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Software As A Service: The Mediating Role Of Consequences Of Saas Diffusion On Firm Performance

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SOFTWARE AS A SERVICE: THE MEDIATING ROLE OF CONSEQUENCES OF SAAS DIFFUSION ON FIRM PERFORMANCE

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DEDICATION

To my husband Robert and our children, for their love, unfailing support, and encouragement throughout this long journey.

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CHAPTER 1: INTRODUCTION

"Most of the bright people don't work for you – no matter who you are."

"Innovation will occur, elsewhere."

— Bill Joy

There's tremendous value enabled by adopting cloud – more than $1 trillion just for Fortune 500 companies. Almost all of that value comes from business innovation and optimization rather than IT cost reduction (Forest, Li, Tamburro, & Van Kuiken, 2021). "Cloud can become an important source of strategic advantage for businesses. It's time for boards to get involved" (Forest et al., 2021). A 2017 Forbes article suggests that switching to the software-as-a-service (SaaS) business model will be the best business investment for the year (Rhyman, 2017). The article mentions advantages like cost savings, eliminating hardware and software maintenance, space savings, system upgrades and customization, and time management and performance. It also suggests that companies looking to thrive should leverage the security, availability, and performance of cloud computing.

This dissertation examines the consequences of SaaS implementations specifically firm competencies and the subsequent financial performance within levels of SaaS diffusion in over 500 companies both public and private. Firm performance is measured both subjectively and objectively using appended Bloomberg data. The dissertation begins with the introduction and some relevant case study material, then the literature review where we examine decades of data on SaaS diffusion looking at both advantages and obstacles to implementation. We then look at the elements of the research experiment, the results, the discussion, and conclusion.

SaaS implementations and the associated consequences have been in the news for decades. More recently, a 2018 Harvard Business Review (HBR) article suggests that Business-to-Business (B2B) firms providing SaaS multitenant services can help their customers, who agree to

participate, leverage the cloud data into customer scores. These scores, based on data and analytics, can compare them with their peers on broad functions or processes and provide a path for improvement (Thomas Davenport, 2018). For instance, if a selection of companies using the same functional SaaS tool for sales automation were to compare their forecasting accuracy, they could identify best practices within the tool and share experiences.

In 2020, Forbes confirmed that SaaS companies are, in fact, increasing specificity of their applications, in other words "doing one thing excellently" and providing more value to specific users rather than trying to address entire enterprise functionality. This increasingly granular functionality allows specific teams to do their job more efficiently (Mumma, 2020). Multitenancy, the foundation of SaaS, enables the sharing of an infrastructure creating economies of scale for the vendors who can create low cost specific usage models for end users (Loukis, Janssen, & Mintchev, 2019). There is only a single instance of the common code and data definitions on the vendors server. The code cannot be customized. Customer configuration changes can only be made at the meta data level, on top of the common code, using vendor interfaces (Benlian & Hess, 2011). With all the advantages of SaaS, why do some firms leverage modern technology via open innovation and outsourcing and other choose to develop and support proprietary in-house applications?

Maybe the answer lies in perceptions from the past. In 2000, a study was published by MIS Quarterly (Bharadwaj, 2000), that discussed a link between superior IT (information technology) capabilities and firm performance. The study examined organizations that were at the top of the Information Week 500 list for Leadership in IT during the years 1991–1994 and found that there was a relationship between IT leadership and firm performance. IT leaders possessed in-house, proprietary technology expertise. These findings were consistent with the Resource Based View

Theory, where it is believed that outstanding resources lead to outstanding firm performance (Mitra, O'Regan, & Sarpong, 2018). As a follow up to this study, and again published by MIS Quarterly, Ho-Chang Chae led a similar study in 2014, looking at similar firms from Information Week 500 leaders during the years 2001–2004 to see if the results remained consistent, considering the significant changes in IT over the decade that divided the two studies. Their results showed no significant difference between the firm performance of the IT leaders and the control group, except for one small partial correlation. One of the explanations for the vast difference was the ready availability of enterprise software packages like ERP (enterprise resources planning) and "web technologies" along with outsourcing and off-shoring services and readily available web search engines which significantly reduce IS (Information System) development time and cost (Chae, Koh, & Prybutok, 2014). The authors felt that this off-the-shelf, low-cost technology potentially levelled the playing field between the IT leaders and the control group, rendering the in-house, proprietary, technology less influential than in the previous study.

The study suggested that "IT leadership", which was defined as organizations with the resources and capabilities to create and support internally developed, proprietary applications, no longer offered any competitive advantage and that sophisticated technology had become an operational commodity or even a competitive necessity. The article further suggested that the control group of IT non-leaders, who had adopted the new advanced off-the-shelf technology, had potentially even exceeded their competitors in capability (Chae et al., 2014).

In 2016, Choi and George performed a replication study of the Bharadwaj and Chae studies again looking at RBV (Resource Based View) to look at how superior IT capability provides an antecedent to organizational learning and subsequent firm performance over time. They found mixed results. In some years the IT leaders had superior performance (as measured across a number

of financial ratios) and in some years the control group (where homogenous, commodity-type IT assets were used) performed better (Choi & George, 2016).

And finally, in 2018, Chae and Koh provided another follow-on study to the 2014 study to look at the role of industry as it relates to IT leaders and firm performance (Chae, Koh, & Park, 2018). They found that industry and the associated implementation of IT either in a transformational, automation or informational role played an important role in firm performance. Further, they found that IT leadership could be quickly neutralized in the dynamic business environment that had evolved over two decades. Specifically, that "cutting edge IT capability was readily available to all, so any advantage of IT could be quickly neutralized and transitory. The ever decreasing price of IT in the 2000s had made IT innovations more affordable and available, allowing companies to buy an off-the-shelf, state-of-the-art application for a fraction of the cost that IT leader firms would pay to develop it" (Chae et al., 2018, p. 529).

While cloud computing and SaaS are not specifically called out in any of the articles, there is a mention as one of the many off-the-shelf alternatives: "In fact, changes in an industry are frequently caused and influenced by information and communication technologies including the internet, mobile computing, offshoring, outsourcing, cloud computing, big data, and enterprise applications such as ERP, CRM, and SCM" (Chae et al., 2018, p. 526). So, it might be reasonable that they are part of the control group solution, but we don't know for sure.

What we know from the literature is that SaaS and multi-tenancy make up a specifically homogenous segment of technology because of the lack of customization that is available to end users, which is often viewed as an obstacle to adoption (Chihande & van der Poll, 2017) but also as an advantage of SaaS (Rodrigues, Ruivo, & Oliveira, 2014; Winkler & Brown, 2013). The literature articulates advantages to SaaS like cost savings, scalability, and lowering the barriers to

innovation. Cost savings are articulated in a number of ways, for instance; reduction in hardware expenses, reduction in data center expenses (electricity, real estate), administrative personnel reductions, reductions in up front capital to begin technology projects and many more. Lowering the barriers to innovation refers to enabling access to cutting edge software that enables organizations to understand their business processes, markets and customer needs better and to provide new and more relevant services to their constituents (Fox et al., 2009; Loukis et al., 2019; Marston, Li, Bandyopadhyay, Zhang, & Ghalsasi, 2011; Martins, Oliveira, & Thomas, 2016).

These necessary business services are either too expensive for SMBs (Small and Medium Businesses) to purchase and support on-premise, or they are incapable of developing in-house proprietary versions with available skills. This barrier to IT capability was one of the original premises of the Bharadwaj results, linking IT leadership to superior firm performance. In more recent years, SaaS has made this advanced IT capability affordable and ubiquitous.

Other recent findings link cloud computing to business model innovation (Alrokayan, 2017) and agility (Salleh, Hussin, Suhaimi, & Ali, 2018; Zhang, Ma, & Huang, 2017b) in SMBs, which the literature tells us are antecedents to firm performance (S. Malladi & M. S. Krishnan, 2012; Sambamurthy, Bharadwaj, & Grover, 2003). The National Institute of Standards and Technology in the U.S. Department of Commerce "defines" SaaS in terms of providing broad network access, "capabilities are available over the network…that promote use by heterogenous thin or thick clients" (i.e., mobile phones…), on-demand self-service where "consumers can unilaterally provision computing capabilities such as server time and network storage as needed automatically without requiring human interaction with each service provider", rapid elasticity where "capabilities available for provisioning often appear to be unlimited and can be appropriated in any quantity at any time" and so on (Mell & Grance, 2011). Cloud computing offers compelling

value propositions for businesses, and yet, many companies still prefer proprietary in-house developments.

The literature tells us why companies maintain the "proprietary" status quo. In addition to the widely accepted perception that in-house developed technology provides a competitive advantage and contributes to firm performance (Bharadwaj, 2000; Santhanam & Hartono, 2003), there is also the fear of change, fear of the loss of power, inertia, politics, legal issues and compliance, fear of hidden costs, vendor lock-in, vendor financial viability, security in the cloud, reliability, lack of control, etc. (Asatiani, 2015; Benlian & Hess, 2011; Polites & Karahanna, 2012).

These fears are significant and even recent literature speaks of the need for international standards for integration of cloud applications and artificial intelligence tools to assist with usability and networking and more efficient data protection techniques along with many other suggestions that the authors felt would assist with proliferation of the technology (Buyya et al., 2018). There is literature that articulates the links between information technology competency, decision making and firm performance (Aydiner, Tatoglu, Bayraktar, & Zaim, 2019) where infrastructure and IT human resources and their capabilities are linked to firm performance. The article does not call out cloud computing and potentially leads firms to believe that only homegrown capabilities offer firm sustainable computing advantages. But are all firms capable of developing advanced IT capabilities and if they are not, what are the options for maintaining competitiveness in today's dynamic market?

SaaS offers firms dynamic and affordable capabilities for non-differentiated processes/services. While early literature was more cautious, focusing on obstacles (Benlian & Hess, 2011; Haag & Eckhardt, 2014a) recent publications are more encouraging. Many of the more recent articles reflected the post adoption industry knowledge of SaaS capabilities, and obstacles

like security became advantages recognizing that big software vendors had more at stake if hackers penetrated their systems, and took incredible precautions to protect their data (Mitra et al., 2018; Seethamraju, 2015; Widyastuti & Irwansyah, 2018).

Like security, many of the "obstacles" are considered advantages in other articles. Compliance is listed as both an obstacle (H. Yang & Tate, 2012) and an advantage (Seethamraju, 2015; Widyastuti & Irwansyah, 2018), reliability as an obstacle (Benlian & Hess, 2011) and as an advantage (Salleh et al., 2018; Widyastuti & Irwansyah, 2018). Of some 118 relevant articles reviewed, using ATLAS.ti coding, cost was the number one advantage (Benlian & Hess, 2011; Marston et al., 2011; Widyastuti & Irwansyah, 2018; H. Yang & Tate, 2012) and security was noted 33 times as an advantage (Avram, 2014; Cho & Chan, 2015). We explored the specifics in the literature review, suffice to say there are varied, conflicted findings.

And why shouldn't there be conflicting opinions, that is the nature of academics; to constantly challenge perceptions. In the case of SaaS and cloud computing more broadly, however, there is even more reason, the lack of clarity around cloud computing technology in the literature. There were more than 40 different definitions of cloud computing or SaaS. Cloud computing was often used as a generic term to describe SaaS or Infrastructure-as-a-Service (IaaS) or Platform-asa-Service (PaaS) functionality rather than the more specific terms (Avram, 2014; Haag, 2015). While there are certainly benefits to leveraging IaaS, like cost savings (W. Kim, 2009; Marston et al., 2011), there are also compelling benefits for Small and Medium Businesses (SMBs), and other organizations with limited IT resources, from leveraging SaaS.

SaaS is an application (the "service") running in a remote data center with access via the internet (Benlian & Hess, 2011; Jula, Sundararajan, & Othman, 2014). SaaS provides users "complete turnkey applications through the internet, even complex systems such as those for CRM

or ERP" (H. Yang & Tate, 2012). Examples of SaaS are: Salesforce.com (Customer Relationship Management CRM), Google docs (productivity), Workday (for human resources, accounting and finance), Concur (for managing), Microsoft Office and Microsoft OneDrive (for productivity).

You can also categorize most of the apps on your phone as SaaS-like: the Chase banking app, shopping apps like Amazon and Nordstrom, Apple Maps, Google Mail, the Delta app, etc. Users can go out to the internet, put in a credit card number, set up a password and immediately start using the application. There is little or no set up required, and SaaS, which is built on a multitenant (defined above, one code base for multiple clients) architecture, does not allow users to customize the source code (Benlian & Hess, 2011; Wortmann, Don, Hasselman, & Wilbrink, 2012). It can be configured, if they wish, meaning superficial things like the number of fields that a user sees, they can change the names of the fields, the colors, etc. but they cannot change the source code. This means that very little time (and zero time if they choose) is consumed customizing a system (which also makes upgrading simpler). The application can be immediately available (Seethamraju, 2015; Wortmann et al., 2012).

What was compelling to me was that as a result of this immediate application availability the companies could stop allocating time and resources to non-core functionality like email, expense management, HR administration, accounting, and focus on their core competency (Benlian & Hess, 2011; Marston et al., 2011), which supports agility and business model innovation (Alrokayan, 2017), like developing an autonomous car or a new merchandising plan for a retailer.

SaaS offers users the advantage of having resources doing more strategic work (Benlian & Hess, 2011; Mitra et al., 2018; Widyastuti & Irwansyah, 2018; J. Wu, Chen, & Gao, 2015) vs the

much cited SaaS obstacle, losing control (Abdollahzadegan, Hussin, Razak, Moshfegh Gohary, & Amini, 2013; Benlian & Hess, 2011; Lapointe & Rivard, 2005) of their computing assets.

In our dynamic, ubiquitous global marketplace, can SMBs dedicate time to creating and maintaining (controlling) a homegrown CRM or purchasing system when they could be focused on how to transform their product offerings into the Internet of Things (IOT) or removing waste from a process? In other words, would SMBs be more profitable if they could allocate more resources to their products and services and customer value activities? How does creating a proprietary vs outsourced CRM or purchasing system make more money for the firm? Can SMBs create profitable differentiation through proprietary IT development? Can SMBs develop a strategic capability in purchasing that Oracle or SAP haven't figured out? And at what cost do they continue to maintain these systems? Remember cost was the number one advantage to SaaS (S. Malladi & M. S. Krishnan, 2012; Marston et al., 2011; Widyastuti & Irwansyah, 2018; Zhang, Ma, & Huang, 2017a).

The literature also mentions innovation as an advantage of SaaS. Specifically, lowering the barriers to innovation (Avram, 2014; Marston et al., 2011) and innovation through new capabilities (S. Malladi & M. S. Krishnan, 2012; Marston et al., 2011). This means that new advanced capabilities/functionalities are available to the organization in the SaaS application. This functionality allows firms to improve their offerings to consumers or in some cases identify and protect themselves from threats in the market (see case study below). This could be one of the reasons that the Chae and Koh study produced different results from the Bharadwaj study. In my empirical work I have seen firms that typically relied on proprietary development which was slow in producing innovation, deliver unprecedented capabilities with SaaS and it has driven me to study this subject in more detail.

In a large automotive manufacturer, I saw a small marketing department identify a competitive strategy executed by a rival with a Salesforce.com object that took the administrator two weeks to create. Her IT department told her that it would take a year and hundreds of thousands of dollars to develop a proprietary version. In the thirty days following the diffusion of the new functionality, they knew who the competitor was, and they were able to mitigate the situation saving them millions of dollars in lost customers.

In another firm (an SMB), two SaaS tools were leveraged, Piano and Clickshare to identify when a customer would be willing to subscribe to a publication rather than read a limited number of articles for free. The publication was able to generate a significant number of new subscribers, adding to firm performance. In both instances, there was no way to develop these capabilities in a proprietary fashion in time to react effectively to the dynamics of the market.

Another important advantage is the impact of IT on organizational learning (Akram, Goraya, Malik, & Aljarallah, 2018; K. Kim & Altmann, 2013; Tippins & Sohi, 2003), and the subsequent impact on sustainable competitive advantage and perceived organizational performance (Akram et al., 2018). Organizational learning is defined by Tippins and Sohi at a very basic level as the process by which new knowledge or insights are developed by a firm. Organizational learning consists of four components: information acquisition, information dissemination, shared interpretation and development of organizational memory (Tippins & Sohi, 2003, p. 749).

In today's dynamic environment, IT plays a critical role in identifying market issues, and improving the efficiency and effectiveness of business processes, thus achieving superior business performance. It helps managers make better and faster (more efficient) decisions (Akram et al.,

2018; Widyastuti & Irwansyah, 2018; Zhang et al., 2017a) thus improving business performance (Akram et al., 2018).

The ability to off-load non-core application development and focus on core application development is, in many ways, the culmination of the SaaS/cloud advantages. If SaaS can save organizations money to invest in core offerings and free up resources to do more strategic or core work which results in more competitive product offerings (Amini, 2014; Benlian & Hess, 2011; Martins et al., 2016), they can gain a sustainable competitive advantage and perceived organizational performance (Akram et al., 2018; Martins et al., 2016; Oliveira, Thomas, & Espadanal, 2014). This is especially true in SMBs where resources and capabilities are not as abundant as in large firms and may, in fact, give SMBs superior capability over their larger competitors (Chae et al., 2014).

One example of leveraging IT and firm knowledge is the concept of collective intelligence which is defined as "the capacity of human collectives to engage in intellectual cooperation to create, innovate and invent, voluntarily for economic return, fame or self-contentment. And it serves as a key to open innovation" (K. Kim & Altmann, 2013). An open innovation system is defined as the software vendors, their services, software users, and the platform. An open innovation system and collective intelligence provide for the open innovation capability where users from different companies develop and submit features to the SaaS vendor for inclusion in future versions. The independent users create a collective group which openly adds capability to the SaaS application. This collective contribution elevates the capability of the SaaS application for all users. This additional capability helps users, and their organizations discover new ways to service the market.

SaaS users can combine functions from multiple SaaS applications enhanced by the intelligence of multiple collective groups into their own app that then provides new capabilities to their customers. An example of this capability is “mashing” which is about combining SaaS functions like, for example, CRM from Salesforce.com and mapping from Google (K. Kim & Altmann, 2013) to provide a new location specific service that gets customers to your door. The company doesn’t have to worry about maintaining the maps and they have a mobile ready platform provided by Salesforce.com. All they provide is their product or service (their core competency). Using the imbedded SaaS functionality, they can see instantly that, for example, customers in the south or female consumers or people over fifty, are not using their new service and immediately send a notification through the mobile interface to test new product or delivery options to mitigate the situation.

This knowledge can be disseminated through the organization using a tool like Slack or Yammer (organizational communication tools, like Facebook for businesses, for example) to develop new ideas, using the intelligence gained, and quickly deploy it. My earlier example of the Midwest Manufacturer that leveraged the SaaS tool to identify competitive actions is another example of organizational learning that resulted in improved firm performance.

Along with electricity, manufacturing, water and gas, SaaS represents the 5th utility (Gupta, Seetharaman, & Raj, 2013; Z. Yang, Sun, Zhang, & Wang, 2015) assisting firms in improving performance. What would be the fate of SMBs if they had to provide their own electricity or manufacturing capacity? How would they be able to focus on providing better products if their time and resources were scattered to provide bare essential capabilities? Scholars have predicted the rise of SaaS as a natural evolution of software development, similar to the evolution of

manufacturing and electricity from bespoke to servitization (Gupta et al., 2013; Waggener & Wheeler, 2009; Wortmann et al., 2012; Z. Yang et al., 2015).

These scholars remind us that many functions that were once a required capability of companies, over time migrated into a utility that was rented from a provider with the competency to make the once bespoke function much more affordable and reliable as a service. One article asked "If you woke up this morning and read in the Wall Street Journal that, say, Overstock.com has stopped using UPS and FedEx and the U.S. Mail and had bought fleets of trucks and started leasing airport hubs and delivering products themselves, you would say they were out of their minds. Why is it that much more insane that a healthcare company is spending $2 billion a year on information technology" (Knowledge@Wharton, 2009; Marston et al., 2011). SMBs are not in a position to spend $2B on technology, and so are even more dependent on utility-based services to provide them with competitive capabilities.

After nearly 20 years of articles, what is left to write about? How do we add to this? In answering a call for future research, we can "assess the actual impact cloud deployment success has on firm performance (e.g., sales, profit and process efficiency) (Garrison, Wakefield, & Kim, 2015), which are the specific performance indicators impacted by SaaS (Overby, Bharadwaj, & Sambamurthy, 2006)? How are the non-IT leaders improving and perhaps exceeding the capabilities of their larger proprietary based IT competitors (Chae et al., 2014)? I looked at self-reported firm performance, specifically: revenue, costs and productivity and objective firm performance using the ratios from Bharadwaj and Chae (Bharadwaj, 2000; Chae et al., 2018) in firms leveraging SaaS and saw a measurable and predictable link between SaaS diffusion and firm performance.

CHAPTER 2: LITERATURE REVIEW

Typing cloud computing into Google Scholar returns 2,410,000 articles, Software as a Service returns 97,400. The topic is well researched. But specifics on how SaaS impacts firm performance is "cloudy". Over the past four years, I have examined well over 250 articles, looking for clarity around the topic of whether small and medium businesses (SMB) can improve firm performance by leveraging SaaS or whether the homogenous nature of multitenant SaaS offers no particular advantage.

When I began this study, I started with the academic articles that examined SaaS adoption. Advantages such as the cost/pay as you go element of SaaS was mentioned 146 times (Amini, 2014; Benlian & Hess, 2011; Gupta et al., 2013; Widyastuti & Irwansyah, 2018; Yeboah-Boateng & Essandoh, 2014). This notion of moving technology expenses from capital acquisitions to merely renting a service was a significant opportunity for SMBs lacking large IT budgets and resources. Technology implementations consisting of hardware and software purchases which were often seriously underutilized, often less than 10% (Marston et al., 2011), could now be used gradually, allowing benefits to accrue before significant monetary investment. Further, now SMBs with limited IT budgets had access to computing technology way beyond their own capabilities (Garrison et al., 2015). Could this advanced technology improve firm performance?

As a result of my years of employment with Salesforce.com, I have anecdotal evidence that SaaS can improve a firm's execution capabilities, market awareness and subsequently firm performance. This notion is supported by the literature that I have examined extensively. Using ATLAS.ti[1], I coded 113 articles of the 156 retained in Endnote. There is also extensive literature on the obstacles inherent in adopting and successfully implementing cloud computing/SaaS which

[1] ATLAS.ti is a powerful workbench for the qualitative analysis of large bodies of textual, graphical, audio and video data. https://atlasti.com

would refute performance gains. My intent with this literature review is to clarify the findings, identify the gaps and develop a basis for my dissertation experiment.

Let's begin with the advantages. In Appendix A, the advantages are organized to facilitate future research into a specific topic. Several articles in the literature support that firms that leverage SaaS effectively can reap performance improvements (Garrison et al., 2015; Loukis et al., 2019). The gains were reported in the surveys used to support these studies. The individuals who chose to adopt SaaS are the same ones being asked if SaaS is making a difference so there is an inherent bias recognized by the authors. So, is it really making a difference? SaaS is cloud based, like the apps on our phones. The SaaS applications are accessed over the internet. There is no hardware or software to purchase or install, and no customization to the applications, which provides simplicity to organizations (Abdel-Basset, Mohamed, & Chang, 2018; Abdollahzadegan et al., 2013).

