Finland by industry. A comparison of early and late responses in management and end-user samples indicated that non-response bias is not a problem.

4.2. Measures of the study

All study measures were adopted from prior studies. Questionnaires were backward and forward translated by bilingual native speakers to ensure translation accuracy. For content validity, the questionnaires were pre-tested with nine C-level IT executives from different industries (manufacturing, IT and media, professional services, construction). Table 4 summarizes main constructs, sub-constructs and their measurement types, item contents and sources of measures. Questionnaire and the indicators of the measures are presented in Appendix A.

All measures were on a 7-point Likert scale measures. Firm-level IT Capability (ITC) and CRM System Capability (CRMSC) are both higher-order constructs. Following established measurement guidelines (Jarvis, MacKenzie, & Podsakoff, 2003; Petter, Straub, & Rai, 2007), some of the applied first-order scales modeled as reflective in prior studies were actually formative. Specifically, ITC was modeled as a second-order

Table 3
Sample Characteristics (N = 148).

Industry	N	%	Revenue (m€)	N	%
Manufacturing	29	20	<20	32	22
Wholesale	24	16	20–100	43	29
Professional services	20	14	101–500	38	26
IT & Media	20	14	>500	35	24
Public	10	7	Total	148	100
Education	9	6			
Finance & Insurance	8	5	**Position of Respondent**	**N**	**%**
Transportation & Warehouse	8	5	IT director/manager	42	28
Construction	5	3	CIO	27	18
Retail	5	3	CEO/Vice president	22	15
Others	4	3	Development director	19	13
Health & Social services	3	2	Sales/Marketing/ Customer director	16	11
Hospitality	3	2	Project director/manager	15	10
Total	148	100	Others	7	5
			Total	148	100
			Type of CRM system	**N**	**%**
			CRM-on-Premise	127	86
			On-demand Cloud-based CRM	21	14
			Total	148	100

formative, first-order formative (Type IV) construct whereas four out of five sub-dimensions forming CRM system capability (CRMSC) are reflectively measured; project management resources (PMR) is the only formatively measured sub-construct.

Second, we specified System Quality (SQ) as a formative scale that was previously modeled as reflective. Third, the organizational productivity measures, Organizational Productivity Gains (OPG) and Productivity Gain Discrepancy (PGD), were measured by aggregating end-user responses (individual productivity gains, IPG). Specifically, we used the additive composition process to compute organizational productivity gains (within-unit aggregate mean), and the variance in IPG to gauge productivity gain discrepancy (within-unit aggregate standard deviation), respectively (Bliese, 2000; Chan, 1998). For the discrepancy measure, values were standardized, and higher values represent higher levels of discrepancy (variance).

Finally, in the case of organizational productivity gains – which is based on an additive composition model – within-group homogeneity and inter-rater agreement are not necessary to support aggregation from the individual to organizational level (i.e., to compute organizational-level means); however, it is important to consider the reliability of the mean scores, typically assessed via ICC(2) (Bliese, 2000). In our study, the ICC(2) value for organizational productivity gains is 0.51. This value is moderately lower than the established standards (i.e., 0.70), a finding that is not surprising given the sensitivity of the ICC(2) statistic to within-group sample sizes (see Netemeyer, Maxham, & Lichtenstein, 2010 for a similar example). Importantly, our ICC(2) value does not preclude aggregation, it simply implies that it might be difficult to identify significant relationships with other model constructs using the aggregate score (Bliese, 2000).

Structural IS project risks were controlled via three scales originally developed by Gemino et al. (2007). *Relative project size*, measured with a single-item measure, compares CRM project size to the client firm's other recent IS projects. *Application complexity*, measured using a two-item scale, captured the extent of technological integration required for the CRM project. *Requirements uncertainty* was measured with a three-item scale to assess risks associated with the diversity of end-user needs. Finally, with single-item measures, we controlled for *SBU size* by means of annual revenue and *time since CRM system rollout* in years.

Table 4
Measure Descriptions.