The vendors that provide the SaaS applications are specialized in their field so SMB customers can gain access to best practices (Benlian & Hess, 2011; Garrison et al., 2015), and cutting edge software (Abdel-Basset et al., 2018; Gupta et al., 2013), that support innovation through new capabilities (Abdollahzadegan et al., 2013; Avram, 2014; Benlian & Hess, 2011; S. Malladi & M. S. Krishnan, 2012; Marston et al., 2011). The multi-tenant nature of SaaS means that the vendor supplies a single copy of the software to all the customers. There is no tailoring of the application to adjust to organizational processes (Chihande & van der Poll, 2017; Xin & Levina, 2008) as a result the responsibilities of the IT organization are significantly reduced for the SaaS application and they can focus on more strategic work (Benlian & Hess, 2011; El Alami, Sadok, & Elhaoud, 2015; Garrison et al., 2015; Gupta et al., 2013; Mitra et al., 2018) that could support the core competencies of their organizations (Benlian & Hess, 2011; Garrison et al., 2015;

Gupta et al., 2013; Kiblawi & Khalifeh, 2015; Widyastuti & Irwansyah, 2018; Yeboah-Boateng & Essandoh, 2014).

One of the most cited benefits, as mentioned above, was that customers could pay-as-you go, significantly reducing the costs involved in implementing software applications (Abdollahzadegan et al., 2013; Buyya, Yeo, Venugopal, Broberg, & Brandic, 2009; Kyriakou & Loukis, 2017; S. Malladi & M. S. Krishnan, 2012; Marston et al., 2011). The advantage to business is that an implementation can start with one user. Perhaps an innovator or early adopter (Rogers, 2010) in the enterprise who wants to experiment with a new idea. They can pay for one license that might cost less than $200 dollars per month. There is no hardware to buy, the user doesn't need to involve IT with the work. They can just pay for it, log in and start using the application. If they see value, they can add a few more users or a pilot group. Again, there are no capital costs, no implementation time, no IT resources. Once a business case can be made that the application can bring value, then they can easily scale up use (Buyya et al., 2018; Buyya et al., 2009; Fakieh,

Blount, & Busch, 2016; Fox et al., 2009; Garrison et al., 2015; Marston et al., 2011; Schniederjans & Hales, 2016) bringing on more users and perhaps engaging with IT to integrate the new SaaS application with other applications in the enterprise. If they do not find value, they can simply shut off the service and stop paying the monthly fee.

This type of behavior is well documented in the literature as shadow IT (Haag & Eckhardt, 2015). Steffi Haag has done extensive research on SaaS, Shadow IT and its impact on the organization. While her research begins with a negative approach to SaaS and its ease of use which makes it very simple for end users to ignore IT requirements, she concludes with positive contributions as well, like access to computing resources and internal focus on core competencies.

The difference between SaaS Shadow IT and a more traditional Shadow IT is that SaaS is not downloaded onto the corporate computers introducing potential malware. The trialability (Rogers, 2010) aspect of SaaS applications, however, to determine if there is a justification to invest corporate resources into diffusing a new application into the enterprise (Rogers, 2010) is very powerful.

In addition to the above mentioned benefits, other advantages like ease of implementation of SaaS (Avram, 2014; W. Kim, 2009; Winkler & Brown, 2013), and flexibility (Avram, 2014; Benlian & Hess, 2011; Kiblawi & Khalifeh, 2015) and short implementation time (Avram, 2014; Winkler & Brown, 2013) and speed (Abdollahzadegan et al., 2013; Buyya et al., 2018; Fakieh et al., 2016; Marston et al., 2011) are appealing. The SaaS resources are up and working quickly, which means that IT resource performance can be improved (Benlian & Hess, 2011; Chihande & van der Poll, 2017; Garrison et al., 2015). If non-core applications like email, potentially Customer Relationship Management (CRM), Expense Management, HR can be off-loaded into the cloud, IT resources can focus on core competencies (Garrison et al., 2015; Gupta et al., 2013) and lower the barriers to innovation, (Alrokayan, 2017; Fox et al., 2009; Gupta et al., 2013; Loukis et al., 2019; Mitra et al., 2018) for the organization. SaaS applications give organizations instant access to new technologies that allow them to develop new ideas and processes. The mobility component of SaaS means that companies have real-time access to their employee data, customers' needs and feedback, and metrics. An area where many organizations struggle.

Other advantages to organizations of using SaaS include the quality of the applications (Benlian & Hess, 2011; Bieber, Grivas, & Giovanoli, 2015; Dubey & Wagle, 2007; Fox et al., 2009) supported by continuous and automatic upgrades (Chihande & van der Poll, 2017; Seethamraju, 2015; Stadtmueller, 2013). Access ubiquity and mobility (Abdollahzadegan et al.,

2013; Buyya et al., 2018; Buyya et al., 2009; Haag & Eckhardt, 2014b) enabled through internet access and mobility which supports higher levels of enterprise collaboration (Abdel-Basset et al., 2018; Gupta et al., 2013; Loukis et al., 2019). Since many SaaS vendors are compelled to provide robust back-up and disaster recovery capabilities (Seethamraju, 2015), business continuity and reliability becomes an advantage for users (Bardsiri & Hashemi, 2014; Chihande & van der Poll, 2017; Yeboah-Boateng & Essandoh, 2014).

The many advantages combined support improved firm productivity (Fakieh et al., 2016; Widyastuti & Irwansyah, 2018), and business efficiency (Alrokayan, 2017; Liu, Chan, Yang, & Niu, 2018; Mitra et al., 2018; Oliveira et al., 2014; Widyastuti & Irwansyah, 2018) through enterprise communication alignment. Alignment is facilitated by access to a single source of corporate data ubiquitously (Alrokayan, 2017; Fox et al., 2009; Mitra et al., 2018; Zhang et al., 2017a) potentially contributing to improved competitiveness (Carr, 2005; Chihande & van der Poll, 2017; Liu et al., 2018; Martins et al., 2016; Mitra et al., 2018; Widyastuti & Irwansyah, 2018) and organizational agility (Abdollahzadegan et al., 2013; Alrokayan, 2017; Bardsiri & Hashemi, 2014; Fakieh et al., 2016; Kyriakou & Loukis, 2017; Liu et al., 2018; Mitra et al., 2018; Oliveira et al., 010011 2014; Bieber et al., 2015; Marston et al., 2011; Yeboah-Boateng & Essandoh, 2014), it does nothing to impact the obstacles that are more powerful and emotional.

In Appendix B, the obstacles are detailed to provide ease of access for researchers. Obstacles like lack of control (Abdollahzadegan et al., 2013; Amini, 2014; Avram, 2014; Benlian & Hess, 2011; Fox et al., 2009; Lapointe & Rivard, 2005; Widyastuti & Irwansyah, 2018) because the applications and data are no longer within a firm's datacenter walls, but in the cloud. Users fear (Avram, 2014; Benlian & Hess, 2011; Haag & Eckhardt, 2014b; Hirschheim & Newman, 1988; Marston et al., 2011) the new type of software application and the disruption to the existing

business and IT processes, IT personnel fear job loss (Avram, 2014; Benlian & Hess, 2011; Haag & Eckhardt, 2014b; Marston et al., 2011) because the administration of the applications are out of the hands of IT, and at the very least, change to traditional IT roles (Avram, 2014; Bieber et al., 2015; Haag & Eckhardt, 2014b) because the SaaS applications are aimed at the business leaders and are not customizable so IT does not need to be part of the development team.

The next set of obstacles are inertia oriented (Asatiani, 2015; Buyya, Yeo, & Venugopal, 2008; Carr, 2005; Haag & Eckhardt, 2014b; Oliveira et al., 2014; Z. Yang et al., 2015) because SaaS and cloud are a departure from existing IT processes. Entrenched incumbents or incumbent system habit (Marston et al., 2011; Polites & Karahanna, 2012; Z. Yang et al., 2015) resulting from years of specific application training, relationships, and comfort of working with existing partners. SaaS and cloud are a major disruption in both technology and business model (Kaltencker, Huesig, Hess, & Dowling, 2013; Kiblawi & Khalifeh, 2015) and coming from outside of known vendors as disruption often does (Christensen, Bartman, & Van Bever, 2016) presents a challenge to IT organizations. Inertia oriented obstacles are not isolated to SaaS implementations and are elaborated in “Shackled to the Status Quo: The Inhibiting Effects of Incumbent System Habit, Switching Costs, and Inertia on New System Acceptance” by (Polites & Karahanna, 2012). Resistance and fear might be more significant with SaaS because the multi-tenant nature of the application changes traditional IT participation and involvement. The application can be initiated and configured by business end users alleviating the need for traditional in-house IT support.

Many applications, like Salesforce.com began with small and medium businesses that did not have IT organizations. For them, it was cloud applications or nothing since traditional proprietary development and even enterprise applications that required complicated set-ups were out of reach for their scant resources. These new SaaS applications gave them, in some cases,

superior functionality to their competitor's proprietary development and enabled them to compete in their industry (Chae et al., 2018). This same capability can be fearsome for a large IT organization that employs hundreds or thousands of people working on highly customized, on-premise, applications like email, CRM, HR, expense management systems, financial systems, and purchasing systems, etc. For these employees, a new SaaS system means they might be looking for a new job outside the firm or at least retraining to take over the support for a different application. For the managers of the IT employees, power issues arise as the responsibility and resources for a particular application or function, shifts from the IT department to line of business executives (Benlian & Hess, 2011; Haag & Eckhardt, 2014b; Hirschheim & Newman, 1988; Lapointe & Rivard, 2005).

In one case, a large Midwest manufacturer, invested tens of millions of dollars and hundreds of people annually on a home-grown CRM system. When Salesforce.com was pursued and implemented, it fell under the responsibility of a business executive in charge of customer service. That executive hired his own people to support the system. The struggle to bring in the cloud-based SaaS system was nearly two years long and involved; attempts to build a Salesforce.com replica by the IT department, numerous security audits and violation reports, administrative hurdles, and numerous attempts to block data loading due to an IT rule against putting PII (Personally Identifiable Information) into the cloud. This IT department had identified the dealer's name and address (something found readily in search results and on billboards and TV advertising) as PII. Had the senior executive involved not been entirely committed to the new functionality, the project would have failed. Senior Executive commitment to success is a key determinant to a successful SaaS implementation and is well documented in the literature

(Kaltenecker, Hess, & Huesig, 2015; Low, Chen, & Wu, 2011; Martins et al., 2016; Z. Yang et al., 2015).

The next set of obstacles involve compatibility with enterprise systems, like lack of standards (Asatiani, 2015; Haag & Eckhardt, 2014b; Midha, Kaur, & Tripathi, 2017) which lead to interoperability concerns (Avram, 2014; W. Kim, 2009). Like the first set, vendors will need to continue working on this area to be able to integrate with other enterprise systems and leverage historical data. Many vendors have developed platforms like Salesforce's Heroku to facilitate interoperability. Lack of customization (Chihande & van der Poll, 2017; Haag & Eckhardt, 2014b; Xin & Levina, 2008) while an obstacle in the literature, could also be classified as an advantage as it prevents organizations from making significant changes to the code to facilitate entrenched processes. It can also be associated with the status quo obstacle as the multi-tenant nature of SaaS means that only the superficial user interface can be changed but the underlying code is not accessible. This prevents mass customization from undermining "best practices embedded in the software, mass customization increases complexity and costs to maintain and integrate with other applications" (Seethamraju, 2015, p. 479). IT organizations provide this complex customization, which is not possible in SaaS applications thus creating another change in roles and responsibility for the IT department.

Then there are the issues that deal with trust in the SaaS vendors. While companies like Oracle, IBM and Microsoft have been around for decades and have established relationships and service level agreements, with many organizations, the SaaS vendors might still be strangers. And so issues like vendor lock-in (Asatiani, 2015; Bieber et al., 2015; Haag & Eckhardt, 2014b; Salleh et al., 2018; Widyastuti & Irwansyah, 2018; Ye, Seo, Desouza, Papagari, & Jha, 2006; YeboahBoateng & Essandoh, 2014), threat of government spies (Haag & Eckhardt, 2014b), data

loss (Bieber et al., 2015; Chihande & van der Poll, 2017) and hidden costs or rising costs (Avram, 2014; Benlian & Hess, 2011; Chihande & van der Poll, 2017; Fox et al., 2009) are a concern to new customers and inhibit adoption. None of these objections are limited to SaaS vendors and as mentioned by Polites and Karahanna may not be rational (Polites & Karahanna, 2012), but are nonetheless frequently mentioned in surveys and qualitative research.

The next set of obstacles are yet to be resolved and are sited in even the most recent literature as issues. Application availability (Avram, 2014; Benlian & Hess, 2011; Chihande & van der Poll, 2017; K. Kim & Altmann, 2013; W. Kim, 2009; Midha et al., 2017) and bandwidth (Abdollahzadegan et al., 2013; Asatiani, 2015; Avram, 2014; Benlian & Hess, 2011; Bieber et al., 2015; Buyya et al., 2018; Chihande & van der Poll, 2017; Dubey & Wagle, 2007; Fox et al., 2009; "IaaS Popularity Surges in 2018," ; Marston et al., 2011; Midha et al., 2017; Seethamraju, 2015; Widyastuti & Irwansyah, 2018) are related to each other, as there is no availability without adequate bandwidth. This issue is significant. If organizations and regions like Indonesia (Widyastuti & Irwansyah, 2018) do not have adequate internet access and mobility, then SaaS is not a good fit. Even marginal bandwidth is troublesome as the applications work but not well causing frustration among the users, something I have experienced myself in the early years of CRM.

The last obstacle, loss of critical skills (Abdollahzadegan et al., 2013; Asatiani, 2015; Benlian & Hess, 2011; Haag & Eckhardt, 2014b; Hirschheim & Newman, 1988) leads us into the next set of thinking. In here, we explore the types of applications that organizations might adopt in a SaaS format and those that the organization might want to retain in proprietary development. In some ways this obstacle is addressed with the “enabling core competencies” advantage (Seethamraju, 2015; Widyastuti & Irwansyah, 2018), meaning, organizations that adopt SaaS can

off-load less critical applications so that resources can focus on those applications that add value to the core functions of the organization. When we examine this obstacle, we need to further look at what applications are a concern? Do firms believe that they need skills in non-critical areas that are being off loaded to SaaS, like CRM, expense management, and email? Or are firms faced with a SaaS application decision in an area that they consider a core competency for the firm?

In a very recent study by Chae and Koh firm performance was studied by looking at the different roles of technology in the industries in which a firm operated and assessed whether there was a need to develop proprietary technology in order to differentiate in the market and the subsequent impact on firm performance (Chae et al., 2018). The 2018 Elsevier article by HoChang Chae et. al, is, to date, the last in a series of articles written to investigate whether proprietary development (application development done in-house by IT leader firms) provided a competitive advantage and improved firm performance (Bharadwaj, 2000; Chae et al., 2018; Chae et al., 2014; Choi & George, 2016; Santhanam & Hartono, 2003).

In these articles, the statistical significance of whether organizations that are deemed IT leaders by the Information Week 500 (IW 500) outperform the control group (which were not recognized as IT leaders) is tested (Bharadwaj, 2000; Chae et al., 2018; Chae et al., 2014; Choi & George, 2016; Santhanam & Hartono, 2003). The set of articles begin with the much cited Bharadwaj article which was published in 2000 using data from 1991-1994 and deemed, with statistical significance, that IT leaders which at the time were developing proprietary applications had better performance that the non-IT leaders (Bharadwaj, 2000). That study was followed by Santhanam and Hartono who wanted to see if the financial halo effect of the IT leaders had been properly accounted for. This study used the same data from the Bharadwaj study and was published in 2003 and confirmed the Bharadwaj findings (Santhanam & Hartono, 2003). In 2014, Ho-Chang

Chae looked at the same study with more recent data, 2001-2004, to see if the performance results were still statistically significant. He found that they were not. IT leaders (deemed by IW500) no longer had a performance advantage over the control group (Chae et al., 2014). Then Inmyung Choi and Joey George from Iowa State University examined the same construct but broadened the groups to look at the average profit ratios of firms with superior IT capability against the average profit ratios of all other firms in the industry. They found mixed results. In some cases the IT leaders average was better and in some cases the control group was better (Choi & George, 2016).

To explain this change from the Bharadwaj study to the Chae and Choi studies, Choi reasons that "IT resources are widely available in markets, and they are commoditized after the prevalent use of enterprise resource planning (ERP) and Web technologies. Thus, it is difficult to attain competitive advantage from the deployment of IT systems, and having superior IT capability does not necessarily improve firm performance" (Choi & George, 2016, p. 2).

To simplify the explanation given by Choi is to say that the control group closed the IT gap between themselves and the Information Week 500 IT leaders by leveraging homogenous leading edge or advanced technology readily available in the industry in the years following the original Bharadwaj study which studied firms between the years 1991 -1994. This is consistent with SaaS findings from Seethamraju who states, "Compared to the "on-premise" model, SaaS based solutions have shifted the value frontier and may provide the same level of value at a lower price, or more value at the same price." (Seethamraju, 2015, p. 476)

In hindsight, we understand the tremendous disruptions that occurred following those years. In fact, "since the first publication of the IW 500 list, the selection criteria constantly evolved to reflect changing business and technological developments and to fine tune its benchmarking power" (Chae et al., 2014, p. 309). So, while the IW 500 remains a reliable barometer for firms

and has been used previously (Chae et al., 2014), we cannot replicate the leadership characteristics because there is no detail in the writings. Are the leaders leveraging commercial applications now? Are they using SaaS? This is one of the gaps in this set of studies. The definition of IT leadership is unclear.

In 2018 Chae studies the results again to look for more explanation and goes on to write about the fluid nature of the industry environment and the adoption of advanced technologies "including the internet, mobile computing, offshoring, outsourcing, cloud computing, big data, and enterprise applications such as ERP, CRM, and SCM that have produced a fundamental change in the business (Chae et al., 2018, p. 526). Industries like book stores and music whose business models have been significantly disrupted by technology are mentioned (Chae et al., 2018).

Chae and Koh also write that the role of IT (automate, informate, transform) within an industry contributes to the level of value that is delivered to the organization from IT implementations. Whether the implementations are strategic or tactical, the level of intensity and complexity of development, suggests that the idea of leadership also includes knowing when to develop skills in house and when to wait for available technology "costs to drop and systems to stabilize" (Chae et al., 2018). Why are these two things, IT capability and homogenous technology, separated? Isn't leveraging technology in whatever model it comes, whether off-the-shelf, cloud, or proprietary, into a competitive advantage an important capability of an IT organization? When the authors state that the control group has leveraged enterprise applications and has caught up to the leaders, we have to ask; what advanced technology? What did they use to catch up? How can SMB leaders make IT decisions in their own organizations when "advanced technology" is not well defined?

While the Bharadwaj, Santhanam, Chae and Choi groups studied "proprietary development" and "advanced technology" and can say to SMBs that you might not need a big, sophisticated IT organization to gain a competitive advantage in your industry. We still need to give them some clarity on what types of "advanced technology" improve performance.

There are many studies that looked specifically at SaaS and cloud technologies which get us a little closer to an answer for SMBs on what to use. These studies look at the use of SaaS and how it facilitates IT enabled innovation (S. Malladi & M. S. Krishnan, 2012), and how SaaS contributed to business model innovation using a case study in China (J. Wu et al., 2015). How SaaS enables: agility, market insights, cost efficiency and scalability all of which contribute to business model innovation and competitive advantage in start-ups (Alrokayan, 2017). Other studies examined how SaaS contributed to open innovation leveraging collective intelligence, which is inherent in many SaaS environments (K. Kim & Altmann, 2013). Several studies look at SaaS adoption, use and benefits and reflect on the effect of firm size (Abdollahzadegan et al., 2013; Benlian & Hess, 2011; Kaltenecker et al., 2015; Liu et al., 2018).

Many of the studies looked the TOE (Technology, Organization, Environment) framework and how elements like IT infrastructure, Top Management Support, Relative advantage, Simplicity, Compatibility, Trialability, Competitive Pressure and Partner Pressure affect readiness and attitudes toward SaaS adoption and intention (Low et al., 2011; Martins et al., 2016; Z. Yang et al., 2015). Another study looked at how organizational capabilities (Managerial IT Capability, Technical IT Capability, and Relational IT capability) effect cloud success and subsequent firm performance (Garrison et al., 2015). Another study looking at firm performance, examined how governance, absorptive capacity and SaaS adoption contributed to SaaS operational and

innovational benefits and subsequent firm performance (Loukis et al., 2019) giving SMBs more confidence that perhaps SaaS under the right conditions can lead to improved firm performance.

Misra and Mondal developed a mathematical model to show how ROI (return on investment) is affected by cloud computing's impact on profitability, customer service, a focus on core competencies and disaster recovery (Misra & Mondal, 2011). In 2016, Schniederjans and Hales looked at how cloud computing impacted collaboration and subsequently economic and environmental performance (Schniederjans & Hales, 2016). Then there was a study that examined how cloud impacted flexibility of an organization (Liu et al., 2018). Chan Liu et al, looked at how cloud in any form whether, PaaS (Platform-as-a-Service), SaaS, or IaaS (Infrastructure-as-a-service) impacted economic flexibility, process flexibility, performance flexibility and or market flexibility (Liu et al., 2018). Obviously in these times of constant change and disruption, flexibility is going to be important, especially for smaller firms that might not have the monetary resources to weather a storm.

Lastly there were three studies that looked at technology and the capability and/or knowledge management of the personnel combined to impact business value through new types of systems and approaches (Akram et al., 2018; Kyriakou & Loukis, 2017; Zhang et al., 2017a). These studies complement an older study published in 2003 by Tippins and Sohi that examine the importance of IT competency (not specifically SaaS) on organizational learning and firm performance (Tippins & Sohi, 2003). In my experience, these studies support my empirical observations that technology and tools enable understanding, learning and knowledge and can contribute to insights that allow firms to obtain or maintain a competitive advantage and subsequent performance gains.

I saw this firsthand during my time with Salesforce.com. The Midwest manufacturing firm I supported, noticed a slight uptick in defection from their customers but could not identify the source because the data was not coming in consistently or in a usable form. The firm used emails and spreadsheets that went from one hand to another across the company. By the time it got into the hands of the marketing team the opportunities were lost.

The marketing manager went to the Salesforce.com administrator that was responsible for the system that supported the field reps. He told her the problem and within a couple of weeks they had developed a small section within the existing CRM system where the field reps could ask a quick question like "Has any organization recently been here to solicit your business away from us?" If the answer is yes, ask the name of the organization and type it in. The reps were asked to fill in the new section on their next visit to the dealer. Within a month, the firm had identified a national program in place by a large competitor aimed at their most lucrative business area. They were able to mitigate the situation with better offers to the customer which resulted from quick reactions from the marketing department. Without the learning/understanding of the market, the firm could not have reacted properly, and performance could have suffered.

For me the more recent studies support the older premises developed by Tippins that organizational learning should be the goal around which the information technology strategy is designed. "That the ability to obtain information about markets and customers helps to ensure that firms are more attuned to changes in the environment and can result in a competitive advantage over slower, ill-informed competitors (Tippins & Sohi, 2003, p. 745). This thinking and the brief case study shed light on the value of SaaS in providing quicker learnings by alleviating the time involved in proprietary development. In the case study above, the marketing manager approached the IT organization before he went to the Salesforce administrator. The IT department told him

that it would take over a year and cost hundreds of thousands of dollars to develop the capability he needed. Neither the cost nor the development time required presented a feasible alternative for the manager.

The gaps in the extensive literature are two-fold. First, the measurement models used to determine the impact of SaaS on agility, and flexibility and firm performance are based on surveys with self-reported data. Many of the authors of these articles call for a more objective measure of firm performance. The annual Salesforce.com survey is similar looking at measures such as leads generated, opportunities closed, sales revenue increased but focuses on responses from those closest to the implementation for assurances. There is an inherent bias in the results.

The second gap is the granularity of definition with respect to the tools in studies that look at IT capability and its effect on firm performance objectively. In the well cited set of five articles written between the years of 2000 and 2019, by Anandhi Bharadwaj (2000), Radhika Santhanam and Edward Hartono (2003), Ho-Chang Chae and Chang E. Koh (2014), Inmyung Choi and Joey George (2016), and Ho-Chang Chae and Chang E. Koh (2018) examining the impact of IT capability and firm performance (Bharadwaj, 2000; Chae et al., 2018; Chae et al., 2014; Choi & George, 2016; Santhanam & Hartono, 2003), the relationship between IT capability and firm performance is examined and reexamined as homogenous off-the-shelf technology emerges and matures in the 18 year span of the studies. This adoption of homogenous technology elevated the capabilities of the control group. The new capabilities in the control group blurred the lines between the advantages of the Information Week 500 IT leaders and the control group. These advanced technologies adopted by the control group included the internet, and web technologies along with other innovations (Bharadwaj, 2000; Chae et al., 2018). The gap in the studies is the specific definition and granular comprehension of the tools.

What is “web technology”? What company isn’t using the internet or web technologies in 2014, 2016 or 2018? How can we really say what IT leadership is? In other words, the technology itself whether on the IT leaders’ side or the control group side is not explained fully. Advanced technology is not granular enough to provide guidance on decision making.

Theoretical Approach: Resource Based View

Many of the articles used to support this dissertation are based on the resource-based view (RBV) management theory. The resource-based view of the firm attributes superior financial performance to organizational resources and capabilities (Benlian & Hess, 2011; Bharadwaj, 2000; Kyriakou & Loukis, 2017; Loukis & Kyriakou, 2018; Rodrigues et al., 2014; Tippins & Sohi, 2003). More specifically RBV links the performance of organizations to resources and skills that are firm specific, rare and difficult to imitate or substitute. It focuses on costly to copy attributes of the firm which are seen as the fundamental drivers of performance (Bharadwaj, 2000, p. 170).

SaaS would not qualify as a “resource” in resource-based theory as it is not unique at all. In fact, the homogenous nature of SaaS is a significant feature. The single code base for all clients that give SaaS its ability to launch new features quickly and easily also prevents customers from customizing it and thus making it unique to them. RBV, however, does offer a way to further explain how SaaS can positively impact firm performance. SaaS serves as a mediator, a resource that helps elevate the capabilities of the firm and subsequent performance. And while SaaS itself is not unique, the specific capabilities that the firm develops may be very unique and difficult to replicate, thus supporting the resource-based view.

Resources tend to survive competitive imitation when protected by isolating mechanisms such as time compression diseconomies, historical uniqueness, embeddedness and causal ambiguity. Time compression diseconomies refers to the time needed to acquire the resource through learning, experience, firm specific knowledge, or trained proficiency in a skill. SaaS

contributes to learning and knowledge development through its quick implementation advantage (Amini, 2014; Avram, 2014) and lowering barriers to innovation (Gupta et al., 2013; Loukis et al., 2019) that allow human resources to gain the knowledge and tools they need to quickly launch new features into their markets to gain competitive advantage.

Embeddedness of resources refers to the value of a resource being inexplicably linked to the presence of another complementary or cospecialized resource (Bharadwaj, 2000, p. 171; Tippins & Sohi, 2003). SaaS demonstrates this value, for example, through the concept of mashing where SaaS functions are combined (maps and CRM for example) by individual customers into a new function available to the organization (K. Kim & Altmann, 2013). These readily available features that are launched continuously and automatically by SaaS firms (Midha et al., 2017; Seethamraju, 2015) give organizations new ways to reach customers through unique combinations of SaaS applications that suit their customers and markets.

While resources serve as the basic units of analyses, firms create competitive advantage by assembling resources that work together to create organizational capabilities. Capabilities, thus refer to an organizations ability to assemble, integrate and deploy valued resources (Bharadwaj, 2000). Capabilities subsume the notion of organizational competencies and are rooted in processes and business routines. Described as a hierarchy of organizational competencies, specialized capabilities are integrated into the broader functional proficiencies such as marketing, manufacturing, and IT skills. Functional proficiencies in turn integrate to form cross-functional capacities such as new product development, customer support, etc. For example, a firm's customer support capability may derive from the cross functional integration of its marketing, IT and operations capabilities (Bharadwaj, 2000).

This dissertation examined capabilities in detail through very specific survey questions aimed at understanding how SaaS contributes to capabilities and subsequently to firm performance. We looked at capabilities such as: process development, focus on and improvement of core competency, building competencies that distinguish them from their competitors, a focus on core strategies, and using technology more effectively than their competitors. The goal for organizations is, of course, to build competitive advantages that distinguish them from other market choices. Survey questions were directed at understanding how SaaS contributes to the development of capabilities and how those capabilities translate into higher revenues, lower costs and higher productivity.

According to the RBV, IT may not generate a sustainable advantage, because it can be commoditized through competitive imitation and acquisition. However, the advantages of IT can be protected by embedding it in an organization through complementarity and co-specialization. Complementarity is said to exist when the value of one resource is enhanced by the presence of another resource. Thus, the value of IT is enhanced when firms use it to develop knowledge stores about its customers, markets and other factors that influence performance.

Strategy literature has recognized the role of knowledge as an important intangible resource for the firm. Knowledge development is a part of organizational learning (Tippins & Sohi, 2003). This work focused particular attention on organizational learning and the associated Capabilities, and firm agility and the consequences on firm performance. Consequences of organizational learning, like Capabilities, Speed, and a Focus on Core Competencies were mediators examined to determine if there is an impact on firm performance. We asked several survey questions that looked at organizational learning from the standpoint of experience and whether the number of years that SaaS has been deployed effected the organizational knowledge and subsequent

performance. Had firms developed specific processes for deploying SaaS and once deployed did firms gain specific insights about their markets and customers?

Adopting a resource-based perspective, information systems researchers have identified various IT related resources that serve as potential sources of competitive advantage. For example, some argue that managerial IT skills are rare and firm specific and, therefore, likely to serve as sources of sustained competitive advantage. Along with competent IT skills, a reusable technology base and a strong partnering relationship between a firm's IT and business unit management (relationship asset) influence a firm's ability to deploy IT for strategic objectives (Bharadwaj, 2000) This perspective was taken from the Bharadwaj article from 2000, a study that looked at data from the mid-1990s. At the time, Bharadwaj was arguing that IT Leaders, who were defined as having superior in-house IT development skills, outperformed a control group of non-IT leaders. And while over time these IT leaders no longer outperformed the control group, who it was assumed leveraged off the shelf technology, web-based services, cloud computing, etc.(Chae et al., 2014), the relationship between IT resources and business resources remains just as critical.

Unfortunately, many IT departments suffer from inertia. IT resources have built up systems that are rigid and difficult to manage (Polites & Karahanna, 2012) resulting in negative time compression diseconomies that hamper the innovation process. SaaS, again, can be a big help to business in this endeavor. The SaaS applications are very easy to implement and are targeted at business users rather than IT departments. This targeting enables the business users to implement strategies in a faster manner (Benlian & Hess, 2011; Garrison et al., 2015). Further extending the traditional RBV notion of organizational capabilities to a firm's IT function, a firm's IT capability is defined here as its ability to mobilize and deploy IT based resources in combination or co-present with other resources and capabilities (Bharadwaj, 2000).

We asked specific questions about whether SaaS helps to mobilize IT resources for business by enabling faster reaction time and faster decision making. Further, we investigated whether businesses are turning to SaaS vendors and readily available systems to improve firm capabilities and agility and subsequent firm performance.

Resource Based Theory works like a loop, where it starts by identifying the organization's resources, followed by exploring the possible capabilities from these resources to determine the business directions. After that, organizations could understand the possible capabilities from these resources to determine the business directions. Further, organizations could understand the potential of their competitive advantages and weaknesses and develop strategies. Lastly some gaps could be identified. The loop starts again by re-identifying the new resources to fill the new gap and so on (Fakieh et al., 2016). The empirical work that supports the pursuit of this dissertation is based on the SaaS impact on this RBT loop. SaaS can be quickly mobilized in specific areas with very targeted applications. Managers can look at data in real-time, directed to them through easy to develop reports that can answer big and little "what if" questions and allow them to take quick action to rectify market issues. New gap-filling resources can be checked on with the same reporting to ensure that the proper outcome is achieved.

There are high expectations that cloud computing can generate sizable business value for firms, which includes important benefits, associated with cost reduction, agility enhancement and innovation facilitation and support. Kyriakou and Loukis (2017) used the theoretical resource based view of the firm to investigate the effect of a set of human factors that concern the firm's general human capital, Information Communication Technology (ICT) specific human capital, as well as the co-operation and relationship between the personnel of the ICT unit and the personnel of the business units, and on the business value generated by cloud computing (Kyriakou & Loukis,

2017). The role and importance of a firm's human capital for its innovation activity has been widely recognized both theoretically and empirically in previous innovation literature. Since cloud computing constitutes a radical innovation in the ICT support of the firm's activities, we expect that a firm's relevant ICT human capital will be important for its success. This dissertation examined the effect of SaaS on firm performance through mediators like self-reported innovation as well as other important firm characteristics namely: capabilities, agility, new projects, and the role of technology.

One last note regarding the literature, a new article by Jorge Rodriguez was made available in 2021 that sheds some new light on SaaS (Rodrigues, Ruivo, & Oliveira, 2021). It is the first time, that we are aware, that an SEM model was used to look at SaaS and firm performance. The research was done in 2016 and contributes some unique thoughts to the SaaS field. We agree that much of the literature about Information Technology and Firm performance generally refers to "generic IT" and therefore is too vague to assist practitioners in deciding between on-premise solution and cloud tools like SaaS. We agree that SaaS provides more convenient access to new software packages and functionality like CRM and ERP, especially to SMBs who did not have access to this type of functionality in the past. We also agree that accessing applications as a service, provides the most up to date application functionality versus the on-premise option, making the new IT capabilities available in a timelier fashion to increase firm capabilities. We also took a similar approach with a research model that incorporates SaaS usage, mediators and subjective firm performance (Rodrigues et al., 2021, p. 2).

Our research differs from Rodrigues et al in that their SEM model looks at constructs that are at a lower level of granularity than ours. Where they look at items like innovative differentiation, market differentiation and low cost combined into a combined mediator called

"business strategy", we looked at more granular concepts such as capabilities, agility, innovation and measured them with diffusion levels and more granular concepts of firm performance, namely, revenue, costs, and productivity. Their endogenous variable firm performance was self-reported Market performance and Profitability (Rodrigues et al., 2021, p. 2).

In addition, our methodology includes three models looking at firm performance from slightly different perspectives. First, the ANOVA analysis looks at objective firm performance using self-reported data combined with Bloomberg financials. Second, our SEM model looks at more granular attributes of the firm; specifically; capabilities, agility, innovation, the role of technology and new projects, giving firms specific direction on where improvements might be expected. Our firm performance is also more granular as we are looking at revenues, costs and productivity vs profitability, which might be difficult to report subjectively. Lastly, the multigroup model examines the importance of core vs non-core capabilities and their impact on firm performance.

The literature has some overlap but from close examination, very little. The Rodrigues authors took a business strategy approach (Rodrigues et al., 2021), while we take a more operational look at the impact of SaaS on firm performance.

What I believe I have contributed to this extensive research is a study that fills the literature gap around specific technology definitions like SaaS and objective firm performance. Further, this research looks specifically at SaaS and the characteristics that mediate firm performance, contributing a more thorough understanding of the contributions of one specific web technology that leverages the internet, and its impact on the performance of a firm thus providing insight to SMBs making technology decisions.

CHAPTER 3: RESEARCH STATEMENT AND HYPOTHESIS DEVELOPMENT

Research Statement

In this section we examine the motivation behind the research, the academic support for the research, the gaps in the existing studies in this field and why I feel the research is important. We also examine the Hypothesis Summary Table which summarizes each hypothesis with academic support. We also examine the Key Constructs Table that summarizes the variables developed, their definition, the survey questions that supported them, the academic support for each survey question, the operationalization of the survey question and finally the hypothesis supported.

I have spent thirty years in the technology field. My career has spanned many innovations and disruptions and has created in me a profound curiosity for the breadth of organizational behavior in the field of information systems. I was taught to understand business needs and to prescribe specific solutions to resolve issues. In the mid-80s when I started at IBM, many of the solutions involved proprietary development. Then, IBM packages like COPICS and MAPICS became popular, but many organizations made significant changes to the "packages" to provide compatibility with their proprietary processes that, at the time, were core competencies and provided significant competitive advantage to the firms deploying them.

In the mid-90s, I worked for Sun Microsystems, I had the privilege of working with Dow Corning on an SAP project where I learned that they were not planning on making many modifications to the SAP software. Instead they challenged employees with learning the software and modifying the business processes (Gibson, 2004). In the case of accounting, they felt that the SAP system offered them "a far superior process" (Ross, 1999). They embraced the homogenous software that potentially eliminated any IT advantage that they would have enjoyed with a proprietary implementation. Dow Corning was recognized for their successful ERP

implementation by academia (Gibson, 2004; Ross, 1999) and business as an extraordinary effort. The Dow Corning case study supports the findings of Chae and Koh and Choi that homogenous software provides firms with competitive tools to improve firm performance (Chae et al., 2018; Chae et al., 2014; Choi & George, 2016).

Wortman et, al (2012) compared the development of software to the manufacturing industry, walking through the journey from bespoke development to configurable products (Wortmann et al., 2012). Just as manufacturing organizations recognized the cost and quality advantages to modular structures, so too has the software industry benefitted. Customers, especially SMBs have been able to elevate their capabilities with homogenous software, taking advantage of access to cutting edge software (Avram, 2014; Benlian & Hess, 2011; Chihande & van der Poll, 2017) and best practices (Garrison et al., 2015; Gupta et al., 2013) to improve their processes (Gibson, 2004) and gain business process advantages once reserved for large organizations with IT capabilities that provided proprietary business capabilities (Chae et al., 2018).

My most recent experience with Salesforce.com, created an even more significant interest. There, I worked with a large manufacturer and saw the benefits of a homogenous cloud platform over their traditional proprietary implementations. A homogenous CRM cloud platform, implemented in several departments, enabled functionality that improved the company's ability to react to unforeseen changes in the market. The CRM cloud technology, by its multitenant nature was identical to every other implementation deployed by the vendor and, in fact, more so than enterprise software because it could not be customized by the client/manufacturer (Chae et al., 2018; Wortmann et al., 2012). But it gave them the information they needed about their market in a timelier fashion than a proprietary development that would have taken over a year to develop.

They were then able to use their proprietary resources and core competencies to react to the information gained from the homogenous technology and mitigate the issue discovered. The homogenous technology gave them the flexibility and speed that a proprietary development could not because of the time it would have taken to develop similar capability in house.

Since resources are always finite, where is the best place to deploy corporate IT resources to maximize business performance? Should IT resources develop technology in house that is available as a homogenous cloud platform? Does it depend on the industry (Chae et al., 2018)? If a company in the Customer Relationship Management business like Facebook or eHarmony, used Salesforce.com to manage their customers, would they be giving up a competitive advantage that could be maintained with proprietary software? Probably. But what if a company sold household cleaners or automobiles or organic produce? Would a company whose competency was something other than CRM perform better using homogenous technology for CRM and deploying their proprietary development skills toward something that served the core competencies of the business? CRM is just an example, of course, there are thousands of cloud applications covering many aspects of business, like digital marketing, purchasing, and accounting, inventory control, human resources, the list goes on and on. Would SMBs improve their firm performance by leveraging cloud technology for functions that are not their core competency and use their finite, proprietary skills to advance the core aspects of the business?

There is much research that substantiates the advantages of SaaS for businesses. I have reviewed over 150 articles, coding 116 with Atlas TI and finding significant support for the idea that the implementation of cloud-based SaaS might provide for improved firm performance. The documented advantages include cost savings from a reduction in hardware and software purchases

and maintenance, to the speed of implementing firm capabilities and the quality of the SaaS applications.

While one can extrapolate from these and many other cloud features that there should be advantages to cloud implementations, there were not studies that supported that construct until a controversial work came out in 2014 from Chae and Koh (Chae et al., 2014). In this study the authors contradicted earlier studies by Bharadwaj and Santhanam and Hartono which asserted that firms with superior IT capability, which was defined in part, as the ability to create and maintain proprietary systems, contributed to enhanced firm performance (Bharadwaj, 2000; Santhanam & Hartono, 2003). Chae and Koh asserted in their study that this was no longer an advantage and that firms using homogenous software had caught up to the proprietary IT leaders (Chae et al., 2018). This work was further explored by (Choi & George, 2016) where they found mixed results in firm performance between firms developing proprietary capabilities and firms leveraging homogenous software applications. Lastly, Chae and Koh explored the work again in 2018 and confirmed earlier findings that the results were mixed and that in some cases, the firms deploying the generic software actually exceeded the firm performance of the proprietary systems (Chae et al., 2018).

Much of the literature on the advantages of cloud computing and SaaS suggests that the advantages like cost savings and focus on strategic issues or core competencies would lead to firm performance (Avram, 2014; Bieber et al., 2015; Garrison et al., 2015; Marston et al., 2011; Salleh et al., 2018). There are studies that suggest that SaaS improves IT enabled innovation (Alrokayan, 2017; S. Malladi & M. S. Krishnan, 2012) and organizational performance (El Alami et al., 2015; Garrison et al., 2015), but to date there is nothing that looks at the effects of SaaS on the objective measures of firm performance namely, Return on Assets, Return on Sales, Operating Income to

Assets, Operating Income to Sales, Operating Income to Employee, Cost of Goods Sold to Sales, and Selling and General Administrative Expenses to Sales (Bharadwaj, 2000). This is a missing piece. In fact, the previous studies suggest that future studies be directed at more objective measures rather than survey data from firm personnel.

Another missing piece in these studies, for my interest, is the lack of classification of the generic, homogenous software. While cloud computing is mentioned along with other enterprise systems like ERP and CRM, along with internet software, mobile computing, offshore outsourcing, and big data as "influencing change" in industries, They are labeled simply "advanced information technologies" (Chae et al., 2018, p. 526), which is not specific enough to provide guidance to SMBs in making choices between proprietary development, on-premise enterprise systems and cloud computing applications like SaaS.

Combining these two gaps, the problem of interest becomes whether advanced homogenous technology, specifically SaaS, deployed in Small and Medium Enterprises improves (objective and subjective) firm performance and what mediates that improvement.

Based on the research, the hypotheses in Table 1 were developed:

Table 1: Hypothesis Summary Table

Hypothesis	Academic Support
H1a: The average profit ratios of firms that have deployed higher percentages of SaaS applications are higher than the average profit ratios of those firms that have deployed lower percentages of SaaS applications.	Extending the research of (Bharadwaj, 2000; Chae et al., 2014)
H1b: The average cost ratios of firms that have deployed higher percentages of SaaS applications are lower than the average profit ratios of those firms that have deployed lower percentages of SaaS applications.	Extending the research of (Bharadwaj, 2000; Chae et al., 2014)
H1c: The average productivity ratios of firms that have deployed higher percentages of SaaS applications are higher than the average profit ratios of those firms that have deployed lower percentages of SaaS applications.	Extending the research of (Bharadwaj, 2000; Chae et al., 2014)

H2a: The role of technology in the organization positively mediates the relationship between the percentage of the IT budget spent on SaaS and firm performance (revenue, costs, productivity).	Extending the research of (Chae et al., 2018)
H2b: The role of technology in the organization positively mediates the relationship between the percentage of SaaS applications in the infrastructure and firm performance (revenue, costs, productivity).	
H3a: Innovation positively mediates the relationship between the percentage of the IT budget spent on SaaS and firm performance (revenue, costs, productivity) (S. Malladi & M. S. Krishnan, 2012, p. 2).	Extending the research of (S. Malladi & M. S. Krishnan, 2012)
H3b: Innovation positively mediates the relationship between the percentage of SaaS applications in the infrastructure and firm performance (revenue, costs, productivity) (S. Malladi & M. S. Krishnan, 2012).	Extending the research of (S. Malladi & M. S. Krishnan, 2012)
H4a: Agility positively mediates the relationship between the percentage of the IT budget spent on SaaS and firm performance (revenue, costs, productivity).	Extending the research of (Benlian & Hess, 2011; Garrison et al., 2015; Seethamraju, 2015)
H4b: Agility positively mediates the relationship between the percentage of SaaS applications in the infrastructure and firm performance (revenue, costs, productivity).	
H5a: New projects with SaaS positively mediates the relationship between the percentage of the IT budget spent on SaaS and firm performance (revenue, costs, productivity) (S. Malladi & M. S. Krishnan, 2012, p. 2).	Extending the research of (S. Malladi & M. S. Krishnan, 2012)
H5b: New projects with SaaS positively mediates the relationship between the percentage of SaaS applications in the infrastructure and firm performance (revenue, costs, productivity)(S. Malladi & M. S. Krishnan, 2012, p. 2).	
H6: Capabilities positively mediates the relationship between the number of years SaaS has been deployed and firm performance (revenue, costs, productivity).	Extending the research of (Benlian & Hess, 2011; Chae et al., 2014; Garrison et al., 2015; S. Malladi & M. S. Krishnan, 2012; Tippins & Sohi, 2003; Widyastuti & Irwansyah, 2018)
H7: Agility positively mediates the relationship between the number of years SaaS has been deployed and firm performance (revenue, costs, productivity).	Extending the research of (Benlian & Hess, 2011; Garrison et al., 2015; S. Malladi & M. S. Krishnan, 2012)
H8: Capabilities positively mediates the relationship between the area where SaaS has been deployed and firm performance (revenue, costs, productivity).	Extending the research of (Benlian & Hess, 2011; Chae et al., 2014; Garrison et al., 2015; S. Malladi & M. S. Krishnan, 2012; Tippins & Sohi, 2003; Widyastuti & Irwansyah, 2018)
H9: Agility positively mediates the relationship between the area where SaaS has been deployed and firm performance (revenue, costs, productivity).	Extending the research of (Benlian & Hess, 2011; Garrison et al., 2015; S. Malladi & M. S. Krishnan, 2012)

The following Key Constructs Table breaks down the initial constructs, definitions, survey questions, academic sources, and operationalization. This summary table is very helpful in understanding, at a glance, the justification and survey support for each variable.

Table 2: Key Constructs Table

Construct/ Dimensions	Definition	Items	Source	Operationalization
Corporate and Participant Information Company Information Participant Information	General Information to assist in Bloomberg research. Part II of the study. Company Name, Industry Participant title to ensure the participant has specific information about SaaS usage at the Firm	**Company Information: (CORP)** Q3: What is your company name? **Participant Information: (PERS)** Q1: What is your name? Q2: What is your job title?	Chae, H.-C., Koh, C. E., & Prybutok, V. R. (2014). Information technology capability and firm performance: contradictory findings and their possible causes. *MIS quarterly, 38*(1), 305-326.	Q2: This question includes a pull-down menu that includes; CIO, IT Executive/Mgmt, IT – Responsible for cloud computing, Responsible for cloud computing, Other. Q2 allows us to determine if the participant is qualified to answer the questions **Support for H1 and H2**
SaaS Adoption and Diffusion SaaS Adoption Percentage of SaaS adoption	Indication that the organization has adopted SaaS Indication of how much SaaS has been adopted. This helped us to determine whether more or less SaaS effects performance.	**SaaS Adoption (ADOPT)** Q5: Do you use SaaS in your organization? **SaaS Diffusion (DIFFUSE)** Q6: What percentage of your information technology infrastructure consists of SaaS?	Malladi, S., &Krishnan, M. S. (2012). *Does Software-as-a-Service (SaaS) has a role in IT-enabled innovation? – An empirical analysis.* Paper presented at the 18th Amer. Conf. Inf. Sys. 2012, AMCIS 2012 IDG. (2018). 2018 Cloud Computing Survey. Retrieved from https://www.idg.com/tools for-marketers/2018cloud computing-survey/	Q5: A binary variable (yes, no) Q6: A slide bar from 0% – 100%. *This was collapsed during*

Construct/ Dimensions	Definition	Items	Source	Operationalization
Percentage of IT budget allocated to SaaS	Indication of organizational commitment to SaaS			*analysis into quadrants.*
		Q7: What percentage of your information technology budget is spent on SaaS?		Q7: A slide bar from 0%- 100% I examined whether the % of budget allocated to SaaS impacts firm performance. **Support for H1 and H2**
IT Role in Industry (INDUS) Specific Industry IT Role in Industry	Looking at whether particular industries have better/worse performance with SaaS adoption. This construct extends the 2018 Chae research by asking the participant whether they think that that role of IT in their organization is to automate, informate or transform.	Q4: What is your industry? Q12: What is the role of information technology in your organization?	Chae, H.-C., Koh, C. E. & Park, K. O. (2018). Information technology capability and firm performance: Role of industry. *Information & Management, 55*(5), 525-546.	Q4: This is a dropdown list of popular industries provided by the survey tool. **Support for H3** Q7: This is a drop down menu with the Chae 2018 definitions: -Information technology helps us to automate by replacing human labor with automated business processes. -Information technology helps us with information to empower management and employees -Information technology fundamentally transforms our business and industry processes and relationships. A drop down menu provides the items for selection.