Construct	Type	Item Content	Source/Reference
Firm-level IT Capability (ITC)	Formative 2nd order	–	IT Capability (Bharadwaj, 2000; Pavlou & El Sawy, 2006; Ross et al., 1996)
IT Infrastructure (INF)	Formative 1st order *(originally treated as reflective)*	Modularity (INF1); scalability (INF2); transparency (INF3); handling of multiple applications (INF4)	IT Infrastructure (Bhatt & Grover, 2005)
IS Planning Sophistication (ISP)	Formative 1st order *(originally treated as reflective)*	Business units' participation (ISP1); senior management participation (ISP2); formalized methodology (ISP3); methodological guidelines (ISP4)	IS Planning Sophistication (Ravichandran et al., 2005)
IS Personnel Skill (PS)	Formative 1st order *(originally treated as reflective)*	Technical knowledge base (PS1); learning new technologies (PS2); project management (PS3); co-operation with clients (PS4)	IS Personnel Skill (Ravichandran et al., 2005)
Internal Partnership Quality (IPQ)	Formative 1st order *(originally treated as reflective)*	Information sharing (IPQ1); under-standing each other (IPQ2); trust (IPQ3); co-operation (IPQ4); conflicts (IPQ5)	Internal Partnership Quality (Ravichandran et al., 2005)
External Partnership Quality (EPQ)	Formative 1st order *(originally treated as reflective)*	Conflicts (EPQ1); vendor proactiveness (EPQ2); vendor responsiveness (EPQ3); trust (EPQ4); longevity (EPQ5)	External Partnership Quality (Ravichandran et al., 2005)
CRM System Capability (CRMSC)	Formative 2nd order	–	ERP Delivery System (Karim et al., 2007), IS Resources (Karim et al., 2007)
Project Management Resources (PMR)	Formative 1st order *(originally treated as reflective)*	Formal techniques (PMR1); competence (PMR2); realistic scheduling (PMR3)	Project Management Resources/ Knowledge (Karim et al., 2007)
Consultant Resources (CR)	Reflective 1st order	Reflective items measuring experience and competence of external consultants.	Consultant Resources/ Knowledge (Karim et al., 2007)
Training Resources (TR)	Reflective 1st order	Reflective items measuring the provision of end-user training.	Training Resources (Karim et al., 2007)
Top Management Support (TMS)	Reflective 1st order	Reflective items measuring the extent of top management support.	Top Management Support/ Involvement (Karim et al., 2007)
User Involvement (UI)	Reflective 1st order	Reflective items measuring the involvement of end-users.	User Involvement (Karim et al., 2007)
System Quality (SQ)	Formative 1st order *(originally treated as reflective)*	Reliability (SQ1); maintainability (SQ2); functionality (SQ3); response time (SQ4); overall quality (SQ5)	Product Performance (Wallace et al., 2004)
Organizational Productivity Gains (OPG)	Within-unit aggregate mean (reflective 1st order measures from end-users)	Additive composition model of reflective items measuring individual productivity gains from CRM system use perceived by end-users.	Perceived Usefulness (Venkatesh & Davis, 2000) - Additive composition model (Chan, 1998; Glick, 1985)
Productivity Gain Discrepancy (PGD)	Within-unit aggregate standard deviation mean (reflective 1st order measures from end-users)	Dispersion model of reflective items measuring individual productivity gains from CRM system use perceived by end-users.	Perceived Usefulness (Venkatesh & Davis, 2000) - Dispersion model (Bliese, 2000; Chan, 1998)

5. Results

The conceptual model was tested with Partial Least Squares Modeling (SmartPLS 3 Ringle, Wende, & Becker, 2015) with 5000 resample bootstraps to estimate the significance levels of the instrumentation (Hair, Hult, Ringle, & Sarstedt, 2013). We modeled firm-level IT capability and CRM system capability (CRMSC) as multidimensional constructs, the Firm-level IT capability and CRMSC are Type IV and Type II formative composite constructs, respectively (Jarvis et al., 2003; Petter et al., 2007). In PLS analyses, we modeled them using a hierarchical component model with repeated indicators. A Mode B (path-weighting scheme) was selected for the formatively-measured repeated indicators because this approach produces the most reliable results for structural models including endogenous Type II higher-order constructs (Becker, Klein, & Wetzels, 2012). Using Cadogan and Lee's recommendation (2013), we decomposed the structural model when specifying the antecedent relationship to CRMSC; that is, we estimated the hypothesized antecedent relationship for the higher-order CRMSC construct through its lower-order dimensions (Cadogan & Lee, 2013). To account for the total effects on CRMSC, the explained variance in each dimension is multiplied by its weight and the individual contributions of each dimension are added together (Becker et al., 2012). Finally, we carried out additional tests following Chwelos, Benbasat, and Dexter (2001) to test whether measurement model specification affects structural results. We tested two versions of the model with all first-order constructs formative and another model with all first-order constructs reflective (scale validity and reliability criteria were met). The results of the structural model were qualitatively similar with no path coefficients gaining or losing statistical significance, and no significant paths changing in sign.

5.1. Measurement model results

Reflectively-measured constructs were assessed in terms of item-level reliability, construct reliability, and convergent and discriminant validity. All item loadings (>0.70), composite reliabilities (>0.70), and AVEs (>0.50) exceed acceptable reliability criteria (Hair, Ringle, & Sarstedt, 2011). All measures discriminate well (Fornell & Larcker, 1981) – see Table 5. Convergent and discriminant validity were further examined with inter-item and item-to-construct correlation matrices based on a modified multitrait-multimethod (MTMM) analysis (Campbell & Fiske, 1959; Loch, Straub, & Kamel, 2003). In terms of convergent validity, items thought to be a part of the same construct should all correlate to a significant level with their construct and with each other. All inter-item and item-to-construct correlations were significant, indicating good convergent validity. In terms of discriminant validity, inter-item and item-to-construct correlations should be higher than correlations with other measures. There were no violations of this principle suggesting support for scale validity.