Construct/ Dimensions	Definition	Items	Source	Operationalization
Organizational Learning (LEARN) Previous experience with SaaS	This is consistent but extends Malladi to update how previous experience and specific organizational processes	Q15: How many years have you had SaaS in your organization. Q16: Our organization has developed	Malladi, S., &Krishnan, M. S. (2012). *Does Software-as-a-Service (SaaS) has a role in IT-enabled innovation? – An empirical analysis.* Paper presented at the 18th Amer. Conf. Inf. Sys. 2012,	Q15 is a slider bar from 0 -15 years Q16 is a 5-point Likert scale from
SaaS improves an organizations insights	improves chances of success and subsequent firm performance	specific processes for deploying SaaS. Q17: Once SaaS is deployed we gain new insights about our business.	AMCIS 2012 Widyastuti, D., & Irwansyah, I. (2018). Benefits and challenges of cloud computing technology adoption in small and medium enterprises(SMEs). *Bandung Creative Movement (BCM) Journal, 4*(1). p.244 Section 4.3.10 And Empirical work at Ford	47trongly agree to Strongly disagree Q17 had a 5-point Likert scale from 47trongly agree to Strongly disagree **Support for H8**
Focus on Strategic Initiatives IT leaders and firm performance	Do IT leaders have better firm performance than non-IT leaders. Is IT a core competency?	Q13: Adopting SaaS allows our organization to enhance capabilities that distinguish us from our competitors Q14: By adopting SaaS our company can concentrate more on putting our core strategies into action. Q18: Our organization uses	(Benlian & Hess, 2011) (Benlian & Hess, 2011) Chae, H.-C., Koh, C. E., & Prybutok, V.	Q13 leveraged a 5point Likert scale from strongly agree to strongly disagree. Q14 leveraged a 5point Likert scale from strongly agree to strongly disagree. Q18 leveraged a 5point Likert scale

Construct/ Dimensions	Definition	Items	Source	Operationalization
		information technology more effectively than of competitors.	R. (2014). Information technology capability and firm performance: contradictory findings and their possible causes. *MIS quarterly, 38*(1), 305-326.	from strongly agree to strongly disagree. **Support for H7**
Innovation (INNOV) SaaS improves innovation	Much literature associates the advantage of improved innovation with the diffusion of SaaS.	Q10: SaaS improves our ability to innovate.	(Asatiani, 2015; Avram, 2014; Benlian & Hess, 2011; S. Malladi & M. S. Krishnan, 2012; Marston et al., 2011; Waggener & Wheeler, 2009)	Q10 leveraged a 5point Likert scale from strongly agree to strongly disagree. **Support for H5**
New Projects (NEWPR) New Projects facilitate innovation	This question extends the Malladi and Krishnan study on SaaS and IT enabled innovation	Q8: What share of IT budget is allocated to new projects? Q9: What percentage of new projects leverage SaaS	Malladi, S., & Krishnan, M. S. (2012). *Does SaaS (SaaS) has a role in IT-enabled innovation? – An empirical analysis.* Paper presented at the 18th Amer. Conf. Inf. Sys. 2012, AMCIS 2012, p. 4	Q8 had a sliding scale from 0% - 100%. Q9 had a sliding scale from 0% - 100%. **Support for H6**
Speed (SPEED) Agility contributes to firm performance	Much literature speaks of SaaS contributing to the speed that a firm can react to market changes and competitive threats.	Q19: SaaS speeds up our ability to make decisions Q20: SaaS speeds up our ability to react to market pressures.	Benlian, A., & Hess, T. (2011). Opportunities and risks of software-as-a-service: Findings from a survey of IT executives. *Decision support systems, 52*(1), 232-246. Garrison, G., Wakefield, . L., & Kim, S. (2015). The effects of IT capabilities and delivery model on cloud computing success and firm performance for cloud supported processes and operations. *International Journal*	Q19 leveraged a 5-point Likert scale from strongly agree to strongly disagree. Q20 leveraged a 5-point Likert scale from strongly agree to strongly disagree. **Support for H4**

Construct/ Dimensions	Definition	Items	Source	Operationalization
			of Information Management, 35(4), 377-393. Seethamraju, R. (2015). Adoption of software as a service (SaaS) enterprise resource planning (ERP) systems in small and medium sized enterprises (SMEs). *Information Systems Frontiers, 17*(3), 475-492.	

In the next section, we explore the process of operationalizing the constructs and supporting hypothesis into the dissertation models.

Hypothesis Operationalization

In this section we look at the process associated with the development of each hypothesis. The section begins with the name of the model that was used to test the individual hypothesis, the academic and business support for each variable, the development of the survey questions that supported the hypothesis and the individual hypothesis. Finally, we look at the model that was used to test the hypothesis.

The Direct Impact of SaaS diffusion on Objective Firm Performance – The ANOVA (H1a–H1c)

In this section we look at the diffusion of SaaS divided into quartiles and its impact on objective financial ratios for named firms from the survey.

The impact of advanced but homogenous technology in improving objective business performance was investigated in past research and demonstrated that firms using available off the shelf technology could exceed performance of in-house development teams defined as Information Technology (IT) Leaders by Information Week 500 (Chae et al., 2014; Choi & George, 2016). In addition, the specific benefits of SaaS as it related to organizational learning and IT-enabled

innovation which contributed to firm performance were also evaluated in past research (S. Malladi & M. S. Krishnan, 2012). Other research showed that competitive performance through innovations in products, services, channels and market segmentation defined the agility that underlie firms' success in continually enhancing and redefining their value creation and competitive firm performance (Sambamurthy et al., 2003).

IT infrastructure is an important business capability that enabled valuable dynamic capabilities, that helped organizations use its resources more efficiently (S. Malladi & M. S. Krishnan, 2012). The modern IT environment is characterized by highly standardized and homogenous IT applications because of the rapid adoption of ERP and web technologies (Chae et al., 2014, p. 307). The advent and prevalence of the internet and continuous and dramatic reduction in the cost of IT resources have made IT more standardized and easily accessible (Chae et al., 2018, p. 525). Such standardization makes it easier for a firm to counter and even outdo its competitor's in-house IT capability (Chae et al., 2014, p. 307).

This study is a contribution to calls for further research to examine SaaS adoption and its impact on firm performance with self-reported and objective financial measures (Garrison et al., 2015; Liu et al., 2018; Loukis et al., 2019; Rodrigues et al., 2014). In addition, this study examined the effect of SaaS on firm performance over time as IT assets evolved (S. Malladi & M. S. Krishnan, 2012). Finally the study carved out a specific piece of "advanced, homogenous technology", namely SaaS, to help SMBs decide whether to take the financial risk on IT investment (Chae et al., 2018).

The survey first identified the title of the individual to ensure the participant was an appropriate resource to answer the survey questions. The name of the firm was very important as it allowed us to amend the Bloomberg financial data which was the basis for the business

performance ratios. I also asked about SaaS adoption and diffusion, whether the respondents used SaaS, how much of their organization leveraged SaaS technology as a percentage, and how much of their IT budget was dedicated to SaaS. These questions regarding SaaS usage were similar to the International Data Group SaaS survey that comes out bi-annually. This helped me to set up tiers of usage to compare financial results. The objective financial indicators, which were supported by Bloomberg data, were taken from the much-cited series of articles written by Bharadwaj, Chae and Koh, and Choi and George (Bharadwaj, 2000; Chae et al., 2018; Chae et al., 2014; Choi & George, 2016).

Questions are derived from Chae and Koh, International Data Group and Malladi and Krishnan (Chae et al., 2018; Group, 2018; S. Malladi & M. S. Krishnan, 2012).

- Your Company Name
- Industry (Chae et al., 2018)
- Your job title/responsibility
- Do you use SaaS in your organization? (Group, 2018; S. Malladi & M. S. Krishnan, 2012)
- What percentage of your organization's information technology leverages SaaS? (Group, 2018)
    - This question helped me compare, using an ANOVA and/or regression modeling, the impact of SaaS diffusion on business performance.
- What percentage of the IT budget is spent on SaaS?

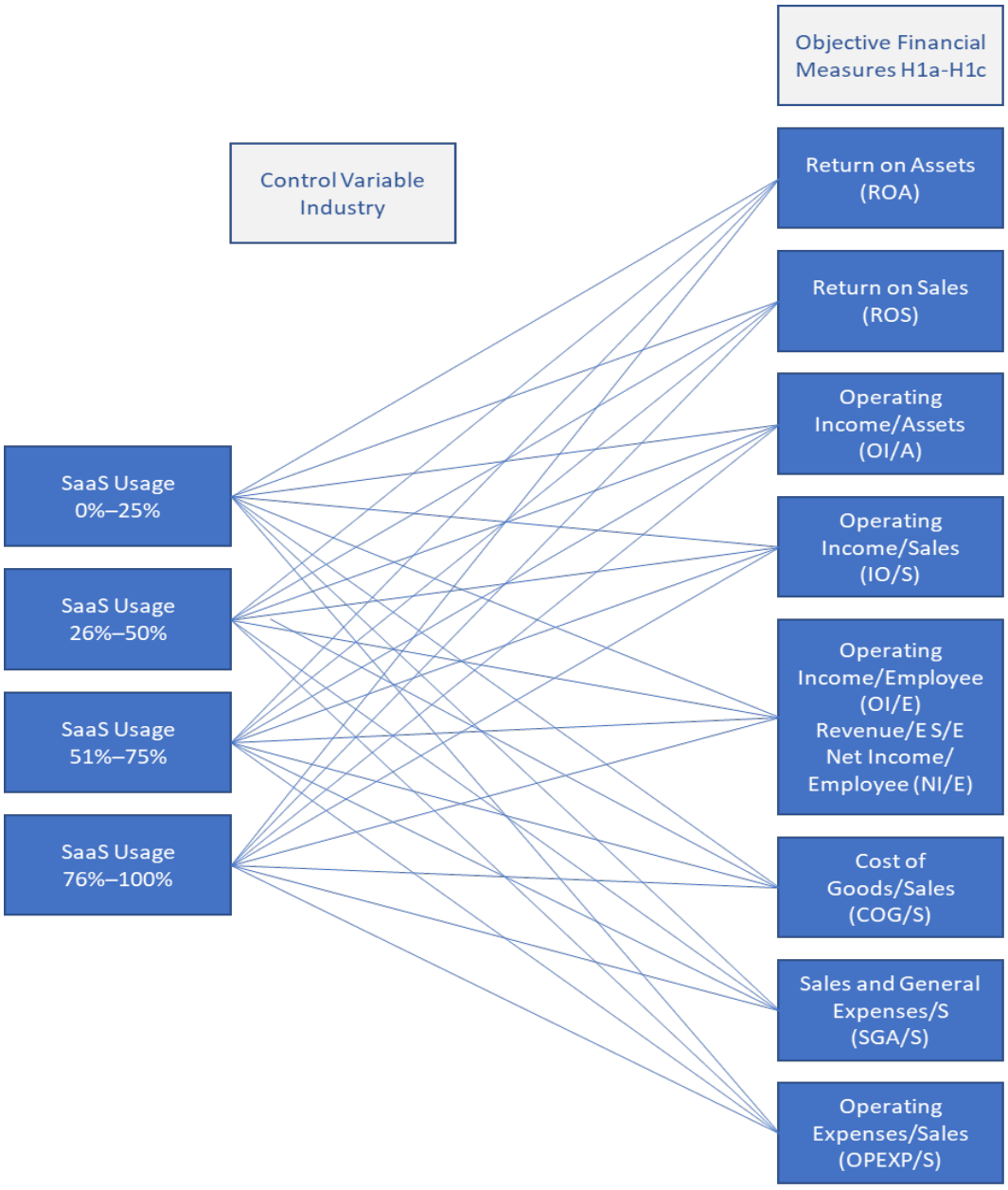
H1a: The average profit ratios of firms that have deployed higher percentages of SaaS applications are higher than the average profit ratios of those firms that have deployed lower percentages of SaaS applications.

H1b: The average cost ratios of firms that have deployed higher percentages of SaaS applications are lower than the average profit ratios of those firms that have deployed lower percentages of SaaS applications.

H1c: The average productivity ratios of firms that have deployed higher percentages of SaaS applications are higher than the average profit ratios of those firms that have deployed lower percentages of SaaS applications.

We used an ANOVA and objective firm performance data from Bloomberg to test the quartiles of SaaS diffusion to extend the research of the much-cited Bharadwaj, Chae and Koh 2014, Chae and Koh 2018 and Choi and George articles to comparing firm performance based on the diffusion of SaaS. This analysis extends the study by giving some additional granularity to the technology elements of the respondents (Bharadwaj, 2000; Chae et al., 2018; Chae et al., 2014; Choi & George, 2016) in (Chae et al., 2014). The Bloomberg objective financial data appended for each firm evaluated the following: Return on Assets (ROA), Return on Sales (ROS), Operating Income/Assets (OI/A), Operating Income/Sales (OI/S), Operating Income/Employee OI/E, for each company. We compared the means for firms with higher levels of SaaS diffusion with firms with lower levels of SaaS diffusion. The firm diffusion data was divided into four quartiles (0%-25%, 26% - 50%, 51% - 75%, 76% - 100%). Figure 1 illustrates the model that was developed.

Figure 1: The Direct Impact of SaaS Diffusion on Objective Firm Performance – The ANOVA (H1A–H1C)



The Mediating Effect of Consequences of SaaS Diffusion on Firm Performance – The Path Analytic Model (Subjective Measures) (H2–H7)

In this section, we examine the mediating effect of the following variables; the role of IT within Industry, Innovation, Speed (Agility), New Projects and Organizational Learning

(Capabilities) on the relationship between SaaS diffusion and Firm Performance. We explore each variable in detail, looking at the academic support, and the potential business impact. We look at how the Speed variables combined into the Agility measure and how the Organizational Learning variables combined into the Capabilities measure. Lastly, we look at the Path Analytic Model in Figure 2.

The Role of IT Within Industry

It is known that the extent to which IT impacts business and induces structural changes varies from industry to industry and organization to organization. Within each industry, information technology capability, an organization's ability to generate business value using its IT assets and know-how, can improve their business performance by leveraging their IT capability to increase revenues, reduce costs, or both. The internet (and cloud-based SaaS) accelerates industry transformation as it lowers entry barriers by reducing the size of capital required for IT investments creating increased levels of competition within certain industries. Thus in industries with ferocious and rapidly changing business environments, IT is an essential element of competition (Chae et al., 2018, p. 527). Contemporary organizations rely on highly standardized and homogenous information systems to enable a firm to counter and even outdo its competitor's IT capability (Chae et al., 2018, p. 528).

In 2018, Chae and Koh wrote that, IT usage within industries is classified into 3 roles. Automate, Informate Up/Down and Transform. These categories are defined as follows:

- Automate: Replace human labor by automating business processes.
- Informate Up/Down: Provide data/information to empower management and employees.
- Transform: Fundamentally change business and industry processes and relationships.

Chae and Koh evaluated the relationship between IT capability using the above mentioned roles and its effect on firm performance (Chae et al., 2018). Some examples of industries within these categories between 1995 and 1998 are:

- Automate: Computer Manufacturing; Metals Manufacturer; Surety, Title and Miscellaneous Insurance; Transportation – Ground and Railroad and Utilities - Electric
- Informate Up/Down: Agricultural Machinery Manufacturing; Automotive Manufacturing; Biotechnology Parts and Service; Diversified Food Manufacturing; IT Consulting Services; Printing, etc.
- Transform: Accounting, Bookkeeping, Collection and Credit Reporting; Advertising; Airlines; Banking: Computer Software Products and Services; Call Centers and other Direct Marketing, etc.

I evaluated the different industries in which the specific firms occupy. There was a survey question asking for the industry. There was a drop-down menu with 17 industries for respondents to choose. We looked at whether industry and the role of IT within the firms mediated results as Chae and Koh (Chae et al., 2018) indicated.

The following survey questions were supported by Chae and Koh's 2018 work (Chae et al., 2018):

- What is your Industry?
- What is the role of information technology in your organization?
    - The drop down replicates the (Chae et al., 2018) groupings mentioned above but respondents chose the result rather than being grouped by the researcher:
        - Automate: Replace human labor by automating business processes.

- Informate Up/Down: Provide data/information to empower management and employees.
- Transform: Fundamentally change business and industry processes and relationships.

Hypothesis 2a -2b were developed based on the above research:

H2a: The role of technology in the organization positively mediates the relationship between the percentage of the IT budget spent on SaaS and firm performance (revenue, costs, productivity).

H2b: The role of technology in the organization positively mediates the relationship between the percentage of SaaS applications in the infrastructure and firm performance (revenue, costs, productivity).

Innovation

This dissertation has extended the original work by Malladi and Krishnan in 2012 (S. Malladi & M. S. Krishnan, 2012) by looking at some of the same elements but added the evaluation of self-reported firm performance. We looked at whether SaaS contributed to innovation and whether that mediated self-reported firm performance. We asked a survey question about whether respondents associated the diffusion of SaaS with improving the innovation capabilities of the firm. Note: Using Atlas.ti, I coded over 113 articles, innovation through new capabilities was mentioned 58 times in the literature as a SaaS advantage. Lowering barriers to innovation was mentioned 21 times.

The following question was taken from Malladi and Krishnan 2012:

- SaaS improves our ability to innovate.

- Drop down 5-point Likert Scale (SA- SD) o This question was chosen to establish the relationship between SaaS, innovation and firm performance.

This question supported H3a and H3b.

H3a: Innovation positively mediates the relationship between the percentage of the IT budget spent on SaaS and firm performance (revenue, costs, productivity) (S. Malladi & M. S. Krishnan, 2012, p. 2).

H3b: Innovation positively mediates the relationship between the percentage of SaaS applications in the infrastructure and firm performance (revenue, costs, productivity) (S. Malladi & M. S. Krishnan, 2012).

Speed

Firms need to be able to dynamically reconfigure their resources to innovate in today's market. On-demand capacity procurement in SaaS positions them to create a business infrastructure that can shape a firm's capacity to launch frequent and competitive actions (S. Malladi & M. S. Krishnan, 2012, p. 2) A firm's IT response speed is vital to meet the demands and pressure of the rapidly evolving markets and business level volatility (Benlian & Hess, 2011; Garrison et al., 2015; Marston et al., 2011). Having these "sense and respond" capabilities help the firm enhance its agility, leading to a surge in the number of new products, innovations, or patents.

Those new products result in positive business performance (Chae et al., 2018, p. 527; S. Malladi & M. S. Krishnan, 2012, p. 2). The following survey questions were developed:

- SaaS speeds up our ability to make decisions.
  - Drop down 5-point Likert Scale (SA- SD)
- SaaS speeds up our ability to react to market pressures.
  - Drop down 5-point Likert Scale (SA- SD)

These speed measures were combined into the Agility construct with a Cronbach's Alpha score of .876.

Table 3: Final Agility Summary Table

Final Path Analytic Model Variable	Initial Variables	Source	Supported Hypothesis
Agility Cronbach's Alpha .876	Speed of Decision Making	(Benlian & Hess, 2011)	H4a, H4b, H7, H9
	Speed up our ability to react to market pressures	(Garrison et al., 2015; Suresh Malladi & Mayuram S Krishnan, 2012)	H4a, H4b, H7, H9

The above constructs supported H4a and H4b.

H4a: Agility positively mediates the relationship between the percentage of the IT budget spent on SaaS and firm performance (revenue, costs, productivity).

H4b: Agility positively mediates the relationship between the percentage of SaaS applications in the infrastructure and firm performance (revenue, costs, productivity).

New Projects

Malladi and Krishnan contend that SaaS contributes to a firm's IT-enabled innovation which improves a firm's ability to launch new projects that result in new products and improved firm performance. (S. Malladi & M. S. Krishnan, 2012) What percentage of new projects leverage SaaS? I examined whether the companies thought that SaaS gave them the flexibility to start new projects as my empirical evidence suggested (Midwest Manufacturer case study work).

- What share of IT budget is allocated to new projects? (S. Malladi & M. S. Krishnan, 2012, p. 4)

The above supported the formation of H5a and H5b:

H5a: New projects with SaaS positively mediates the relationship between the percentage of the IT budget spent on SaaS and firm performance (revenue, costs, productivity).

H5b: New projects with SaaS positively mediates the relationship between the percentage SaaS applications in the infrastructure and firm performance (revenue, costs, productivity).

Organizational Learning – Previous Experience with SaaS

Organizational learning is a dynamic capability wherein firms acquire knowledge and use it to build higher order capabilities that enable competitive advantage. Organizations build technical and business capabilities by learning from doing and use this learning in future endeavors. Research found that IT implementations are more likely to be successful if the firm has gained expertise in implementing similar systems in the past. Once a firm gains experience with an activity, the firm systematizes the activities by developing routines for future usage (S. Malladi & M. S. Krishnan, 2012, p. 3). In the Malladi and Krishnan study, published in 2012, they chose to use Services Oriented Architecture (SOA) and Web services adoption as the markers for testing organization learning and its impact on SaaS diffusion. It would be reasonable to assume that the level of SaaS usage at the time had not reached a level they felt was appropriate to use as a learning marker. Today according to IDG, in 2018 73% of organizations had deployed SaaS in some capacity. The remaining 17% had plans to deploy within the next 12 months (Group, 2018). Therefore, I used Years of SaaS Use as an indicator of whether the organization has previous SaaS experience and whether Capabilities developed from that experience mediate a positive relationship between SaaS experience and firm performance.

The following survey questions supported the above investigation:

- How many years have you had SaaS in your organization? (S. Malladi & M. S. Krishnan, 2012)
- Our organization has developed specific processes for deploying SaaS. This was adapted from: S. Malladi and M. S. Krishnan (2012)

- Once SaaS is deployed we gain new insights about our business? (Widyastuti & Irwansyah, 2018) (and empirical work at a Midwest Manufacturer)
- Our organization uses IT more effectively compared to competition? (Sambamurthy et al., 2003)
- Adopting SaaS fosters concentration on Core (Benlian & Hess, 2011; Garrison et al., 2015)
- Adopting SaaS allows our organization to enhance capabilities that distinguish us from our competitors (Benlian & Hess, 2011)
- Adopting SaaS allows us to put our core strategies into action (Benlian & Hess, 2011; Garrison et al., 2015)

The individual mediators were eventually combined into a single variable named Capabilities. The Cronbach's Alpha was .837.