Formative measures were validated via close multicollinearity and construct validity assessment (MacKenzie, Podsakoff, & Podsakoff, 2011; Petter et al., 2007), including a four-phase measure purification procedure as described by Cenfetelli and Bassellier (2009). First, we carried out multicollinearity tests that led to the removal of item SQ5 (VIF = 4.6)[5] (Diamantopoulos & Siguaw, 2006). Formative measures might be problematic when they have non-significant or negative weights when bivariate correlations are otherwise positive. Yet, these weights can still have an important role for the construct. Cenfetelli and Bassellier (2009) emphasize that the formative measurement validation

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[5] The original system quality construct developed by Wernerfelt (2004) was misspecified as reflective. Item SQ5 measured the overall quality of the system, which explains why the item suffered from excessive multicollinearity.

Table 5
Latent Variable Correlations and Descriptive Statistics.

Construct	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Firm-level IT Capability	–														
2. IT Infrastructure	0.50	–													
3. IS Planning Sophistication	0.76	0.21	–												
4. IS Personnel Skill	0.70	0.33	0.28	–											
5. Internal Partnership Quality	0.85	0.33	0.52	0.55	–										
6. External Partnership Quality	0.53	0.32	0.31	0.35	0.40	–									
7. CRM System Capability	0.58	0.28	0.41	0.42	0.48	0.32	–								
8. Project Management Resources	0.46	0.24	0.27	0.40	0.38	0.27	0.80	–							
9. Consultant Resources	0.40	0.25	0.23	0.31	0.33	0.27	0.69	0.51	**0.90**						
10. Training Resources	0.40	0.11	0.34	0.28	0.30	0.17	0.72	0.46	0.41	**0.84**					
11. Top Management Support	0.45	0.13	0.42	0.24	0.37	0.16	0.64	0.28	0.27	0.40	**0.84**				
12. User Involvement	0.40	0.28	0.29	0.19	0.35	0.23	0.67	0.44	0.35	0.32	0.37	**0.90**			
13. System Quality	0.41	0.27	0.27	0.27	0.36	0.33	0.69	0.52	0.45	0.47	0.42	0.44	–		
14. Organizational Productivity Gains	0.06	0.08	0.07	-0.04	0.09	0.07	0.15	0.10	0.04	0.10	0.11	0.09	0.47	**0.94**	
15. Productivity Gain Discrepancy	-0.01	-0.01	0.00	-0.02	-0.08	-0.08	-0.01	-0.01	-0.04	0.06	-0.02	-0.01	-0.29	-0.49	–
Mean	4.54	4.61	4.23	4.82	4.61	4.43	4.55	4.72	4.25	4.39	4.68	4.73	4.75	4.87	1.20
SD	0.74	1.04	1.08	1.06	1.05	1.07	0.91	1.11	1.35	1.21	1.40	1.38	1.17	0.93	0.76
SE	0.06	0.09	0.09	0.09	0.09	0.09	0.07	0.09	0.11	0.10	0.12	0.11	0.10	0.08	0.06
Alpha	–	–	–	–	–	–	–	–	0.89	0.79	0.90	0.88	–	0.96	–
CR	–	–	–	–	–	–	–	–	0.93	0.88	0.94	0.92	–	0.97	–
AVE	–	–	–	–	–	–	–	–	0.82	0.70	0.84	0.80	–	0.88	–

Note: √AVE bolded in diagonal. Alpha, CR, AVE and √AVE are given only for reflective constructs.

should never be done based on mere significance of weights and *no* insignificant or even negative weights are a problem as long as the validation criteria are met. We used the recommended steps to analyze formative measurement weights. Secondly, we assessed formative indicator weights in different grouping scenarios to determine whether the *number of indicators* led to non-significant weights. Thirdly, we assessed the *co-occurrence of negative and positive indicator weights*, by examining inter-item and item-construct correlations to find suppressor effects that might explain negative weights. Fourthly, we examined the *absolute* (loadings) versus *relative* (non-significant weights) *indicator contributions*. Following the Cenfetelli and Bassellier (2009) guidelines, we reluctantly removed two formative indicators PS1 and EPQ1[6]. Some indicators with non-significant or low negative weights were kept in measurement model based on validation criteria. The final measurement model loadings and weight indicators are presented in Appendix A, which also details the specific reasons for keeping each indicator with non-significant weight.

Finally, we employed another modified MTMM analysis to assess convergent and discriminant validity of the purified formative measures (Campbell & Fiske, 1959; Loch et al., 2003). In terms of discriminant validity, a few violations of the MTMM principles occurred, but no more than expected by chance alone (Campbell & Fiske, 1959).