Table 4: Final Capabilities Summary Table

Final Path Analytic Model Variable	Initial Variables	Source	Hypothesis
Capabilities Cronbach's Alpha .837	New Insights	(Widyastuti & Irwansyah, 2018)	H6, H8
	Fosters Concentration on Core Competencies	(Benlian & Hess, 2011)	H6, H8
	Specific Processes	(Suresh Malladi & Mayuram S Krishnan, 2012)	H6, H8
	Core Strategies into Action	(Benlian & Hess, 2011; Tippins & Sohi, 2003)	H6, H8
	Enhance capabilities	(Benlian & Hess, 2011)	H6, H8
	Use IT more effectively	(Chae et al., 2014; Garrison et al., 2015)	H6, H8

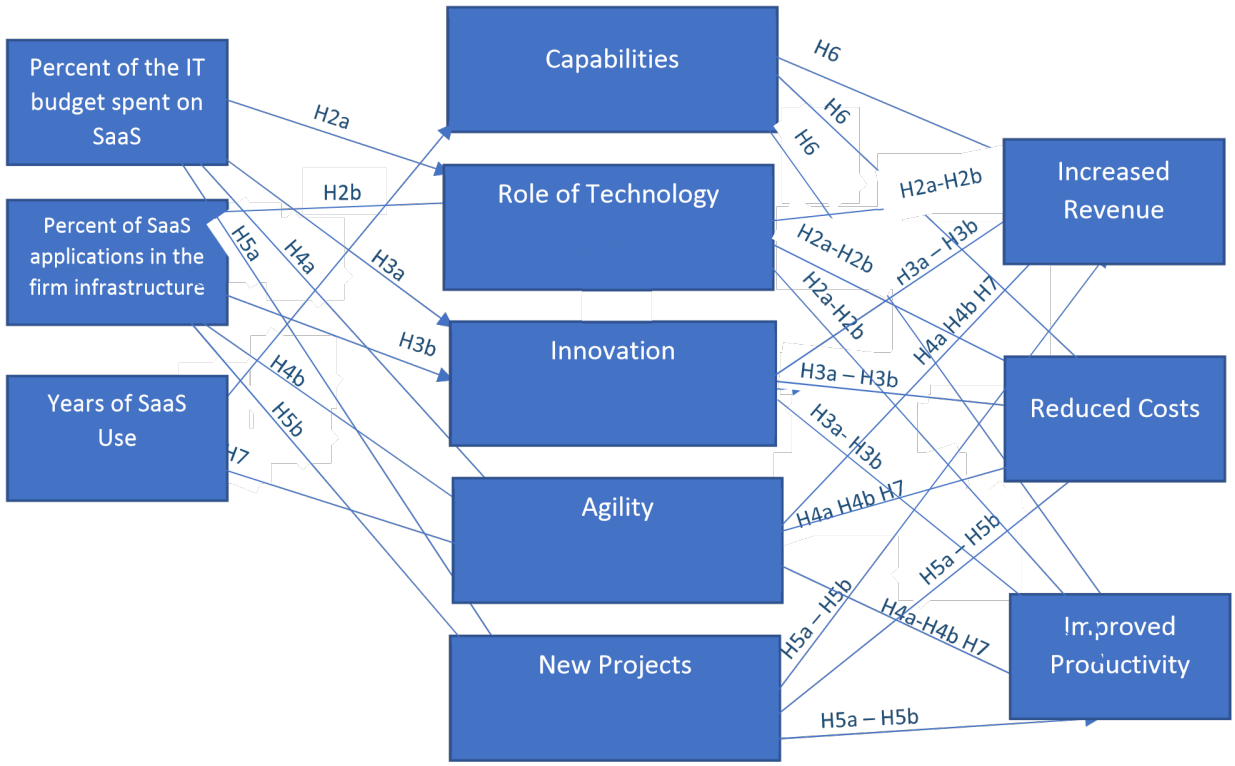
Here, consistent with the above research, H6 and H7 investigated whether capabilities, and agility mediated a positive relationship between past SaaS experience and subsequent firm performance (S. Malladi & M. S. Krishnan, 2012).

H6: Capabilities positively mediates the relationship between the number of years SaaS has been deployed and firm performance (revenue, costs, productivity).

H7: Agility positively mediates the relationship between the number of years SaaS has been deployed and firm performance (revenue, costs, productivity).

In Figure 2 following we see the final path analytic model that was used to analyze H2-H7.

Figure 2: The Mediating Effect of Consequences of SaaS Diffusion on Firm Performance – The Path Analytic Model (Subjective Measures) (H2–H7)



SaaS in Core vs Non-Core Areas and the Impact on Firm Performance – The Multi-group Model (H8–H9)

Outsourcing of non-core activities up or down the supply chain created dynamic business networks to provide value in the most efficient way (Wortmann et al., 2012, p. 6) cloud services can free an organization from the burden of having to develop and maintain large-scale IT systems; therefore, the organization can focus on its core business processes and implement the supporting

applications to deliver competitive advantages improving firm performance (W.-W. Wu, Lan, & Lee, 2011, p. 556).

Using Atlas.ti, I coded over 113 articles; *Internal focus on core competencies* was mentioned 38 times in the literature (Benlian & Hess, 2011; Kiblawi & Khalifeh, 2015; J. Wu et al., 2015; W.-W. Wu et al., 2011). Internal resources doing more strategic work was mentioned 26 times (Benlian & Hess, 2011; Jayatilaka, Schwarz, & Hirschheim, 2003; Low et al., 2011; Seethamraju, 2015). These advantages are very compelling especially for small and medium businesses that have limited resources.

Here I examined whether SaaS could off-load IT resources in non-core areas, freeing the organization to devote more resources to their core areas, thus improving the firm's offerings and financial performance. One of the questions asked whether SaaS was deployed in non-core areas and what percentage of SaaS diffusion was in non-core areas. The ability to off-load IT resources supported the notion that a modularization evolution took place in firms and non-core capabilities could be handed over to partners so that a focus could be placed on improving the core offering of the firm (Wortmann et al., 2012). The following questions were incorporated into the survey:

- In what areas of your business do you leverage SaaS?
    - Non-core areas of the business?
        - CRM (Customer Relationship Management)
        - Accounting, Purchasing, (applications like Procurify)
        - Expense Management (applications like Concur), Human Resources (applications like Workday)

- Core areas of the business? If you are in manufacturing, this might be a plant floor application. If you are a publishing firm, Microsoft 360 for publishing might be an example.
- Core areas and Non-core areas o We do not use SaaS

- Adopting SaaS applications allows our organization to enhance the capabilities that distinguish us from our competitors (Benlian & Hess, 2011, p. 240) Drop down 5-point Likert Scale (SA- SD)
- By adopting SaaS applications in non-core areas, our company can concentrate better on putting our core strategies into action (Benlian & Hess, 2011, p. 240) Drop down 5-point Likert Scale (SA- SD)
- Adopting SaaS applications is a good way to foster the company's IT resources on its core competencies (Benlian & Hess, 2011, p. 240). Drop down 5-point Likert Scale (SA- SD)
- Our organization uses information technology more effectively than our competitors (Sambamurthy et al., 2003). Drop down 5-point Likert Scale (SA- SD)

The above research supported the development of Hypothesis 8 and 9:

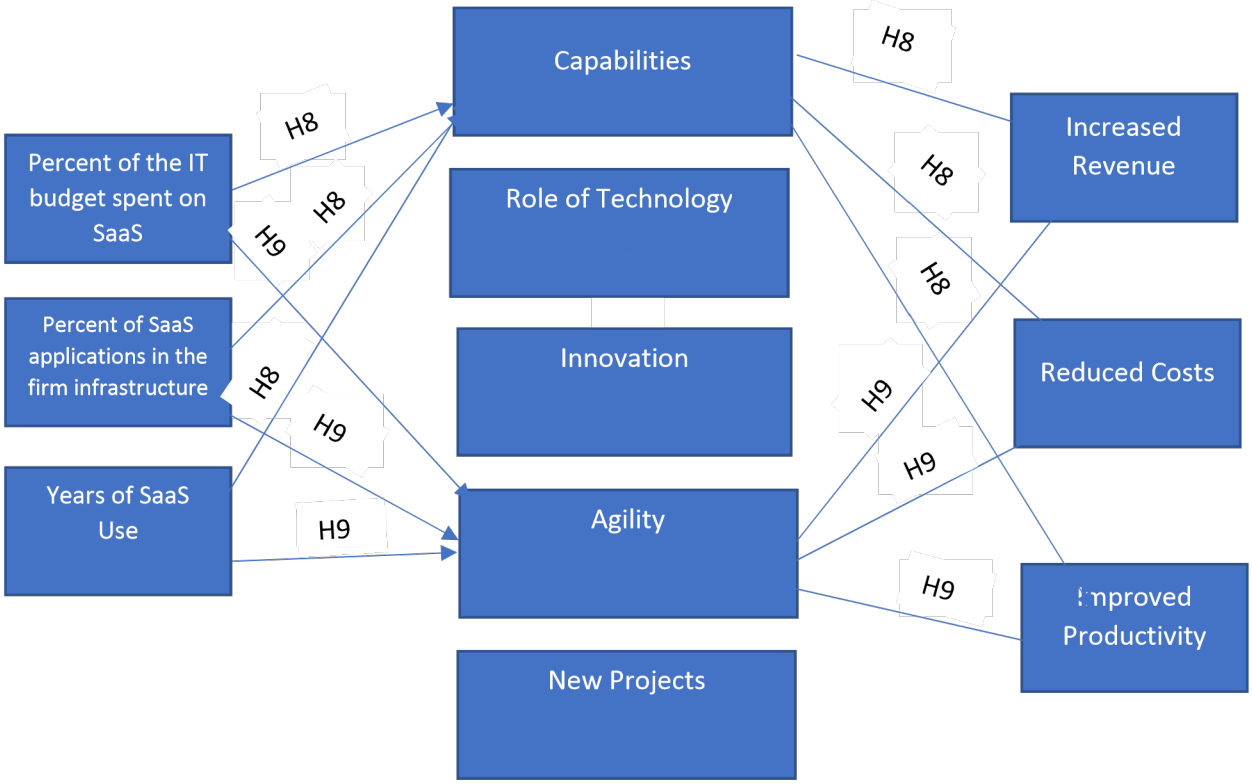
H8: Capabilities positively mediates the relationship between the area where SaaS has been deployed (core and non-core) and firm performance (revenue, costs, productivity).

H9: Agility positively mediates the relationship between the area where SaaS has been deployed (core and non-core) and firm performance (revenue, costs, productivity).

It was determined that H8 and H9 which examined where SaaS was deployed in the firm would need to be evaluated as a multigroup in AMOS. The question asked in the survey was: Where is SaaS deployed in the firm? The responses were: Non-core areas, Core areas, Core and

Non-core Areas, and We do not use SaaS. The third choice "Core and Non-core" answers were recoded into core to even out the responses for the multi-group analysis. There were 286 Non-core responses that served as one group and 268 Core responses that served as the other group. Detailed responses to this question can be found in Appendix H, Table H7. The original path analytic model was revised in AMOS to run as a multigroup analysis illustrated in Figure 3. Where was SaaS deployed in the firm was removed from the model, non-core and core were identified as the two groups and the model was re-run as a multi-group. Detailed results can be found in Appendix I.

Figure 3: SaaS in Core vs Non-Core Areas and the Impact On Firm Performance – The Multi-Group Model (H8–H9)



CHAPTER 4: RESEARCH, METHODS, AND OPERATIONALIZING CONCEPTS

In this section we look at the specific methods used to support the research. We examine the building and fielding of the survey and the survey responses in detail. Tables 5-7 examine the theory and academic support for the final variables along with the models and hypothesis they support.

Research Methodology

A survey instrument was developed in Qualtrics and fielded by LinkedIn, Crain Communications and Dynata. Crain Communications is a family owned, Detroit based "media company featuring 20 brands which stand among the most influential media properties in the verticals they serve" (Communications, 2021). Dynata is the world's largest first party data and insights platform providing clients' business and market understanding by connecting them to the interests, opinions and actions from their community of real people to strengthen market research (Dynata, 2021).

I reviewed the survey questions with the CIO and CTO of Crain and the CIO of North American Bancard to ensure that the meanings of the questions and potential answers are consistent with the survey intent. Modifications were made to add additional granularity to the survey. A question was added to examine respondents favorite SaaS application for example. Initially, there was a question asking for the respondent to give their name, it was determined that most surveys were ending at that point, so the question was removed. Once modified, the survey was sent out via LinkedIn, Crain Communications and Dynata using their executive mailing lists. I targeted CEOs, CIOs and IT executives of thousands of companies across the US. I offered to share the results of the study with them as an incentive. Of the thousands of public, private and charity firms that received the email, 630 public firms completed the survey. Once the data were

reviewed for missing fields, 79 surveys were trimmed and 554 fully completed responses remained in SPSS/AMOS for analysis.

Once the survey data were received and trimmed, the Bloomberg data were appended to 76 survey responses with a verified company name. SPSS and AMOS were used to develop the models and analyze the results of the self-reported data. The objective data were measured with an ANOVA comparing performance ratios of firms with four different levels of SaaS diffusion. The levels were quartiles; 0%-25%, 26% - 50%, 51%-75% and 76%-100%.

With respect to the named companies and the objective firm performance, the ratios from the Bharadwaj and Chae studies were used to extend their academic analysis, I was most interested in the ratio that supported productivity, namely (Operating Income per Employee) OI/Employee. I added another productivity measure (Operating Income/Revenue) OI/Revenue which is not included in the Bharadwaj and Chae studies but is a widely accepted ratio of operating efficiency.

The following represent the descriptive statistics for the research variables.

Table 5: Survey Response Frequencies – SPSS Analysis

	Mean	Median	Standard Deviation
What is your job responsibility? 1. Responsible for all information technology decisions/Chief Information Officer (CIO) 2. Information technology Executive/Management 3. Information technology responsible for cloud computing 4. Responsible for cloud computing decisions 5. Evaluate and Influence cloud computing decisions 6. Other	1.89	2.00	1.264

Role of Information Technology 1. Information technology helps us to automate by replacing human labor with automated business processes.	1.70	1.00	.828
2. Information technology helps us with information to empower management and employees. 3. Information technology fundamentally transforms our business and industry processes and relationships.			
SaaS Percentage in the Infrastructure	70.42	73	23.382
SaaS Percentage in the Budget	66.62	71.50	26.064
Years of SaaS Use	3.88	4	1.865
Where is SaaS deployed in the firm 1. Non-core 2. Core 3. Core and Non-core	1.61	1	.706
SaaS contributes to Innovation (5-point Likert	4.56	5	.719
Percentage of new projects that leverage SaaS	68.51	73	26.648
SaaS and increased revenue (5-point Likert)	4.49	5	.756
SaaS and reduced costs (5-point Likert)	4.27	4	.769
SaaS and improved productivity (5-point Likert)	4.48	5	.724
Adopting SaaS fosters our concentration on core competencies (5-point Likert)	4.26	4	.771
SaaS speeds up our ability to make decisions	4.51	5	.710
SaaS speeds up our ability to react to market pressures	4.35	4	.761
We use information technology more effectively than our competitors (5-point Likert)	4.31	5	.852
Adopting SaaS in non-core, core strategies into action (5-point Likert)	4.21	4	.791
SaaS and insights (5-point Likert)	4.31	4	.769
SaaS specific processes (5-point Likert)	4.56	5	.686
SaaS and enhanced capabilities that distinguish us from competition (5-point Likert)	4.49	5	.752

In this study, path analysis was used to explore our hypotheses about the sequential relationship among SaaS diffusion levels, the consequences of diffusion, and organizational performance with direct and indirect effects (mediation).

Variables of the Models

In this section the variables and constructs are described in detail. We begin with the exogenous variables, then the endogenous variables, brief academic support for the concept of firm performance and finally the mediators. Each section contains a table which explains each variable, which model it resides within, the academic source of the variable, the theory, if applicable, a description of the variable and the relevant Hypothesis. The table for the mediators also describes the transformation of the variables from the original survey to the final mediators and the relevant Cronbach Alpha. There is supporting text as well to further explain the rationale for the use of each variable.

The Exogenous Variables

Table 6: The Exogenous Variables

SaaS Diffusion	Model	Source	Theory	Description	Hypothesis
Percentage of SaaS in the Budget	P M	(IDG, 2018b)		To understand the level of diffusion of SaaS, respondents were asked for the percentage of SaaS in the infrastructure and for the percentage of their IT budget that was allocated to SaaS.	H2a, H3a, H4a, H5a H8, H9
Percentage of SaaS in the Infrastructure	P M	(IDG, 2018b)			H2b, H3b, H4b, H5b, H8, H9
Years of SaaS Use (Experience)	P M	(Suresh Malladi & Mayuram S Krishnan, 2012)	RBV	Previous experience with cloud services and SaaS may contribute to faster and more effective diffusion and subsequently, IT enabled innovation with SaaS Respondents were asked for the number of years that they had used SaaS in their organizations	H6, H7, H8, H9
Where was SaaS deployed in the firm Core vs Noncore	M	Chae and Koh	RBV	Chae and Koh suggested that off-loading non-core activities into SaaS would allow IT resources to be directed to core activities thus improving offerings and firm Performance	H8, H9
(Model Abbreviation: P- Path Analytic, M – MultiGroup, A – ANOVA)					

Two questions were asked to support the construct of general SaaS diffusion. These questions are consistent with the annual survey from IDG that looks at the frequency and accumulation of SaaS users (IDG, 2018a).

To understand the level of diffusion of SaaS, respondents were asked for the percentage of SaaS in the infrastructure and for the percentage of SaaS in their IT budget. Respondents used a sliding bar to answer. These two measures; *SaaS Percentage in the Budget* and *SaaS percentage in the infrastructure* became two of the four antecedents in the models.

Previous experience with cloud services and SaaS may contribute to faster and more effective diffusion and subsequently, IT enabled innovation with SaaS according to Malladi and Krishnan (S. Malladi & M. S. Krishnan, 2012). The respondents were asked for the number of years that they had used SaaS in their organizations. This experience would be a complementary resource to SaaS and the subsequent capabilities that were developed from their embeddedness thus supporting RBV. The measure Years of SaaS Use became the third antecedent in the path analytic model.

The last exogenous variable, 'Where was SaaS deployed in the firm' was used in the Multigroup model. This variable supports the concept of leveraging SaaS in non-core areas to off load IT resources that are then free to support the development of rare and difficult to imitate or substitute offerings. This supports the resource-based view. Respondents were asked whether they deployed SaaS in Core or Non-core areas of the business. The responses were then used as groups in the AMOS model and tested to see if the results were different between the groups.

The Endogenous Variables – Firm Performance

Table 7: The Endogenous Variables

Firm Performance	Model	Source	Hypothesis
Self-Reported Improved Revenue	P M	(Loukis et al., 2019)	H2-H9
Self-Reported Reduced Costs	P M	(Loukis et al., 2019)	H2-H9
Self-Reported Improved Productivity	P M	(Loukis et al., 2019)	H2-H9
Return on Assets (ROA) – Objective - Bloomberg	A	(Bharadwaj, 2000; Chae et al., 2018)	H1a – H1c
Return on Sales (ROS) – Objective - Bloomberg			
Operating Income/Assets (OI/A) – Objective - Bloomberg			
Operating Income/Sales OI/S Objective - Bloomberg			
Operating Income/Employee Objective - Bloomberg			
Revenue/Employee - Objective			
Net Income/Employee - Objective			
Cost of Goods Sold – Objective - Bloomberg			
Sales and General Expenses/Sales -Objective - Bloomberg			

(Model Abbreviation: P- Path Analytic, M – MultiGroup, A – ANOVA)

There is a great deal of literature that speaks to the diffusion of SaaS and subsequent improvement in firm performance (Amini, 2014; Chae et al., 2018; Loukis et al., 2019; Widyastuti & Irwansyah, 2018). Consistent with many of those studies, we assessed firm performance by asking firms to identify whether they felt SaaS improved their firm performance and in what areas. A 5-point Likert scale was provided. The three distinct measures of firm performance were:

1. SaaS has helped increase our revenue.
2. SaaS has helped us reduce costs in our organization.
3. SaaS has improved our productivity.

The Mediators

Table 8: The Mediators

Final Model Variable	Model	Theory	Initial Variables	Likert	Source	Hypothesis
Capabilities Cronbach's Alpha .837	P M	RBV	New Insights	Y	(Widyastuti & Irwansyah, 2018)	H6, H8
			Fosters Concentration on Core Competencies	Y	(Benlian & Hess, 2011)	H6, H8
			Specific Processes	Y	(Suresh Malladi & Mayuram S Krishnan, 2012)	H6, H8
			Core Strategies into Action	Y	(Benlian & Hess, 2011; Tippins & Sohi, 2003)	H6, H8
			Enhance capabilities	Y	(Benlian & Hess, 2011)	H6, H8
			Use IT more effectively	Y	(Chae et al., 2014; Garrison et al., 2015)	H6, H8
Role of Technology: Automate: Information technology helps us Automate Informate: Information technology helps us to Empower Transform: Information technology fundamentally transforms us	P				Chae and Koh examine the construct of industry (Chae et al., 2018) along with the role that technology plays in the industry. While Chae and Koh assigned the role of technology to the industry, we asked the respondents to identify the role of technology in their company.	H2a, H2b
Agility Cronbach's Alpha .876	P M	RBV	Speed of Decision Making	Y	(Benlian & Hess, 2011)	H4a, H4b, H7, H9
			Speed up our ability to react to market pressures	Y	(Garrison et al., 2015)	H4a, H4b, H7, H9
Innovation	P	RBV		Y	(Asatiani, 2015; Avram, 2014; Benlian & Hess, 2011; Marston et al., 2011)	H3a, H3b
New Projects	P			Y	(Suresh Malladi & Mayuram S Krishnan, 2012)	H5a, H5b

(Model Abbreviation: P- Path Analytic, M – MultiGroup, A – ANOVA)

The Role of Technology with its three levels was taken from Chae and was used to help us understand if the role of technology within industries impacted firm performance. Chae suggested that industries using technology in a transformative way would get more benefits from it. I assumed that most respondents would have selected that technology transforms their organization, only 132 did. I was surprised by the 296 out 554 "automate" responses, especially since the survey took place in the middle of the global COVID pandemic. So many people were working from their homes and technology was a key element in keeping businesses going. Chae assigned the role to the industry; we asked the respondents to choose from a drop-down menu.

The Capabilities measure was the mean of six individual measures. The original measures were: SaaS specific processes, SaaS and insights, SaaS and Enhanced Capabilities, Using technology more effectively than competitors, Adopting SaaS in non-core and core strategies into action, Adopting SaaS fosters concentration on core. These measures were combined into the Capabilities factor in AMOS (Cronbach's Alpha .837) The original constructs were assumed to mediate a positive relationship between SaaS diffusion and Firm performance. The RBV supports this presumption as SaaS would be a complementary resource, assisting in time compression for our chosen mediators.

Malladi and Krishnan predicted that previous experience would assist organizations with faster and more effective diffusion of SaaS resulting from firms specific processes that aided diffusion (Suresh Malladi & Mayuram S Krishnan, 2012) and that those processes would mediate the relationship between diffusion and firm performance. Respondents were asked whether they had developed specific processes for deploying/diffusing SaaS. The answer was offered in a 5point Likert scale. These specific processes could help compress time as well supporting RBV.

According to Tippins and Sohi and Widyastuti and Irwansyah, IT competency with an application can contribute to organizational learning and subsequent firm performance. This was also the case with empirical evidence from this researcher's case studies (Tippins & Sohi, 2003; Widyastuti & Irwansyah, 2018), IT competency with an application can contribute to organizational learning and subsequent firm performance. We saw this in the case studies from the Midwest Manufacturer. This organizational learning serves as a key component of RBV as it embeds SaaS as a co-specialized resource to improve organizational learning and subsequent actions within the firm.