5.2. Structural model results

We assessed the adequacy of the structural model by examining explained variances and standardized beta coefficients and we also assessed significance levels (t-statistics) and standard errors using 5000 bootstrap iterations (Hair et al., 2011, 2013). Since CRM system capability (CRMSC) and system quality (SQ) were formally hypothesized (H1-H3) to be key mediators in the relationship between firm-level IT resources and organizational productivity, we further tested indirect effects using the bootstrapping method (see Table 6), with 5000 bootstrap resamples (Edwards & Lambert, 2007; Kenny, 2008; Preacher &

Hayes, 2008).

The results of the mediation hypotheses (see Table 6) were interpreted based on the standardized coefficients and the significance levels, bias-corrected 95% confidence intervals, and standard errors of the indirect effect (Preacher & Hayes, 2008; Shrout & Bolger, 2002; Zhao, Lynch, & Chen, 2010). All mediation hypotheses (H1-H3) were empirically supported ($p < .01$), which supports our claim that it is necessary to account for the intervening role of CRMSC and system quality when the goal is to understand how firm-level IT capability influences organizational productivity.

Structural model results (Fig. 2) reveal that firm-level IT capability (ITC) has significant ($p < .01$) indirect effects on CRMSC via each of its five first-order dimensions. The explained variances of CRMSC dimensions range between 16% (consultant resources, training resources, user involvement) and 21% (project management resources). By calculating total indirect effects (Becker et al., 2012), ITC explains 25% of the total variance in CRMSC. While ITC clearly drives CRMSC, it does not automatically guarantee high system capability. Structural model results indicate that three out of five dimensions forming CRMSC make a significant contribution ($p < .05$) to the underlying second-order construct (see Fig. 2). The other two dimensions, consultant resources (0.23, t = 1.80) and user involvement (0.23, t = 1.86), are also significant at $p < .10$. Project management resources (PMR) make the strongest contribution to CRMSC (0.37, $p < .01$) in our model. Importantly, the results reveal that CRMSC does mediate the link between the first-order effects (PMR, CR, TR, TMS, UI) and system quality (0.69, $R^2 = 0.47$). When the mediating role of the second-order CRMSC construct is not controlled for (i.e., when only the direct impact of the first-order effects on system quality is modeled), the total amount of variance explained is 4% less (or 43% rather than 47%). When neither CRMSC nor its dimensions are controlled for, the direct effect of firm-level IT capability (ITC) predicts 24% of the variance in system quality.

Finally, the results also show that system quality influences organizational productivity gains (0.47, $p < .01$) and gain discrepancy (-0.29, $p < .01$). One control variable, requirements uncertainty, had a significant effect on organizational productivity gains (-0.22, $p < .05$) but otherwise control variables (relative project size, application complexity, requirements uncertainty, firm (SBU) size, time since system rollout) had no significant effects on model endogenous constructs. In sum, all hypotheses received empirical support ($p < .01$), and the model explained 22% of the variance in organizational productivity

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[6] Although removing items may alter the theoretical meaning of the underlying formative construct, PS1 and EPQ1 did not make a contribution to their constructs in the relative or the absolute sense (low loadings). There were no empirical grounds to retain them. Based on theoretical analysis, PS1 and EPQ1 also had a degree of conceptual overlap with other items, further validating their removal (Chan, 2009).

Table 6

Test of the Indirect Effect Hypotheses.

H	Mediation path	Hypothesis	Path *ab*	SE	LLCI 95%	ULCI 95%	Supported?
H1	ITC → CRMSC → SQ	The positive effect of firm-level IT capability (ITC) on system quality (SQ) is mediated by CRM system capability (CRMSC).	0.40**	0.069	0.267	0.541	Yes
H2	CRMSC → SQ → OPG	The positive effect of CRM system capability (CRMSC) on organizational productivity gains (OPG) is mediated by system quality (SQ).	0.48**	0.081	0.321	0.643	Yes
H3	CRMSC → SQ → PGD	The negative effect of CRM system capability (CRMSC) on productivity gain discrepancy (PGC) is mediated by system quality (SQ).	−0.33**	0.091	−0.519	−0.164	Yes

** $p < .01$ (p-value of indirect path *ab* was also assessed at bias-corrected 99% confidence intervals)

LLCI: Lower level bias-corrected confidence interval. **ULCI:** Upper level bias-corrected confidence interval