According to Benlian and Hess 2012, the diffusion of SaaS can help organizations enhance capabilities that distinguish their organization from their competitors. These unique capabilities are very straightforward elements of RBV as these specific skills are fundamental drivers of firm performance. Respondents were asked whether adopting SaaS allowed their organization to enhance capabilities that distinguish them from their competitors. Respondents were asked to respond with a 5-point Likert scale.

In 2000, Bharadwaj established through a resource based perspective, that having superior IT capability compared to your competitors could positively impact firm performance (Bharadwaj, 2000). While the definitions of capabilities may have changed, the necessity of strong IT leadership is key. We asked the following question to support this premise; Our organization uses technology more effectively than our competitors. Respondents were asked to respond with a 5point Likert scale.

There is much literature that speaks of the advantage of off-loading non-core work to SaaS applications so that the organization can deploy their finite resources on core applications thus providing a difficult to duplicate, competitive advantage for the firm through unique offerings

(Benlian & Hess, 2011; Garrison et al., 2015; Gupta et al., 2013; Widyastuti & Irwansyah, 2018). This view supports RBV in that SaaS contributes to off-loading the resources of the firm to focus on developing unique offerings to the market while leaving those non-core elements, where uniqueness is less significant, like accounting, CRM or email, to SaaS.

Much of the literature examined associates the advantage of improved *innovation* with the diffusion of SaaS (Asatiani, 2015; Avram, 2014; Benlian & Hess, 2011; S. Malladi & M. S. Krishnan, 2012; Marston et al., 2011). This is, of course, another straight-forward RBV perspective as innovation is thought to be a unique offering to the market that would improve firm performance. SaaS is a co-specialized resource in this endeavor as it may bring new and cutting edge software into the firm that could be used to develop new market offerings (Benlian & Hess, 2011). Innovation was measured by a single, 5-point Liker's scale question--- Does SaaS improve their ability to innovate?

A complementary construct to innovation is the construct of new projects. This question extends the Malladi and Krishnan study from 2012 regarding the contribution to firm performance made through the development of new projects (S. Malladi & M. S. Krishnan, 2012). Again, these new projects are assumed to contribute to firm performance by offering a new and important offering to the market, supporting RBV. Again, SaaS helps to support this concept in a complementary way by bringing new technology into the firm. SaaS supports experimentation because it can be enabled in very small increments. This allows small experiments to take place inexpensively, allowing business cases to be developed before large expenditures are required. A single measure asked participants "What percentage of new projects leverage SaaS"?

The *agility* construct was the mean of two individual measures; SaaS speeds up our ability to make decisions and SaaS speeds up our ability to react to market pressures. These measures

were combined into the Agility factor in AMOS (Cronbach's Alpha .876). There is much literature that supports the construct that SaaS can improve the speed at which firms can react to market changes and competitive threats (Benlian & Hess, 2011; Garrison et al., 2015; Seethamraju, 2015).

In more recent literature, this speed is also referred to as SaaS and agility (Kyriakou & Loukis, 2017; Mitra et al., 2018; Schniederjans & Hales, 2016; Yeboah-Boateng & Essandoh, 2014). SaaS contributing to Speed in making decision and reacting to the market would be certainly support RBV as it could be very unique in particular markets. This agility also limits the effectiveness of the unique offerings from other competitors by quickly being able to offer a similar product or service as empirical evidence demonstrated to this author.

Industry was originally evaluated in the model as a control. It showed no significance across any of the many iterations and was eventually removed.

CHAPTER 5: RESULTS

In this section we look at the results which examined the premise that levels of SaaS diffusion have consequences on firm performance. The results were obtained using three models; an ANOVA which supported H1a but did not support H1b or H1c, a path analytic model which supported H2 (in part) and H3-H7, and a Multigroup model which supported H8. H9 was not supported by the results of the Multigroup model. Earlier examined figures are brought back in this section for the convenience of the reader. The sections of chapter seven include:

1. The Complete Table of Hypothesis results – Table 9 summarizes the results for each Hypothesis with the corresponding theory, whether the Hypothesis was supported or not and the p-value associated with each result.
2. The ANOVA Results – Figure 1 and Table 10, along with a brief narrative explain the model and results for H1a, H1b, and H1c.
3. The Path Analytic Model Results – This section describes in detail the results for H2-H7.
4. The Multi-group Results – This section explains the model and results for H8- H9.

Table 9: Hypothesis Results Table

Hypothesis	Theory	Supported/Not Supported	p-value
H1a: The average profit ratios of firms that have deployed higher percentages of SaaS applications are higher than the average profit ratios of those firms that have deployed lower percentages of SaaS applications.		Supported	.005-.061
H1b: The average cost ratios of firms that have deployed higher percentages of SaaS applications are lower than the average profit ratios of those firms that have deployed lower percentages of SaaS applications.		Not Supported	
H1c: The average productivity ratios of firms that have deployed higher percentages of SaaS applications are higher than the average profit ratios of those firms that have deployed lower percentages of SaaS applications.		Not Supported	
H2a: The role of technology in the organization positively mediates the relationship between the percentage of the IT budget spent on SaaS and firm performance (revenue, costs, productivity).		Supported	.079

H2b: The role of technology in the organization positively mediates the relationship between the percentage of SaaS applications in the infrastructure and firm performance (revenue, costs, productivity).		Not Supported	
H3a: Innovation positively mediates the relationship between the percentage of the IT budget spent on SaaS and firm performance (revenue, costs, productivity) (S. Malladi & M. S. Krishnan, 2012, p. 2).	RBV	Supported	.002 - .003
H3b: Innovation positively mediates the relationship between the percentage of SaaS applications in the infrastructure and firm performance (revenue, costs, productivity) (S. Malladi & M. S. Krishnan, 2012).	RBV	Supported	.001 - .092
H4a: Agility positively mediates the relationship between the percentage of the IT budget spent on SaaS and firm performance (revenue, costs, productivity).	RBV	Supported	.000 - .004
H4b: Agility positively mediates the relationship between the percentage of SaaS applications in the infrastructure and firm performance (revenue, costs, productivity).	RBV	Supported	.000 - .001
H5a: New projects with SaaS positively mediates the relationship between the percentage of the IT budget spent on SaaS and firm performance (revenue, costs, productivity) (S. Malladi & M. S. Krishnan, 2012, p. 2).	RBV	Supported	.004 - .011
H5b: New projects with SaaS positively mediates the relationship between the percentage of SaaS applications in the infrastructure and firm performance (revenue, costs, productivity) (S. Malladi & M. S. Krishnan, 2012, p. 2).	RBV	Supported	.004 - .050
H6: Capabilities positively mediates the relationship between the number of years SaaS has been deployed and firm performance (revenue, costs, productivity).	RBV	Supported	.026 - .037
H7: Agility positively mediates the relationship between the number of years SaaS has been deployed and firm performance (revenue, costs, productivity).	RBV	Supported	.015 - .060
H8: Capabilities positively mediates the relationship between the area where SaaS has been deployed and firm performance (revenue, costs, productivity).	RBV	Supported	$p < .05$
H9: Agility positively mediates the relationship between the area where SaaS has been deployed and firm performance (revenue, costs, productivity).	RBV	Not Supported	

The Direct Impact of SaaS diffusion on Objective Firm Performance – The ANOVA (H1a–H1c) Results

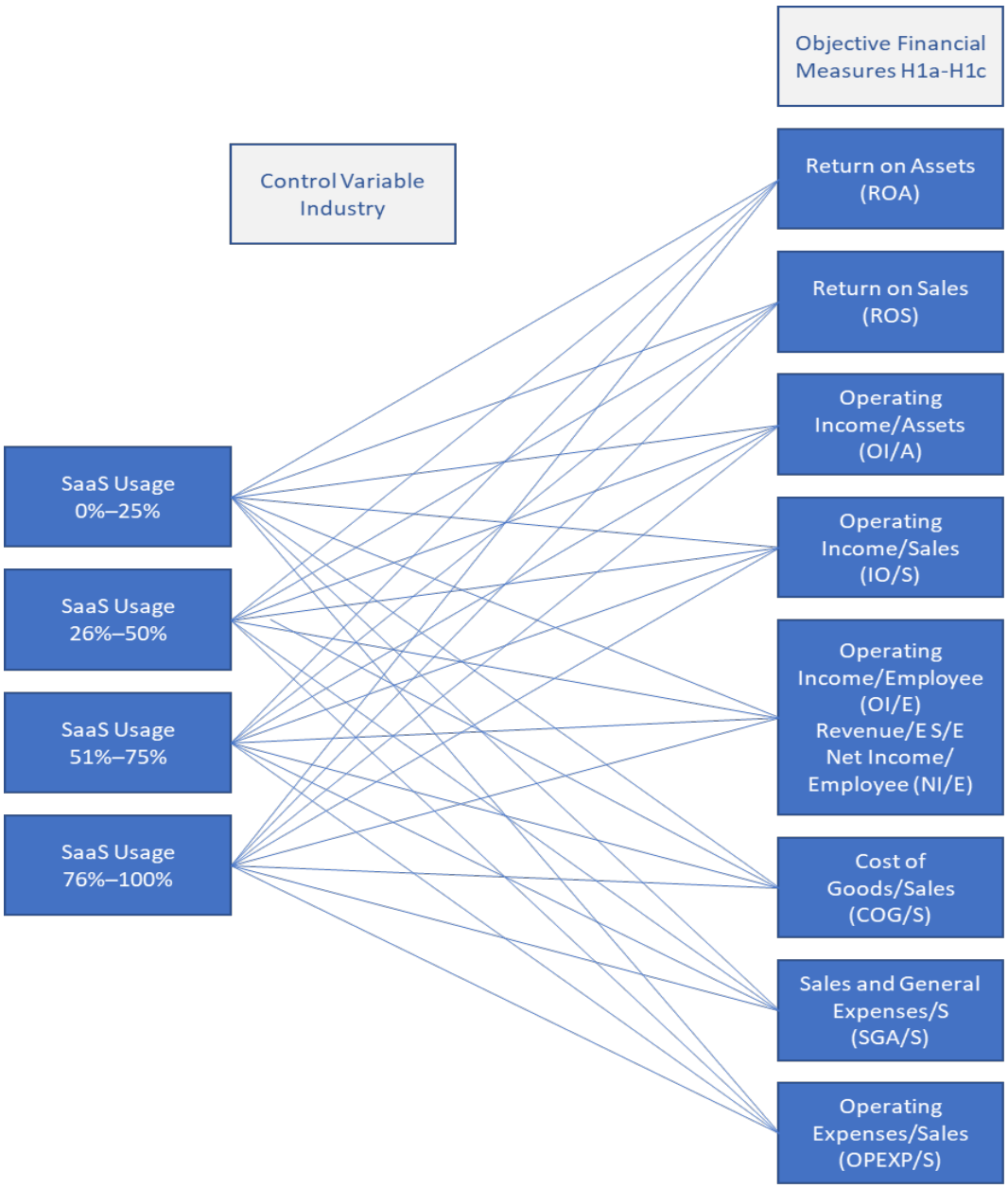
Hypothesis1a: Performance ratios of firms that have deployed higher percentages of SaaS are higher than firms that have deployed lower percentages of SaaS.

Hypothesis1b: Cost measures and cost ratios, of firms that have deployed higher percentages of SaaS are lower than firms that have deployed lower percentages of SaaS.

Hypothesis1c: Productivity ratios of firms that have deployed higher percentages of SaaS are higher than firms that have deployed lower percentages of SaaS.

The constructs for Hypothesis 1 were examined using 48 one-way ANOVA tests. Objective performance measures for each named company were obtained from Bloomberg. Twelve variables representing firms' cost, performance and productivity measures were examined over four years (2016, 2017, 2018, 2019). Each diffusion construct (SaaS percentage in the infrastructure and SaaS Percentage in the Budget) was tested with 192 individual ANOVAs.

Figure 1. The Direct Impact of SaaS diffusion on Objective Firm Performance – The ANOVA (H1a–H1c)



The breakdown for the diffusion constructs was as follows:

SaaS percentage in the Infrastructure and SaaS Percentage in the Budget:

Diffusion percentages (0%-25%, 26%-50%, 51%- 75%, 76% - 100%):

- 4 cost measures per year (2016, 2017, 2018, 2019)
    - Cost of Goods Sold (COGS)
    - Sales and General Administrative Expenses (SGA)
    - Costs of Goods Sold/Sales (COGS/S)
    - Sales and General Administrative Expenses SGA/S
- 5 performance measures per year (2016, 2017, 2018, 2019)
    - Operating Income (OI)
    - Net Income (NI) ○ Return on Assets (ROA)
    - Net Income/Sales (NI/S)
    - Operating Income to Sales (OI/S)
- 3 productivity measures per year (2016, 2017, 2018, 2019)
    - Sales/Employee (S/E)
    - Operating Profit/Employee (OI/E)
    - Net Income/Employee (NI/E)

Table 10: The Direct Impact of SaaS Diffusion on Firm Performance – Objective Measures – The ANOVA Model Results

Year	Variable	F	Significant	Hypothesis
2016	Net Income/Sales	2.615	.061	1a
2016	Operating Income/Sales	4.769	.005	1a
2017	Net Income/Sales	3.939	.013	1a
2017	Operating Income/Sales	4.261	.009	1a

Hypothesis H1a was supported. H1b and H1c were not supported.

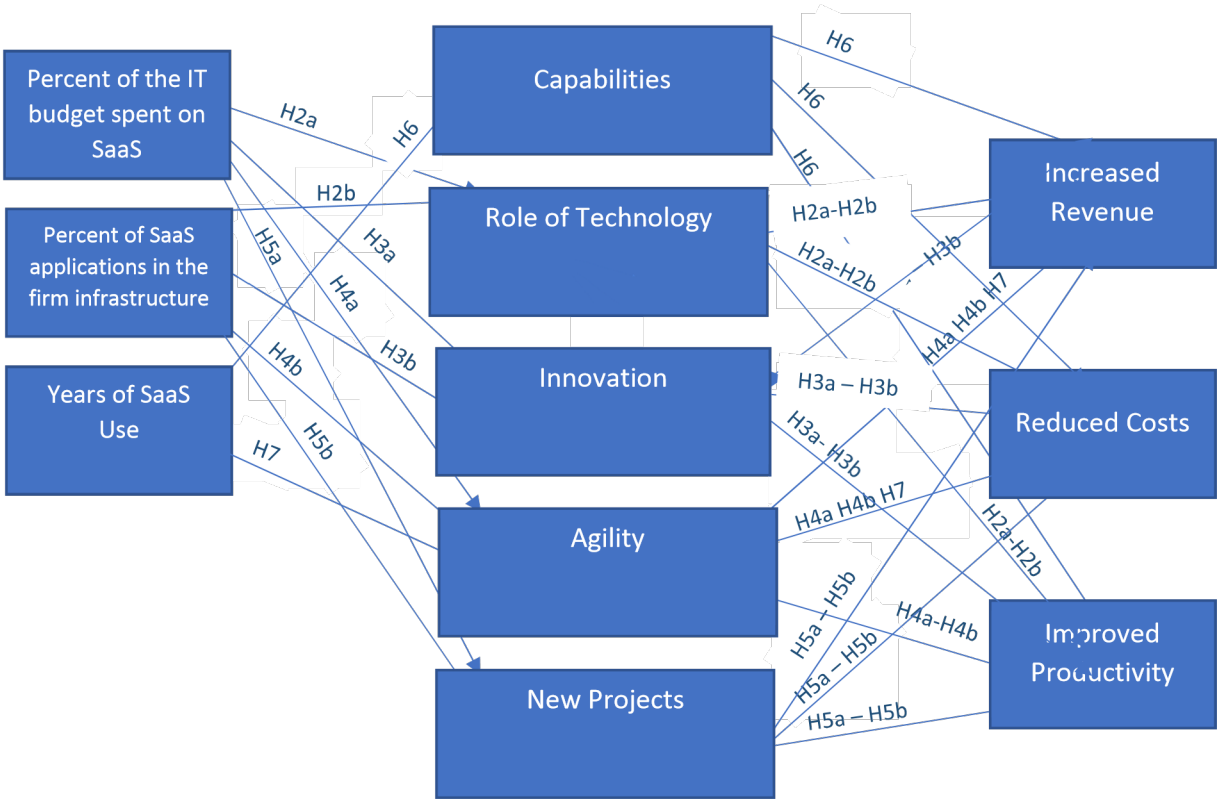
The significance of these ratios implies that companies that deploy higher levels of SaaS are more effective at generating profits. Operating Income/Sales is the operating margin of the company. It measures profitability and therefore some may say the success of the company. In two of the four years examined, operating margins of the companies that had diffused higher percentages of SaaS in the infrastructure generated higher operating margin. While Net Income/sales was also significant and higher in companies where SaaS was more heavily diffused, it is harder to judge effectiveness with this ratio as large transactions may take place within the net income measure making it more difficult to decipher the impact.

The full ANOVA tables can be found in the appendix: SaaS percentage in the infrastructure (Appendix E), SaaS Percentage in the Budget (Appendix F).

The Mediating Effect of Consequences of SaaS diffusion on Firm Performance – The Path Analytic Model (H2–H7)

As shown in Figure 2, the path analytic model consisted of 13 factors. The path analytic model contained three drivers of firm performance representing SaaS diffusion: SaaS percentage in budget, SaaS percentage in Infrastructure and Years of SaaS Use (measure of previous experience with SaaS). The model contained consequences of SaaS Diffusion treated as mediators: Capabilities, The role of technology, Innovation, Agility and New Projects that leverage SaaS. There were three endogenous variables representing firm performance: revenue, costs, and productivity.

Figure 2. The Mediating Effect of Consequences of SaaS Diffusion on Firm Performance – The Path Analytic Model Subjective Measures (H2–H7)



The typical path model fit statistics indicated that the model fit the data very well. (CMIN/DF of 1.494, X^2 =26.895, df=18, RMSEA=.030, CFI=.997, RMR=.074). The results indicated that the mediated relationships between SaaS diffusion and firm performance, with one exception were significant with appropriate standard errors.

The following tables show the path coefficient direct effect estimates, critical ratio (CR) and significance levels.

Table 11: The Mediating Effect of Consequences of SaaS diffusion on Firm Performance – The Path Analytic Model Results (H2–H7)

Regression Weights Table					
Relationship	Estimate	Standardized Regression Results	S.E.	C.R.	p-value
SaaS Budget → Capabilities	.103	.180	.030	3.489	***
SaaS Budget → Tech Role	-.260	-.312	.034	-7.751	***
SaaS Budget → Innovation	.126	.174	.040	3.137	.002**
SaaS Budget → Agility	.115	.174	.035	3.257	.001***
SaaS Budget → New Projects	13.781	.534	1.022	13.479	***
SaaS Infrastructure → Capabilities	.212	.327	.034	6.334	***
SaaS Infrastructure → Innovation	.142	.173	.046	3.124	.002**
SaaS Infrastructure → Agility	.193	.174	.040	4.815	***
SaaS Infrastructure → New Projects	7.410	.253	1.159	6.393	***
Years of SaaS → Capabilities	.019	.064	.009	2.141	.032*
Years of SaaS → Tech Role	.054	.122	.018	3.040	.002**
Years of SaaS → Agility	.021	.058	.011	1.905	.057+
Years of SaaS → New Projects	.722	.053	.390	1.853	.064+
Capabilities → Revenue	.344	.260	.065	5.332	***
Capabilities → Costs	.472	.350	.073	6.475	***
Capabilities → Productivity	.275	.216	.068	4.021	***
Tech Role → Revenue	-.084	-.092	.027	-3.131	.002**
Tech Role → Productivity	.050	.057	.028	1.755	.079+
Innovation → Revenue	.247	.235	.042	5.910	***
Innovation → Productivity	.074	.074	.044	1.684	.092+
Agility → Revenue	.300	.261	.055	5.454	***
Agility → Costs	.397	.338	.061	6.455	***
Agility → Productivity	.434	.393	.058	7.452	***
New Projects → Revenue	.003	.096	.001	2.939	.003**
New Projects → Costs	-.001	-.030	.001	-.801	.423
New Projects → Productivity	.003	.101	.001	2.793	.005**

The results in Table 11 indicate SaaS diffusion is a strong predictor of the consequences of diffusion namely, Capabilities, the role of technology, agility, innovation, and new projects, however Years of SaaS Use (previous experience) was only a marginal predictor of agility and new projects. Further, the mediators showed themselves to be strong predictors of firm

performance; revenue, costs and productivity, however innovation and tech role were only marginal predictors of productivity.

Next, the mediation hypotheses were tested following the usual process. The mediators were first removed from the final model and direct relationships were tested. Those results are found in the first column of Table 12. The mediators were then returned to the model and it was re-estimated . Those results and the type of mediation (full, partial or no mediation) are provided in Table 12. In 57.1% of the relationships partial mediation was present. In 28.5% of the relationships, full mediation was shown. In the remaining 14.2% no mediation was found.

Table 12: Mediation Testing Results

Relationship	Direct without Mediator	Indirect (SE)	p-value	Mediation Type
SaaS Budget → Capabilities → Revenue	.203***	.047	.000***	partial mediation
SaaS Budget → Capabilities → Costs	.095 (.028)*	.063	.001**	partial mediation
SaaS Budget → Capabilities → Productivity	.131 (.001)***	.039	.001***	partial mediation
SaaS Budget → Tech Role → Revenue	.203***	.029	.001**	partial mediation
SaaS Budget → Tech Role → Productivity	.131 (.001)***	-.018	.072+	partial mediation
SaaS Budget → Innovation → Revenue	.203***	.041	.003**	partial mediation
SaaS Budget → Innovation → Productivity	.131 (.001)***	.013	.155ns	no mediation
SaaS Budget → Agility → Revenue	.203***	.045	.003**	partial mediation
SaaS Budget → Agility → Costs	.095 (.028)*	.059	.003**	partial mediation
SaaS Budget → Agility → Productivity	.131 (.001)***	.069	.004**	partial mediation
SaaS Budget → New Projects → Revenue	.203***	.051	.004**	partial mediation
SaaS Budget → New Projects → Costs	.095 (.028)*	-.016	.526ns	no mediation
SaaS Budget → New Projects → Productivity	.131 (.001)***	.054	.011*	partial mediation

Relationship	Direct without Mediator	Indirect (SE)	p-value	Mediation Type
SaaS Infrastructure → Capabilities → Revenue	.205***	.085	.001***	partial mediation
SaaS Infrastructure → Capabilities → Costs	.188***	.114	.001***	partial mediation
SaaS Infrastructure → Capabilities → Productivity	.152***	.071	.001***	partial mediation
SaaS Infrastructure → Innovation → Revenue	.205***	.041	.002**	partial mediation
SaaS Infrastructure → Innovation → Productivity	.152***	.013	.114ns	no mediation
SaaS Infrastructure → Agility → Revenue	.205***	.067	.000***	partial mediation
SaaS Infrastructure → Agility → Costs	.188***	.087	.001***	partial mediation
SaaS Infrastructure → Agility → Productivity	.152***	.101	.001***	partial mediation
SaaS Infrastructure → New Projects → Revenue	.205***	.024	.004**	partial mediation
SaaS Infrastructure → New Projects → Costs	.188***	-.007	.505ns	no mediation
SaaS Infrastructure → New Projects → Productivity	.152***	.026	.010*	partial mediation
Years of SaaS → Capabilities → Revenue	.010 (.525)ns	.017	.031*	full mediation
Years of SaaS → Capabilities → Costs	.019 (.244)ns	.022	.037*	full mediation
Years of SaaS → Capabilities → Productivity	.021 (.172)ns	.014	.026*	full mediation
Years of SaaS → Tech Role → Revenue	.010 (.525)ns	-.011	.001**	full mediation
Years of SaaS → Tech Role → Productivity	.021 (.172)ns	.007	.047*	full mediation
Years of SaaS → Agility → Revenue	.010 (.525)ns	.050	.015*	**full mediation**
Years of SaaS → Agility → Costs	.019 (.244)ns	.020	.047*	full mediation
Years of SaaS → Agility → Productivity	.021 (.172)ns	.023	.060+	**full mediation**
Years of SaaS → New Projects → Revenue	.010 (.525)ns	.005	.045*	full mediation
Years of SaaS → New Projects → Costs	.019 (.244)ns	-.002	.313ns	no mediation
Years of SaaS → New Projects → Productivity	.021 (.172)ns	.005	.050+	full mediation

*** p<.001; ** p<.01; * p<.05; + p<.10

Role of Technology in the Organization and its Mediating Role Between SaaS Diffusion Percentages and Firm Performance

Hypothesis 2a predicts that the role of technology within the organization will mediate the relationship between SaaS percentage in the IT budget and firm performance (revenue, costs, productivity). Hypothesis 2b predicts that the role of technology within the organization will mediate the relationship between SaaS percentage in the infrastructure and firm performance (revenue, costs, productivity. H2a was supported. H2b was not supported.