2nd order composite construct   ** p<.01; * p<.05; + p<.10 (2-tailed)   Explained variances R² in **bold**
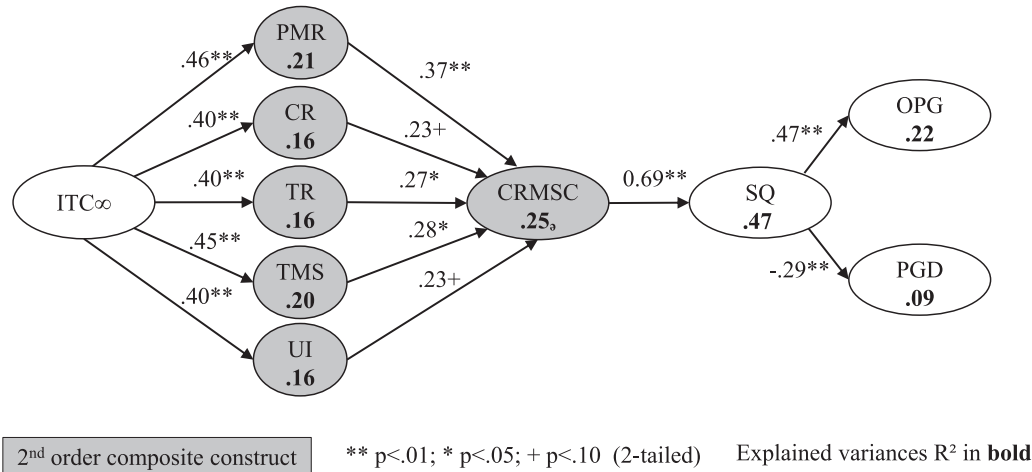
ITC: Firm-level IT Capability, CRMSC: CRM System Capability, SQ: System Quality, OPG: Organizational Productivity Gains, PGD: Productivity Gain Discrepancy, PMR: Project Management Resources, CR: Consultant, Resources, TR: Training Resources, TMS: Top Management Support, UI: User Involvement. (∞ for ease of presentation, formative dimensions leading into ITC are not illustrated in the Figure. ITC dimension weights are INF .12ns. ISP .42** PS .33** IPQ .35** EPQ .10ns.)

ₐ CRMSC R2 represents the total indirect effects ITC→CRMSC

Fig. 2. Structural Model and Mediation Hypotheses Results.

gains, and 9% in productivity gain discrepancy.

6. Discussion

This study builds on RBV theory to conceptualize the major effects of CRM system capability (CRMSC), a new construct that acts as the central mechanism linking firm-level IT capability to CRM project outcomes (i. e., system quality), and, ultimately, firm performance (i.e., organizational productivity gains and productivity gains discrepancy). In so doing, the study makes several contributions to CRM and IS research and practice that are summarized in Table 7.

6.1. Implications for theory

The system implementation phase should not be neglected. To date CRM studies have focused on broad organizational implementation issues (see Dalla Pozza et al., 2018). This study extends CRM research "backwards" (see Chatterjee et al., 2020; Kim et al., 2011; Maklan et al., 2015) by demonstrating that the business value firms realize from their CRM investments depends on what occurs during the system implementation phase. Our study reveals that a project-level of analysis (c.f. Ashrafi & Mueller, 2015) and focus on system quality (c.f. Gu & Jung, 2013) offer invaluable insight for quantifying the benefits provided by CRM systems and for identifying the root causes behind failed CRM

initiatives. We elaborate on these ideas next.

Drawing on RBV, our study improves understanding of the mechanisms through which *(*i.e.*, how)* CRM investments impact organizational performance by answering calls for research to consider the role that project-level resources and outcomes play in the called-for-new-research process (Alexander, 2019; Karim et al., 2007; Maklan et al., 2015; Mikalef et al., 2020). Consistent with prior RBV research on the business value of IT systems, we find that system quality is a critical mediator of the impact of the firms' strategic- and project-level IT capabilities on organizational performance (Gu & Jung, 2013; Hitt, Wu, & Zhou, 2002; Stratopoulos & Dehning, 2000). Specifically, system quality, a hitherto ignored determinant of CRM success (Avlonitis & Panagopoulos, 2005), impacts organizational performance by enhancing the productivity of organizational customer-facing processes (Kohli & Grover, 2008; Ray et al., 2005). Finally, we find that system quality influences organizational productivity in two distinct ways. First, it drives organizational productivity gains (Jayachandran et al., 2005; Mithas et al., 2005). Secondly it reduces productivity gain discrepancy, which suggests that system quality may serve to mitigate the influence of individual differences (Avlonitis & Panagopoulos, 2005).

Resource combinations (not isolated resources) should be the focus of CRM and IS implementation research. This study makes a notable contribution to marketing and IS research by offering deeper empirical insight into the technology-specific factors that determine the quality of

Table 7
Key findings, Theoretical and Practical Contributions.