The frequencies breakdown can be seen in Appendix H, Table H5. (Note: In the survey and subsequent analysis, Automate was coded as a 1, Empower 2, and Transform 3.) Almost half of the respondents 53.4% classified technology in the automate category, 22.7% chose Empower (Informate up/down) and 23.8% chose the transform category. The crosstab frequencies (Appendix J) showed that only two industries Manufacturing and Utilities classified technology as transformational more often than automate or empower. The retail industry was highest on empower. These results were surprising especially since the technology industry made up 37.9% of the survey. If companies are not getting enough value from technology, this could be an explanation, they are not expecting much.

Table 12 provides the indirect or mediation effect of role of technology. Mediation is suggested if the following conditions are met: a) The independent variable is a significant predictor of both the dependent variable and the mediator; b) the mediator is a significant predictor of the dependent variable and c) the effects of the independent variable on the dependent variable are reduced when the mediating variable is added to the regression equation. Full mediation is indicated if the effect of the independent variable is no longer significant when the mediating variable is added.

Role of technology mediates the positive effect between SaaS Percentage in the Budget and increased revenue .029 (p-value .001) and the role of technology mediates a negative relationship between SaaS Percentage in the Budget and improved productivity -.018 (p-value .072).

Innovation and its Mediating Role Between SaaS Diffusion and Firm Performance

Hypothesis 3a predicts that innovation will strengthen the relationship between the diffusion of SaaS Percentage in the Budget and firm performance (revenue, costs and productivity). Hypothesis 3b predicts that innovation will strengthen the relationship between the diffusion of SaaS Percentage in the Infrastructure and Firm Performance (revenue, costs and productivity). H3a and H3b were supported.

We asked survey respondents to respond to a Likert scale from strongly agree to strongly disagree with “SaaS improves our ability to innovate”. Frequency results showed that over 92% of respondents agreed. Standardized regression weights results showed a significant positive relationship between SaaS percentage in IT budget and innovation .174 (p-value .002) and SaaS Percentage in the Infrastructure and innovation .173 (p-value .002). Further, we also saw that innovation has a significant positive effect on increased revenues .235 (p-value <.001) and a significant positive effect on improved productivity .074 (p-value .092).

Additional analysis of the indirect effects showed that innovation mediates the positive relationship between SaaS Percentage in the Budget and increased revenues (standardized estimate .041 (p-value .003), innovation also mediates the positive relationship between SaaS Percentage in the Infrastructure and increased revenues .041 (p-value .002)

Through observation, one can see that SaaS could be a good tool for trial-and-error experimentation. Salesforce.com has many case studies on their YouTube channel that tell stories of how firms use the easy to configure tool to experiment with new ideas to engage customers.

Agility and Its Mediating Role Between Diffusion of SaaS and Firm Performance

Hypothesis 4a predicts that agility will positively mediate the relationship between SaaS Percentage in the Budget and improved firm performance (revenue, costs, and productivity). Hypothesis 4b predicts that agility will positively mediate the relationship between SaaS Percentage in the Infrastructure and improved firm performance (revenue, costs, and productivity).

Table 13: Agility Standardized Regression Weights Estimates

Measure	Result	p-value
SaaS in the budget and agility	.174	.001
SaaS in the infrastructure and agility	.258	<.000
Agility and revenue	.261	<.000
Agility and costs	.338	<.000
Agility and productivity	.393	<.000

Table 14: Agility Mediation Results

Measure	Result	p-value
SaaS in the Budget to Agility to Revenue	.045	.003
SaaS in the Budget to Agility to Costs	.059	.003
SaaS in the Budget to Agility to Productivity	.069	.004
SaaS in the Infrastructure to Agility to Revenue	.067	.000
SaaS in the Infrastructure to Agility to Costs	.087	.001
SaaS in the Infrastructure to Agility to Productivity	.101	.001

Support for H4a and H4b was obtained.

New Projects With SaaS and Their Mediating Role Between SaaS Diffusion and Firm Performance

Hypothesis 5a predicts that new projects leveraging SaaS will positively mediate the relationship between SaaS Percentage in the Budget and firm performance (revenue, costs and productivity). Hypothesis 5b predicts that new projects leveraging SaaS will positively mediate the relationship between SaaS Percentage in the Budget and firm performance (revenue, costs and productivity). H5a and H5b were supported.

Table 15: New Projects Standardized Regression Weights Estimates

Measure	Result	p-value
SaaS in the budget and new projects	.534	<.000
SaaS in the infrastructure and new projects	.253	<.000
New projects and revenue	.096	.003
New projects and costs	-.030	.423ns
New projects and productivity	.101	.005

Table 16: New Project Mediation Results

Measure	Result	p-value
SaaS in the budget to new projects to revenue	.051	.004
SaaS in the budget to new projects to costs	-.016	.526ns
SaaS in the budget to new projects to productivity	.054	.011
SaaS Percentage in the Infrastructure to new projects to revenue	.024	.004
SaaS Percentage in the Infrastructure to new projects to costs	-.007	.505ns
SaaS Percentage in the Infrastructure to new projects to productivity	.026	.010

The Mediating Role of Capabilities between Years of SaaS Use (Previous Experience with SaaS) and Firm Performance

Hypothesis 6 predicts that Capabilities will positively mediate the relationship between Years of SaaS Use (previous experience with SaaS) and firm performance (revenue, costs, productivity). The survey question was How many years have you had SaaS in your organization, and the responses choices were 0-1 years, 1-2 years, 2-3 years, 3-5 years, 5-7 years, 7-8 years, 8-10 years, and more than 10 years. More than forty percent of the responses were between three and seven years, 12% had more than 10 years and only 2.3% had between 0 and 1 years of experience. H6 was supported.

Table 17: Capabilities Standardized Regression Weights Results

Measure	Result	p-value
Years of SaaS Use and Capabilities	.064	.032
Capabilities and revenue	.260	<.000
Capabilities and cost	.350	<.000
Capabilities and productivity	.216	<.000

Table 18: Capabilities Mediation Results

Measure	Result	p-value
Years of SaaS Use to Capabilities to revenue	.017	.031
Years of SaaS Use to Capabilities costs	.022	.037
Years of SaaS Use to Capabilities productivity	.014	.026

The Mediating Role of Agility on Years of SaaS Use and Its Relationship to Firm Performance

Hypothesis 7 predicts that agility will positively mediate the relationship between Years of SaaS Use (previous experience) and firm performance (revenue, costs, and productivity). Standardized regression estimates show strong direct positive relationships between agility and the firm performance (revenue, costs and productivity). H7 was supported.

Table 19: Agility and Years of SaaS Use Standardized Regression Results

Measure	Result	p-value
Years of SaaS Use and Agility	.058	.057
Agility and revenue	.261	.000
Agility and costs	.338	.000
Agility and productivity	.393	.000

Table 20: Agility and Years of SaaS Use and Firm Performance Mediation Results

Measure	Result	p-value
Years of SaaS Use to Agility to revenue	.050	.015
Years of SaaS Use to Agility to costs	.020	.047
Years of SaaS Use to Agility to productivity	.023	.060

SaaS in Core vs Non-Core Areas and the Impact on Firm Performance – The Multi-group Results (H8–H9)

H8 and H9 examine the relationship between where SaaS in deployed in the firm (non-core or core) and the moderating effects of Capabilities and Agility on the relationship between SaaS diffusion and firm performance. Hypothesis 8 predicts that Capabilities will positively moderate

the relationship between where SaaS is deployed in the firm and firm performance. H8 was supported.

As outlined previously, as a final analysis, a multigroup model was run to examine the effects of where SaaS was deployed in the firm, as a moderator on firm performance through all paths in the model.

Figure 3. SaaS in Core vs Non-Core Areas and the Impact on Firm Performance – The Multi-group Model (H8–H9)

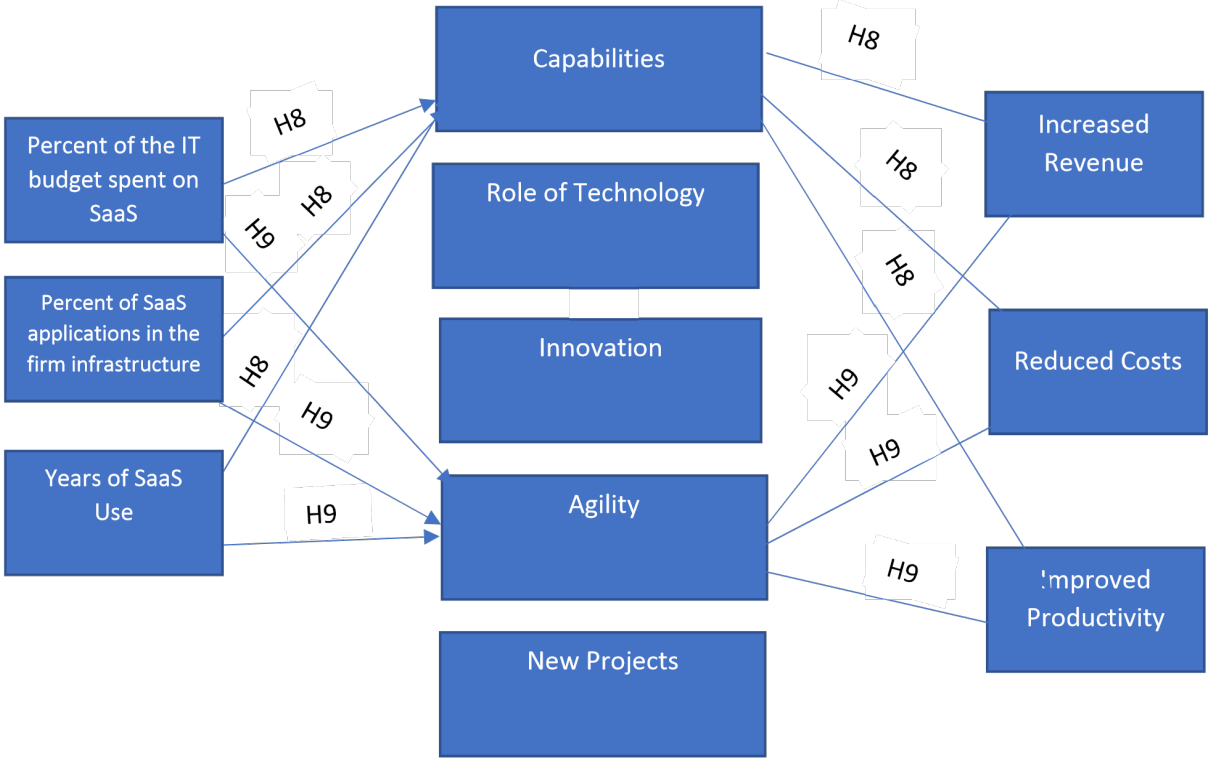


Table 21: Pairwise Comparisons Where SaaS Deployment in the Firm (Non-Core or Core) Strengthened the Relationship

Measure	Standardized Estimate	z-score	p-value
Capabilities and increased revenue		2.303**	p < .05
• Core estimate	.452		.000
• Non-Core estimate	.153		.096

*** p<.001; ** p<.01; * p<.05; + p<.10

Table 22: Pairwise Comparisons Where SaaS Deployment in the Firm (Non-Core or Core) Weakened the Relationship

Measure	Standardized Estimate	z-score	p-value
Capabilities and productivity		-2.803***	p < .01
• Core Estimate	.119		.154ns
• Non-core estimate	.508		.000

*** p<.001; ** p<.01; * p<.05; + p<.10

There is a significant difference between where SaaS is deployed in the firm and the relationship between Capabilities and Firm Performance.

The Positive Moderating Effects of Where SaaS is Deployed in the Firm (Non-Core or Core) and the Relationship Between Agility and Firm Performance

Hypothesis 9 predicts that where SaaS is deployed in the firm (core or non-core areas) will positively moderate the relationship between agility and firm performance.

A multigroup model was run to examine the effects of agility between where SaaS was deployed in the firm (non-core and core areas), and firm performance through all paths in the model. Results indicated SaaS deployed in non-core weakened the relationship between SaaS diffusion and firm performance. There were no positive moderating effects. H9 was not supported.

Table 23: Pairwise Comparisons Where SaaS Deployment in the Firm (Non-Core or Core) Weakened the Relationship

Measure	Standardized Estimate	z-score	p-value
SaaS Percentage in the Budget to agility z-score		-1.907*	p < .10ns
• Core estimate	.056		.244
• Non-core estimate	.193		.000

*** p<.001; ** p<.01; * p<.05; + p<.10

CHAPTER 6: DISCUSSION

In this section we summarize the impact of the findings. Each hypothesis is restated along with the results from Table eight. A detailed discussion of the academic and business impact of each result follows.

This work began as an empirical study at a large Midwest manufacturer that was expanding its use of Salesforce.com. Their newfound agility and shift toward businesspeople doing IT work inspired me to pursue a systems engineering PhD to understand how the diffusion of SaaS affected business performance. This work confirms and extends previous studies that demonstrated some of the benefits of SaaS or cloud computing namely; agility (Kyriakou & Loukis, 2017; YeboahBoateng & Essandoh, 2014), improved IT performance (Benlian & Hess, 2011; Seethamraju, 2015), innovation (S. Malladi & M. S. Krishnan, 2012; Marston et al., 2011; Widyastuti & Irwansyah, 2018), speed (Widyastuti & Irwansyah, 2018), Capabilities (Avram, 2014; Benlian & Hess, 2011), new projects (Suresh Malladi & Mayuram S Krishnan, 2012), and the role of technology (Chae et al., 2018), all which may contribute to improved firm performance (Benlian & Hess, 2011; Garrison et al., 2015).

Now we'll take a look at the results of each hypothesis in detail.

Figure 4: Hypothesis 1a–1c – SaaS Diffusion and Objective Data

H1a: The average profit ratios of firms that have deployed higher percentages of SaaS applications are higher than the average profit ratios of those firms that have deployed lower percentages of SaaS applications.	Supported	.005 – .061
H1b: The average cost ratios of firms that have deployed higher percentages of SaaS applications are lower than the average profit ratios of those firms that have deployed lower percentages of SaaS applications.	Not Supported	
H1c: The average productivity ratios of firms that have deployed higher percentages of SaaS applications are higher than the average profit ratios of those firms that have deployed lower percentages of SaaS applications.	Not Supported	

In the experiment to support H1 we looked at the quartiles of SaaS diffusion percentages in named firms combined with the appended Bloomberg financial ratio data (objective data) and a firm performance. This experiment provides an extension to the 20 years of academic work starting with Bharadwaj in 2000 (Bharadwaj, 2000) and ending with the 2018 Chae article (Chae et al., 2018) in addition to work from many other scholars listed in Appendix A. In our experiment we took a more granular look at the "off-the-shelf, cloud based, internet applications" described in Chae (Chae et al., 2014).

Our results show that in this particular case, the profit ratios, operating income/sales and net income/sales are positively associated with higher levels of SaaS diffusion. They were the only two metrics that were significant out of the eight ratios tested. This provides support for the idea that off-the-shelf SaaS applications support improved firm performance as Chae suggested (Chae et al., 2014). These results support the literature and my observations. When the ease-of-use features of SaaS, make experimentation easier and experimentation leads us to understand more about our customers we create better offerings and compete better in the market as our mediation results support. When companies become stronger competitors, profits improve.

These results, however, contradict much of the literature reviewed about the advantages of SaaS and reduced costs. These results which reject the idea of productivity gains and reduced costs are consistent with the latest McKinsey report which talks about SaaS contributing to revenue gains and transformation (Forest et al., 2021). Transformation is expensive and more work than inertia. Even simple change is difficult like moving to a new software package. People need to be trained to use new software. Training takes people away from their normal job which is a productivity loss. Training is expensive. Once the software is up and running and people become accustomed to the new way of doing things, productivity might improve. Transformation,

however, is many steps beyond simple change. Transformation means understanding our customers better, enhancing our products to meet changing needs which might require a totally different product. This type of transformation might mean lots of people doing something different from their normal job. It might mean money spent on a new product that might need more and maybe different salespeople. That kind of change is an expensive proposition. So, firms might not think that SaaS implementations save money and they might also think that new software means more work. That thinking would support the results we found.

Cost savings is the most popular advantage of implementing SaaS (see Table 23: Advantages of Cloud and SaaS in the Appendix). While higher profit margins was not mentioned anywhere in the literature, improved firm performance was mentioned (Amini, 2014; Loukis et al., 2019) (see Appendix A). H1 can add additional substantiation and granularity to those academic claims of improved firm performance (Benlian & Hess, 2011; Garrison et al., 2015).

We saw the biggest differences between those firms with the lowest diffusion of SaaS (0%25%) (Marston et al., 2011) and the highest diffusion of SaaS (76%–100%). While to the best of our knowledge, this is the first time objective data were used to look at SaaS diffusion, it is encouraging for firms that are looking to improve their bottom line with easier to implement software applications.

The results may mean that advanced software applications can be implemented by any firm and not just firms with large IT staffs and huge IT budgets. This gives smaller and medium businesses the ability to implement cutting edge software and develop capabilities to run their business better and more profitably (Garrison et al., 2015). The data also cautions against setting expectations around cost savings. This data around cost savings is consistent with some of my empirical observations. Customers don’t pay less money for a SaaS system than an on-premise

system. Depending on contracts and embedded software from Microsoft, for example, firms might pay more money to use Salesforce than they would to use Microsoft Dynamics. The savings originally mentioned in the literature was about using less hardware, data center space, and electricity (Marston et al., 2011) because customers that once allocated an entire stack of hardware and software in a data center in a building to a particular application, now share all that expense with other customers using cloud services like IaaS and PaaS. Today, savings depend on what the SaaS application is replacing. It might be an old system sitting in an Amazon IaaS cloud. In that case, all the traditional savings are already gone, and the new SaaS system might be more expensive than the old proprietary system. What customers gain with SaaS is capabilities and transformation not cost savings (Forest et al., 2021).

Figure 5: Hypothesis 2a–2b – The Role of Technology

H2a: The role of technology in the organization positively mediates the relationship between the percentage of the IT budget spent on SaaS and firm performance (revenue, costs, productivity).	Supported	.001
H2b: The role of technology in the organization positively mediates the relationship between the percentage of SaaS applications in the infrastructure and firm performance (revenue, costs, productivity).	NS	

The second experiment looks at the role of technology which comes from Chae's 2019 work. Chae looked at how technology was used in firms and whether that made a difference in objective results. They found that results were better where technology had a more substantial role in the business.

The three roles that Chae defined were automate (automating manual processes), informate (empowering individuals) and transform (fundamentally transforming the business) (Chae et al., 2018). In Chae's work the authors defined the role within the industry but, in our experiment, we

let the respondents articulate which of Chae's roles they felt described their firm. That difference is significant as it becomes subjective rather than Chae's more consistent definition.

We saw significant results with respect the role of technology mediating the relationship between the percentage of SaaS in the budget and firm performance, specifically revenue. The results for the Role of Technology mediating the relationship between SaaS in the Budget and productivity were negative (-.018, p-value .072). Perhaps firms that expect transformation from technology understand that there is more work, not less involved in getting those results. If we think about early results from technology, results that I would have labelled automation, those were productivity gains. We went from two people composing a letter, one dictating and one taking notes, during the typewriter phase to Microsoft Word. Once managers learned to use Windows, the manager did the typing and the secretary got other work done or there were less secretaries. That was a productivity gain. When the data company I worked for decided to use technology to transform the way they delivered data to customers, if took a large team of people, a lot of time and a bunch of money to build a system that customers could use themselves for data mining. There was a huge revenue gain for the company, but it was not a productivity gain. It took more work to transform.

These results tell us that perhaps firms can experience better profitability if they use technology in a more substantial (transformational) way. This may encourage businesses to look for ways to transform their business with an easier to implement SaaS tool; tools like Workday that can help businesses to run their accounting and financials with up-to-date functions and procedures, CRM tools like Salesforce.com that can help businesses manage customers with ubiquitous data and functionality.

Figure 6: Hypothesis 3a–3b – Innovation

H3a: Innovation positively mediates the relationship between the percentage of the IT budget spent on SaaS and firm performance (revenue, costs, productivity) (S. Malladi & M. S. Krishnan, 2012, p. 2).	RBV Supported	.003
H3b: Innovation positively mediates the relationship between the percentage of SaaS applications in the infrastructure and firm performance (revenue, costs, productivity) (S. Malladi & M. S. Krishnan, 2012)	RBV Supported	.002

The third hypothesis comes from Malladi and Krishnan who looked at innovation as a byproduct of SaaS implementations back in 2012 (S. Malladi & M. S. Krishnan, 2012). As a practitioner, innovation with SaaS was an area I found to be true and valuable to clients. This was the case with the Midwest Manufacturer and the Marketing Manager. Their quick experiment to uncover the invading competitor led to a better understanding of their business and a curtailing of revenue losses.

Our results supported the 2012 findings from Malladi and Krishnan that SaaS can support IT enabled innovation. Because SaaS requires no infrastructure and potentially no capital outlay of funds, it can be implemented by small teams for experimentation. For a modest amount of money, small groups can access a cloud-based SaaS tool and try out the application to see if SaaS can solve a specific problem or not.

In addition, as our case study from the Midwest Manufacturer attests, existing implementations can be used for functions not originally targeted, to provide a platform for experimentation and potential solutions. Our marketing manager was able to identify a competitive action against the firm in less than a month by a modest extension of the existing system.

Our results showed that SaaS had a significant positive relationship to helping firms innovate and further that innovation mediated a positive relationship between levels of SaaS diffusion and improved revenues. These results can encourage firms to use SaaS in specific areas of their firm, like accounting or procurement for specific functions but at the same time, they might

want to be open to what else the application might be able to do for them. Firms should be openminded to trying out new functions and installing new updates to see if they can make a positive impact on their business.

Improved productivity was not supported in the H4 experiment. Innovation and experimentation take extra time and resources, and so productivity may be negatively affected during the innovation stage.

Figure 7: H4a–H4b – Agility

H4a: Agility positively mediates the relationship between the percentage of the IT budget spent on SaaS and firm performance (revenue, costs, productivity).	RBV Supported	.003 – .004
H4b: Agility positively mediates the relationship between the percentage of SaaS applications in the infrastructure and firm performance (revenue, costs, productivity).	RBV Supported	.000 – .001

Agility was one of my primary interests when I started this academic journey. In these ever-changing times, the ability to react faster and more effectively to changes in the marketplace is critical for firm survival. There is much written on agility and SaaS to support the premise that SaaS might be associated with firm agility (Alrokayan, 2017; Kyriakou & Loukis, 2017; Oliveira et al., 2014). The survey question we asked was whether SaaS had any impact on the speed of decision making and speed in reacting to changes in the marketplace. Those two elements were combined into the Agility measure with a Cronbach's Alpha score of .876.