Key findings	Theoretical contributions	Practical implications
1. Firms' IT capabilities are a critical antecedent of CRM success, i.e., IT capabilities are positively related to CRM system quality, which in turn enhances organizational productivity outcomes.	The study is among the first to extend CRM research "backwards" by demonstrating the critical role of the CRM system implementation phase for achieving (a) organizational productivity gains and (b) low productivity gain discrepancy among the system users.	The study suggests that management should prioritize the CRM system implementation phase to improve organizational performance. Due to CRM's unique characteristics, system quality is a key driver of organizational productivity in the post-implementation phase.
2. A second-order formative CRM system capability construct captures the ideal combination of IT resources at the CRM project level necessary for enhancing CRM system quality and organizational performance.	The study provides CRM research with a parsimonious CRM system capability (CRMSC) construct that measures the combined effect of IT resources on CRM system implementation outcomes based on resource-picking and resource complementarity arguments. The relative importance of the different resources is also elucidated.	The CRM system capability construct provides managers with a checklist of IT resources necessary for implementing CRM systems that improve organizational productivity. The study underlines that management should not focus on individual CRMSC dimensions but on resource configurations to achieve CRM success.
3. The relationship between firm-level IT capability and firm-level performance is mediated by project-level CRM system capability and resulting system quality.	The study adds to the research on the strategic and operational resource perspectives in the IT capability paradigm and RBV theory by demonstrating that the impact of a firm-level IT capability on firm performance is realized through resource selection and deployment decisions that give rise to a project-level capability which determines project-level outcomes, that is, system quality.	The study shows that IT resource deployment at the project level primarily determines CRM technology success. Firms lacking in strategic IT capability, however, are less likely to select the right resource combinations for CRM projects. Due to CRM's unique characteristics, CRM system implementation is best undertaken by firms with prior system project experience.

CRM systems. In light of the unique aspects of CRM systems, we introduce CRM System Capability (CRMSC) to the literature. CRMSC identifies five complementary, project-level, CRM-specific IT resources necessary for successfully implementing purchased CRM applications (Karim et al., 2007; Ray et al., 2005). Our study strongly affirms the utility of CRMSC for understanding CRM project outcomes. Building on RBV resource complementarity arguments, we find that the higher-order, formative CRMSC construct predicts system quality better than its individual dimensions in isolation (Pavlou & El Sawy, 2006).

CRMSC should thus be conceptualized as a combination of individual resources that exert a joint influence – which is "greater than the sum of its parts" (c.f. Ho et al., 2016; Shin & Lee, 2019). Its effect on system quality thereby captures the complex pattern of inter-dependencies that exist between the resources necessary for CRM system implementation (Karim et al., 2007). As such, our study suggests that CRMSC is a valuable, rare, and costly-to-imitate operational IT capability (Amit & Schoemaker, 1993; Dierickx & Cool, 1989; Peteraf, 1993) that can be a source of strategic advantage when its value-creating potential is leveraged in IT-enabled customer processes (Barney & Hesterly, 2012; cf. also Mikalef et al., 2020).

IS implementation research should consider the role of hierarchical resource "flows." Our study complements extant research knowledge by

providing detailed theoretical and empirical insights on how IT resources and capabilities that reside at different hierarchical levels within firm boundaries (firm- and project-levels) influence firm performance (see Alexander, 2019; Kraaijenbrink et al., 2010; Mikalef et al., 2020). Building on RBV's resource-picking and resource complementarity mechanisms, we find that a firm-level IT capability influences CRM outcomes by enhancing the firm's ability to acquire the project-level IT resources (from either strategic factor markets or the firm's own resource pools) necessary for effectively implementing the system (Makadok & Barney, 2001; Maritan & Peteraf, 2011; Wernerfelt, 2011). Thus, firms need higher-order (strategic) as well as lower-order (operational) resources and capabilities to achieve CRM success and academics and practitioners should attend to how best to manage resource "flows" across levels (Kraaijenbrink et al., 2010; cf. also Davies & Brady, 2016; Hermano & Martín-Cruz, 2016). Given its systematic focus on hierarchical resource flows, this study contributes to IS capability-performance research by clarifying the complex mediating mechanisms between the studied firm IT capability, systems capability, system quality and organizational performance in a new system implementation context. Research has considered this capability performance chain only partially as earlier studies in this area have omitted one or several of the recognized key mediators from their research models (see Ashrafi & Mueller, 2015; Gu & Jung, 2013).

6.2. Implications for practice

Customer Relationship Management (CRM) technology represents a critical IS investment for firms. Unfortunately, CRM system implementation initiatives often fail outright or lead firms to report limited benefits from their investments in CRM. Our study is rooted in the view that the system implementation phase is key to CRM technology success and it builds on this largely neglected perspective to offer managers three critical recommendations detailed below. The findings should also have relevance to other user intensive IS such as BI and market intelligence.

System implementation efforts are typically driven by the IT department. Consequently, frontline managers often tend to focus on CRM performance only *after* system launch. Our findings suggest, however, that this is a mistake in that the system implementation phase is of equal, if not greater importance to the success of CRM efforts. Hence, our first recommendation for managers is that they should approach CRM efforts with an inclination to view system quality as paramount to avoiding failed CRM initiatives. Moreover, since system quality is contingent upon unique attributes of the organizational context, we advise managers to direct substantial effort towards clearly defining, early on, what constitutes system quality for their firm.

Second, our research advances the notion of CRMSC, a critical, project-level capability composed of five resources or factors necessary for producing high quality CRM systems, providing a checklist for IT managers of the resources they should seek to acquire when their aim is to implement high-quality CRM systems (see Appendix A). Our results also underscore the point that managers should focus on synergies between the five CRMSC factors to avoid the common pitfalls associated with CRM system implementation. Project management, consultants, user training, top management support and user involvement intermingle in a complementary fashion; managers should recognize that inadequacies in any of these dimensions can seriously undermine CRM outcomes that cannot be compensated for by excelling in other dimensions. Making a strategic impact with CRM technology investment necessitates deep cross-functional integration with other enterprise IS. Practitioners should be aware such CRM implementations may have the highest potential for strategic advantage, but they are also particularly vulnerable to project resource deficiencies that will inevitably result in poor CRM system quality.

Finally, we find that CRMSC functions as the critical link between firm-level IT capabilities and CRM outcomes. Firms with better IT

capabilities prior to CRM system implementation are thus more likely enjoy CRM success. Specifically, firms in possession of better IT-related infrastructures, business practices, skills, experiences, and relationships are more likely to select and deploy the right mix of IT resources for the CRM system implementation project. While this finding is not surprising, it has one important implication that managers may fail to recognize, namely, that the relative success of CRM programs may be path dependent and, thus, isolated investments in CRM may not provide the firm with the desired benefits. We therefore recommend that managers assess the feasibility of CRM investment in the context of existing IT-related capabilities prior to devoting resources to CRM initiatives.

6.3. Study limitations and implications for future research

This study has several limitations, some of which point to opportunities for future research. First, the data for this study were collected at the end of 2012. Therefore, the share of SaaS-based CRM initiatives in our study is 14% (Table 3), which likely under-represents the preponderance of SaaS-based CRM initiatives in current practice. While cloud-based (i.e., SaaS) CRM has lowered development costs, the key challenges associated with CRM systems (e.g., integration difficulties and cross-functional user differences) still remain. As a consequence, the success of CRM initiatives is still largely dependent on the adequacy of firm- and project- level IT capabilities. Thus, while our study results are still highly applicable today, we note that study results should be interpreted in light of sample characteristics. Second, the results may be affected by the retrospective reporting of IT management informants with respect to past events of completed CRM projects. We applied rigorous respondent screening controls to decrease the likelihood of biases due to retrospective data collection, but there is still the possibility that the results may be affected by this aspect of our study design. Finally, albeit measured using multiple informants per firm, our study relies on subjective indicators of performance. We call for new studies to replicate our findings using objective performance data.

This study opens several potential avenues for future research. As proposed by Maklan et al. (2015) and executed in this study, more interdisciplinary research that combines the perspectives of marketing research (*what?*) and IS research (*how?*) is needed in order to develop a more comprehensive understanding of the critical socio-technical issues and mechanisms that affect the success of IT-led marketing projects. Moreover, the CRM system implementation phase remains a relatively lightly-explored area where much more research is needed. For instance, our findings underscore that future CRM research should look earlier in the causal chain to understand how IT investments influence organizational performance. As another example, the strategic impact of CRM system quality needs to be understood at a deeper level to identify which characteristics and attributes of CRM systems lead to organizational performance. Such research could provide more detailed advice for practitioners interested in understanding which CRM functionalities and features most influence organizational outcomes.

Finally, our findings suggest that when complementary IT resources are deployed jointly into CRMSC at the project level, their combined effect mediates the relationship between the firm strategic IT resource capacity and organizational outcomes. We call for more future IT capability research to consider closer the interplay between strategic and operational resources and capabilities. In particular, while our study finds that firm-level IT capability influences operational IT capabilities, it is possible that operational IT capabilities may reciprocally contribute to a more extensive accumulation of the firm's strategic resource base (Kraaijenbrink et al., 2010; Maritan & Peteraf, 2011). Thus, future studies may seek to improve understanding about how operational capabilities contribute to the build-up of firm-level technology, human, and relationship resources, potentially with a dynamic capability lens (see Kim et al., 2011). Future research could also consider alternative mediators for CRMSC-performance link, such as improved knowledge management, organizational commitment, customer focus, marketing capabilities, service quality or acquisition success (c.f. Garrido-Moreno, Lockett, & García-Morales, 2014).

Funding

Appendix A. Measures, indicator loadings and weights

Construct	Weight	Loading
IT Infrastructure		
1. The extent to which systems are modular.	0.20	0.69**
2. The extent to which systems are scalable.	0.12	0.75**
3. The extent to which systems are transparent.	0.38	0.81**
4. The extent to which systems are able to handle multiple applications.	0.53	0.88**
IS Planning Sophistication		
1. Business units' participation in the IS planning process is very high.	0.41*	0.68**
2. IS planning is initiated by senior management; senior management participation in IS planning is very high.	0.63**	0.82**
3. We have a formalised methodology for IS planning.	0.28	0.63**
4. Our planning methodology has many guidelines to ensure that critical business, organisational, and technological issues are addressed in evolving an IS plan.	0.08	0.60**
IS Personnel Skill		
1. *Our IS staff has very good technical knowledge; they are one of the best technical groups an IS department could have. (removed indicator)*	–	–
2. Our IS staff has the ability to quickly learn and apply new technologies as they become available.	0.10	0.58**
3. Our IS staff has the skills and knowledge to manage IT projects in the current business environment.	0.88**	0.99**
4. Our IS staff has the ability to work closely with customers and maintain productive user or client relationships.	0.12	0.71**
Internal Partnership Quality		
1. Critical information and knowledge that affect IT projects are shared freely between our business units and IS department.	0.14	0.69**
2. Our IS department and business units understand the working environment of each other very well.	0.46*	0.87**
3. There is a high degree of trust between our IS department and business units.	-0.15 [1]	0.73**
4. The goals and plans for IT projects are jointly developed by both the IS department and business units.	0.50**	0.85**
5. Conflicts between IS departments and business units are rare and few in our organisation.	0.26	0.72**
External Partnership Quality		
1. *We seldom have conflicts with our IT vendors and service providers. (removed indicator)*	–	–
2. We get timely information from our vendors about unexpected problems that could affect their ability to meet our technology needs.	0.27	0.78**

(*continued*)

Construct	Weight	Loading
3. We can rely on our IT vendors and service providers to respond to our IT needs in a timely and effective manner.	0.04	0.81**
4. A very trusting relationship exists between the IS department and our key IT vendors and service providers.	0.54	0.94**
5. We have long-term partnerships with our key IT vendors and service providers.	0.32	0.76**
Project Management Resources		
1. Formal project management tools and techniques were employed for this project.	0.15	0.61**
2. Project managers in charge of the project were highly capable and experienced.	0.81**	0.98**
3. The implementation schedule was realistic.	0.22	0.70**
Consultant Resources		
1. Experienced consultants guided us throughout the course of the project.	–	0.90**
2. External consultants were experienced in our business processes.	–	0.89**
3. External consultants brought considerable expertise and experience to our project.	–	0.92**
Training Resources		
1. Significant time and resources were invested in training employees on using the new system.	–	0.82**
2. Adequate on-the-job training was provided to internal user groups to use the new system.	–	0.89**
3. Both technology and process training were provided to employees using the system.	–	0.81**
Top Management Support		
1. Senior executives demonstrated a lot of enthusiasm and interest throughout the project.		0.92**
2. Upper-level managers were personally involved in the project.		0.87**
3. The overall level of management support in this project was quite high.		0.96**
User Involvement		
1. The user community was involved throughout the (CRM) implementation project.	–	0.87**
2. Business users participated in determining systems needs and capabilities.	–	0.92**
3. Business users participated in identifying input/output needs.	–	0.89**
CRM System Quality		
1. The application developed is reliable.	-0.03 [1]	0.69**
2. The application is easy to maintain.	0.33*	0.79**
3. The users perceive that the system meets intended functional requirements.	0.59**	0.94**
4. The system meets user expectations with respect to response time.	0.26*	0.83**
5. *The overall quality of the developed application is high. (removed indicator)*	–	–
Individual Productivity Gains (for organizational productivity gains / discrepancy)		
1. Using the system improves my performance in my job.	–	0.96**
2. Using the system in my job increases my productivity.	–	0.95**
3. Using the system enhances my effectiveness in my job.	–	0.96**
4. I find the system to be useful in my job.	–	0.89**

$+ \ p < .10$; * $p < .05$; ** $p < .01$**

Note: Indicator *weights* are reported only for formative constructs

Formative indicators are retained despite non-significant weight when they have 1) theoretical relevance for the construct (removing an indicator could affect the theoretical meaning of the construct - Petter et al., 2007*) and 2) absolute contribution to the construct (indicator with low weight but significant loadings should be interpreted as absolutely important but not relatively so. When there is no theoretical overlap, indicators with low weights should be kept in the measure – (*Cenfetelli & Bassellier, 2009*)*

[1]*Retained due to the recommendation to keep negatively weighted items in the measure, when they are 1) not suppressors or 2) not collinear and passed theoretical grouping tests (*Cenfetelli & Bassellier, 2009*)*

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