Our results showed that Agility positively mediated the relationship between SaaS diffusion percentages in the budget and firm performance with p-values less than .01. We also saw significant relationships between the percentage of SaaS applications diffused in the IT infrastructure and firm Agility with p-values at or less than .001.

As mentioned previously, SaaS can be implemented very quickly, especially for smaller firms that might not have any preconceived notions about specific configurations for the

application, meaning that they would be using the application "right out of the box" and so the functionality is available quicker (Amini, 2014; Avram, 2014) and continuous updates (Seethamraju, 2015) can be implemented more seamlessly.

This result can give firms confidence that with the adoption of SaaS firm agility can improve (Alrokayan, 2017; Kyriakou & Loukis, 2017) positively impacting firm performance. These results also support RBV theory where SaaS mediates the development of key resources in the firm.

Figure 8: H5a–H5b – New Projects

H5a: New projects with SaaS positively mediates the relationship between the percentage of the IT budget spent on SaaS and firm performance (revenue, costs, productivity) (S. Malladi & M. S. Krishnan, 2012, p. 2)	RBV Supported	.004 – .011
H5b: New projects with SaaS positively mediates the relationship between the percentage of SaaS applications in the infrastructure and firm performance (revenue, costs, productivity) (S. Malladi & M. S. Krishnan, 2012, p. 2)	RBV Supported	.004 – .010

Hypothesis 5a and 5b extend the Malladi and Krishnan 2012 research looking at SaaS and IT enabled innovation, where new projects are a starting point for firm innovation (S. Malladi & M. S. Krishnan, 2012).

Our results showed a strong relationship between SaaS diffusion in the firm and the ability to launch new projects. We also saw a strong relationship between new projects and improved revenue indicating that SaaS mediated a positive relationship between new projects and improved revenue and improved productivity. Reduced costs was not supported. Again, this contradicts much literature on cost savings and SaaS (Buyya et al., 2018; Garrison et al., 2015).

There are a couple of potential things to consider with regard to costs and SaaS. First, much of the literature talks about the advantage of "pay as you go" as a cost advantage. This flexible spending is an advantage if a new project or experiment fails, and the customer wants to terminate the relationship. Money hasn't been invested in hardware and software, because it is possible to

just download the app. That would be a cost advantage. If the project is a success, then pay as you go is no longer relevant. In my experience, customers signed contracts with the SaaS vendors. They could not get out of the relationship for several years, and the SaaS software at an enterprise level was not necessarily less expensive than any other enterprise software. In fact, the Midwest Manufacturer in the case study paid more money for the Salesfoce.com license than they would have paid for the Microsoft software with similar functionality. Microsoft had bundled the CRM functionality into the enterprise contract so there was no additional cost to the Midwest Manufacturer to use the additional components. So, in their case while they were able to protect their revenue stream, there were additional costs involved.

Further, it may also be that the initial cost savings associated with massive IT infrastructures migrating to the cloud, may have already been exhausted. Many firms have migrated to the cloud in some way, even if it is just moving existing on-premise capacity to an IaaS vendor like AWS. So perhaps the cost savings is less prominent.

Lastly, regarding costs and new projects, there is a cost associated with trying something new. People in the firm must be shifted in order to support a new project or new people have to be brought in to help. New Projects are an investment in the future, and that investment is not free; there is a cost. There is hope that the new project produces a new product or service that brings with it a new revenue stream, but that is not always the case. I recently heard about a case study from HBS about Domino's Pizza and their new project strategy. Apparently, they plan for sixty percent of their new projects to be successful. That sixty percent success rate pays for the forty percent of the projects that fail (Groysberg, Abbott, & Seligson, 2021). There is a cost to experimentation.

New projects are the starting point for new Capabilities within firms that are facilitated by SaaS (Avram, 2014; Benlian & Hess, 2011). We saw this in both case studies that are part of this dissertation. SaaS provided a ready to use platform that facilitated experimentation which enabled a new project that resulted in an innovation or capability for the firm. This ready to use platform eliminated the need for the users to build a business case to justify the procurement and development of hardware and software to try out a new idea. Once a new project is tested out on a SaaS platform, it is easier to show value in the new capability. Users could show a working Saas system and live functionality rather than trying to justify an idea on paper. This building of firm capabilities brings us to our next hypothesis.

Figure 9: H6 – Capabilities and Previous Experience

H6: Capabilities positively mediates the relationship between the number of years SaaS has been deployed and firm performance (revenue, costs, productivity).	RBV Supported	.026 – .037

Capabilities was a combined mediator in this study. We began in the survey by asking several questions that extended academic studies around several areas. We asked whether SaaS facilitated the development of new insights (Widyastuti & Irwansyah, 2018). We examined whether SaaS allowed firms to focus on core competencies (Benlian & Hess, 2011), develop specific processes to support the business (S. Malladi & M. S. Krishnan, 2012), develop organizational learning (Benlian & Hess, 2011; Tippins & Sohi, 2003) to improve the business, whether firms were able to enhance capabilities (Benlian & Hess, 2011) using SaaS and lastly, whether SaaS helped firms use IT more effectively (Chae et al., 2014; Garrison et al., 2015).

All of these “enhanced capabilities” within the firm were combined into a mediator called Capabilities with a Cronbach’s Alpha of .837. Capabilities are the end-product of new projects and

innovations within the firm. They allow firms to improve their offerings to the marketplace thus improving their competitive position.

Our Capabilities variable showed strong regression estimates with respect to improved revenue, reduced costs and improved productivity with p-values less than .001. This hypothesis also incorporates the concept of previous experience which extends Malladi and Krishnan's 2012 work (S. Malladi & M. S. Krishnan, 2012). Malladi and Krishnan had to use experience with an Application Service Provider (ASP) which was a precursor to SaaS, since Saas was not as widespread in 2012. In our study we asked how many years the respondent had been using SaaS. The research found that Years of SaaS Use or previous experience provided full mediation between Capabilities and Improved Revenue (p-value .031), Reduced Costs (p-value .037), and Improved Productivity (p-value .026). We also saw that Capabilities mediated a strong relationship between higher levels of SaaS diffusion and improved firm performance (Improved Revenue (p-value .001), Reduced Costs (p-value .001), and Improved Productivity (p-value .001)).

These results provide strong support for pursuing the addition of SaaS into the firm's infrastructure to build out more and better firm capabilities that improve offerings into the marketplace. We also see that as firms have more experience with SaaS, they get better at building firm capabilities. We saw this at the Midwest Manufacturer as well. As their SaaS administrator solved more and more problems quickly and at no cost to the departments, word spread and she became the first stop for any issues relating to the sales and marketing organization, or any desire to communicate or impact their customers. She earned many awards for her work.

We also saw in this particular experiment that our study supports the existing literature on SaaS and Reduced Costs (Garrison et al., 2015). Capabilities can improve an inefficient process within the firm thus providing cost savings. In addition, because SaaS has a pay as you go

subscription model, it allows users to turn it off if their project is unsuccessful. A much better model than building out hardware and software within the firm that can be costly and potentially wasted if the project does not yield positive results.

Figure 10: H7 – Agility and Previous Experience

H7: Agility positively mediates the relationship between the number of years SaaS has been deployed and firm performance(revenue, costs, productivity).	RBV Supported	.015 – .060

In H7 we examine the impact of previous experience from Malladi and Krishnan, mentioned in the Capabilities section (S. Malladi & M. S. Krishnan, 2012) on firm agility. The questions to support these results looked at whether businesses were able to make decisions faster (Benlian & Hess, 2011), whether businesses could react faster to market pressures (Garrison et al., 2015) and how many years the firm had been using SaaS (S. Malladi & M. S. Krishnan, 2012).

Our study showed that Agility fully mediated the relationship between Years of SaaS Use and Firm Performance. The strongest p-value was associated with increased revenue (p-value .015) followed by reduced costs (p-value .047) and finally improved productivity (p-value .060). Again, we saw these results in the case study. As the success of SaaS's speed and effectiveness spread through the Midwest Manufacturer, the SaaS admin was tasked with more work. Her experience with the SaaS tool as well as her knowledge of the business resulted in very quick solutions for the company. The SaaS admin was a marketing employee, she was not from IT. She understood the business as her degree and experience were in finance (the business of the manufacturer in this department).

The fact that businesspeople are often the admins of the SaaS system is a big advantage of SaaS. There is very little, if any, "translation" of requirements needed as the admins are often business analysts. They understand how the business is measured and how to solve problems. In this manufacturer, when IT is called in to build a custom application, there is often a go-between

interpreter that comes to the meetings to understand the business needs and provide translations to the programmers that will be writing the code to build the custom application. Because the businesspeople do not understand how to write application code and the programmers are not businesspeople and have little or no experience outside of IT, there are often misunderstandings of the requirements which lead to delays and costly rewrites of the code.

The SaaS admins in business units understand the SaaS tool as the tool is usually specific to the department (Workday is for finance and accounting, Salesforce CRM is for marketing and sales, Procurify is for procurement, Concur is for expense reporting, Piano is for digital marketing, etc.). Also, as mentioned earlier, there is no customization to a SaaS application, only configuring of screens and fields, etc., so the tool is usable within business departments without the need for IT.

This independence from IT simplifies implementation and support of the SaaS tool. The businesspeople understand what the tool is used for and appreciate the features and functions as they are specific to the department. When new upgrades are released, they are often in support of a change that is well understood by the businesspeople that support the SaaS system. For example, if Workday were to upgrade their system to support a new accounting requirement, the accountant/analyst that supports Workday would likely understand and appreciate the need for the change and be able to implement it and justify why it was needed to the other accountants and finance people in the department. In contrast, when a traditional on-premise application is upgraded, the new features must be "understood" first by the IT department (whose people may or may not understands the specifics of the new feature), where the upgrade would be initiated, passed on to the accounting department, approved for implementation, applied to the system (which might

be a costly and lengthy process if the on-premise application was customized), and then rolled out to the new users.

In the SaaS model, upgrades are more easily understood and applied as the businesspeople might oversee the upgrades directly. The SaaS system is not customized so upgrades are more seamless. (It should be noted here that customers of SaaS systems can build out "interfaces" to the system that highly customize what the users see. These interfaces do not touch the system code but might hide things that the users might find confusing or irrelevant to their business. When these interfaces are in place, upgrading functions sometimes require the interfaces to be altered so that the new upgrade can be enabled and visible to the users. These changes to the interfaces are nothing like the customization to on-premise application code but can add complexity and time to upgrades.)

This experiment helps us to understand that as we use the SaaS system, we gain new insights about our business and the SaaS system (Widyastuti & Irwansyah, 2018) which can contribute to faster decision making (Benlian & Hess, 2011) and faster reactions to market pressures (Garrison et al., 2015) that can improve firm performance. These results should hasten firms to implement SaaS to build these valuable skills that could improve firm agility.

Figure 11: H8 – Capabilities and Core Competencies

H8: Capabilities positively moderates the relationship between the area where SaaS has been deployed and firm performance (revenue, costs, productivity).	RBV Supported	$p < .05$

In H8 we examined whether Capabilities mediated the relationship between SaaS deployed in core vs non-core areas of the firm and overall firm performance. We asked respondents whether they had deployed SaaS in core areas of the business, non-core areas of the business or both. There is much literature to support the concept of off-loading IT staffs from non-core work so that they

can focus on applications that support the core of the business (Benlian & Hess, 2011; Garrison et al., 2015; Gupta et al., 2013).

Many of the applications that we have discussed in this paper are non-core business applications for most businesses. CRM, for example, supports managing customers and in general supports the marketing and sales departments. The marketing and sales departments are selling the products that the firm produces (their core competency) and so CRM is a support tool or a noncore application. Workday supports the finance and accounting department where revenues and expenses from the sales of the company's product (their core competency) are processed, thus Workday is a non-core application.

Since non-core applications generally do not differentiate a company from its competitors and do not provide a difficult to imitate capability (Bharadwaj, 2000), they can be off-loaded to a SaaS application that is homogenous to each customer but which provides access to cutting edge software (Garrison et al., 2015; Gupta et al., 2013) and competitiveness (Mitra et al., 2018; Widyastuti & Irwansyah, 2018) while off-loading the central IT organization to focus on more strategic applications (Benlian & Hess, 2011; Seethamraju, 2015) that support the core competency of the organization (Garrison et al., 2015; Gupta et al., 2013).

To test the difference between SaaS deployed in core and non-core areas we used a multigroup model in AMOS. Our results showed that there were significant differences between the non-core and core areas of the business where SaaS was deployed. The strongest z-scores were for Capabilities to Revenue (z-score 2.303** p-value less than .05). We saw a negative relationship between Capabilities and Productivity (z-score -2.803*** p-value <.01).

Interestingly, however, the results pivoted between non-core and core. In the case of Capabilities to Improved Revenue, the Core estimate (.452 p-value .000) was stronger than the

Non-core estimate (.153 p-value .096). With Capabilities to Improved Productivity, the Non-Core estimate (.508 p-value .000) was stronger than the Core estimate (.119 p-value .154). So, while we have support for a difference between the diffusion of SaaS in non-core and core areas of the business, we do not have consistency of the categories in the results.

This tells us that perhaps we can expect good results whether we deploy SaaS in non-core or core areas of the business. This potential raises serious questions around the Resource Based View of the firm which supports the idea that resources are unique and difficult to imitate (Bharadwaj, 2000; Tippins & Sohi, 2003). If firms are seeing improvements in capabilities that support increased revenue and increased productivity by implementing a homogenous SaaS application in core or non-core areas, then we need to investigate more thoroughly whether "unique and difficult to imitate" (Bharadwaj, 2000; Tippins & Sohi, 2003) are really prerequisites to improved firm performance. It may simply be that IT is not a core competency and instead the capability that IT enables is the core competency of the firm. We need future work here.

Figure 12: H9 – Agility in Core Competencies

H9: Agility positively moderates the relationship between the area where SaaS has been deployed and firm performance (revenue, costs, productivity).	RBV NS

Like the results in H8, in H9 we looked at where SaaS was deployed in either core or noncore areas of the firm and whether there was a difference in Agility mediation and Firm Performance.

Again, in order to test the difference in Agility between SaaS deployed in Non-core areas of the business and SaaS deployed in Core areas of the business, we used a multigroup model in AMOS. The results showed a negative significant relationship between Agility and where Saas was deployed in Non-core (.193 p-value .000) and Core (.056 p-value .244) areas with a z-score

of -1.907* (p-value <.10). There was not a positive relationship moderated by where SaaS is deployed in the organization therefore H9 is not supported.

In our path analytic model, we show consistent and significant results for Agility mediating the relationship between SaaS diffusion percentages and Firm Performance. We also saw strong regression results between SaaS diffusion and respondents' perception of improved Agility within the firm. But when we ask whether it made a difference if you use SaaS in Non-Core or Core areas we saw less significance. As with the results in H8, this requires more investigation into the impact of IT as a unique and difficult to imitate resource (Bharadwaj, 2000) in the Resource Based View of the firm.

It is important to note here that these survey results regarding SaaS were surprising. There were many firms that reported that they were using SaaS in core areas of the business which is not found anywhere in the literature. The idea that a business would use a tool that is easily accessible by their competition to support a core area of the business might seem risky to a staunch RBV theorist. Perhaps a reason for this behavior is that these businesses that are using SaaS in core areas, do not have access to IT developers that can build a better custom application to support their core business. Perhaps these businesses feel that the SaaS application is better than the alternative, and so they take the risk of being copied. Perhaps the threat of being copied is no longer a concern.

We can walk into Walmart and observe their supplier base and their merchandising strategy; there are no secrets there. The competitive advantage is different than just where they put the hairbrushes. Many years ago, I was working with one of Walmart's competitors. I needed a reason to talk to their CIO. So, I went shopping. I just took my regular shopping list and went to Walmart's competitor, then Walmart and then Target. I spent the most money at Walmart. The

competitor was constantly out of things on my list. I chose one of the missing items and I called their mutual supplier, Conair, about the Walmart merchandising strategy. She told me about a proprietary system that Walmart had built to track the sales of the suppliers' merchandise. They had two years of rolling history of sales that were provided to the suppliers through a terminal into the main system. This system would not have been difficult to copy. The real difference, however, was the responsibility that Walmart gave to the suppliers. Using the data, the suppliers were responsible for having the correct number of hairdryers in the correct distribution centers all year long. The Conair rep told me that the competitor, which used a traditional purchasing approach, requiring a purchase order before anything could be shipped, ran out of hairdryers every September when the kids went back to school. The purchasing guy would call her and ask her to rush out stock to various distribution centers which she was unable to do as the stock was already claimed and it would take months to rebuild the inventory. On the Walmart side, she had the data from the "Retail-link system", the responsibility to make sure that all the stock was at the appropriate levels, and the trusted relationship to just ship the hairdryers and send the bill to Walmart. The real competitive advantage was the relationship with the suppliers not the computer. The relationship was enabled by the system and associated data, but the computer system was not the competitive advantage.

Many companies outsource their services. When a person clicks on an online form and is taken to another website, the secret is out. Many companies participate in reference work for the vendors that support them. When I supported Dow Corning back in the early 2000s, I was working for Sun Microsystems. Dow Corning set up an Executive Briefing Center and hosted prospects that were considering SAP on Sun equipment. After two years of hosting, the data center director who was the main host calculated that they had helped close $300 million dollars in business. No

secrets there. You can watch videos on Salesforce.com's YouTube channel from companies like Phillips, Coke, Rossignol, Burberry and many others, who not only tell you that they are using Salesforce.com but they will tell you what they are doing with it. Perhaps a "difficult to duplicate" software application isn't a necessity anymore because companies have discovered that the software systems are embedded in organizations with cultural practices which use the system and associated data to develop capabilities and speed to market that provide the value to the company, just like Walmart did.

Many publishing businesses that assumed that "barriers to entry" like printing presses and armies of reporters would protect them from competition were surprised when the new entrants captured cell phone images from "citizen reporters" and "published" stories online. Suddenly, the infrastructure was just an expense rather than an asset.

We did not explore the details behind the survey answers; that will be something best done in a qualitative manner. The fact that we saw little difference between non-core and core requires future investigation and exploration of other factors like culture or social interaction patterns that underlie systems like SaaS (Rodrigues et al., 2021). This study contributes more granularity to over thirty years of studies spanning from 1991 – 2021 and covers a transformation of technology from bespoke to mass customization and its impact on firm performance. This work started with Bharadwaj and the 1990s data through seminal works from Benlian and Hess and Marston in 2011 (Benlian & Hess, 2011; Marston et al., 2011), Seethamaraju and Garrison in 2015 (Garrison et al., 2015; Seethamraju, 2015) and through the last Chae article in 2018 (Bharadwaj, 2000; Chae et al., 2018; Chae et al., 2014; Choi & George, 2016; Santhanam & Hartono, 2003) and beyond to the latest articles from Forest and Rodrigues (Forest et al., 2021). These studies ignited the idea that bespoke coding was not necessarily an advantage once sophisticated, homogenous, off-the-shelf

applications and cloud computing came into vogue. The studies did not, however, give us specific types of applications, nor what specific capabilities or advantages we could expect (with the exception of the 2021 Rodrigues article mentioned earlier). The Bharadwaj and Chae articles, using a resource-based view of the firm, over a period of several years, looked at the difference between the top 40-50 IT leader firms from the InfoWeek 500 compared to a control group made up of similar firms that were not on the top of the list but no details on the applications or technology being used.

During the Bharadwaj era, these IT leaders possessed programming capabilities that allowed the firm to do bespoke development that gave them performance advantages, as defined by several financial ratios. Over the next 18 years several authors studied similar firms looking at the Infoweek 500 leaders and corresponding control groups with more updated data and saw conflicting results. The explanation for the conflicting results focused on the Productivity Paradox (large firms spending more money on IT resources but not getting more value) and the availability of off-the-shelf solutions that potentially gave the control group capabilities that exceeded those of the IT leaders. In the Chae studies the financial ratios no longer demonstrated a significant difference between the IT leaders and the control groups. The control group had used “advanced technology” that was readily available to them, to close the performance gap (Bharadwaj, 2000; Chae et al., 2018).

The gap with the studies was that “advanced technology” was broadly defined as; cloud computing, the internet, ERP and other similar descriptions with no particular solution, leaving business owners and CIOs guessing which way to go. Their choices of bespoke development, homogenous, on-premise applications like ERP, Infrastructure as a Service, Platform as a Service and configurable SaaS needed to be narrowed down a bit. This study gives a name to a type of

application, SaaS, and its relationship to firm performance through the mediation of; Capabilities, Agility, Innovation, New Projects, the Role of Technology, and where SaaS was deployed (core and non-core use). The overwhelming response of 554 survey participants gives practitioners a good place to start in helping firms get the most from their IT budget.

CHAPTER 7: LIMITATIONS, DIRECTIONS FOR FUTURE RESEARCH & IMPLICATIONS FOR PRACTICE LIMITATIONS AND FUTURE RESEARCH

This study has several limitations which could serve as avenues for further research. First, the data were collected exclusively from three groups—one secured by Crain Communications and another from a data vendor, Dynata and one using LinkedIn. A broader data collection would thus offer more generalizable findings. In addition, the research design was cross-sectional. Hence, we refrain from making causal inferences based on this study. To overcome this limitation, future research should employ a longitudinal design. Second, in part, we relied on self-reported measures to build our path analytic model. Future research could broaden the conceptualization of SaaS diffusion as well as obtain more objective measures of performance instead of self-reported data. Third, our objective data were difficult to gather and therefore limited in quantity because of the sensitivity of providing firm financial data. It is important to continue to build objective data so that firms can understand more about where improvements can be expected and therefore targeted.

One interesting element of the study was the lack of consistent substantiation around SaaS and cost savings. Cost saving has been hailed as an advantage of SaaS in much academic literature (see SaaS advantages Appendix A) but we were not able to find a consistent link. This is an important clarification as executives looking for cost savings rather than enhanced capabilities might be disappointed and abandon SaaS. The most recent article from McKinsey talks about the fact that SaaS's biggest advantages are on the revenue and new opportunities side rather than cost savings (Forest et al., 2021). We did see Capabilities and Agility mediate a positive relationship between SaaS and costs, but we did not see a cost advantage in new projects, innovation or the role of technology. As mentioned in the discussion section, new projects and innovation can be expensive, so costs could be negative until the experiments produce a revenue stream for the organization. Companies need to be realistic about the expectations for new technology.

Understanding the costs of SaaS and how that compares to other technology options could be helpful for firms making a decision to move to SaaS.

An additional limitation of this research is the potential for social desirability bias. Individuals may have been overly optimistic in their self-report of organizational performance. We attempted to alleviate this by guaranteeing the anonymity of the survey respondents.

Researchers may also want to investigate the surprising findings around the positive relationship between experience with SaaS deployed in Core areas of the business improved capabilities and improved revenue. This opens a new area of research around whether core competencies can be fulfilled with homogenous software like SaaS or whether they need to be developed in house to be unique and difficult to imitate.

It might also be appropriate to conduct further research at a qualitative level to ensure that we have the reasons behind the quantitative answers. What does productivity mean to an organization and how do they measure it? What is an example of a new project? What are their expectations of innovation and new projects? How do they go about experimenting and what is the role of SaaS in the experiment? All these answers can help us to understand the value of SaaS in the enterprise and can help others shape their expectations appropriately.

Lastly, investigation into the RBV would be valuable. It is important to understand more about which resources of the firm need to be unique and difficult to imitate. In many cases, it may not be IT. This potential finding could comfort firms implementing SaaS, encouraging them to develop capabilities that could be unique to the firm rather than worry about custom coding.

Implications for Practice

From the practitioner's perspective, this study helps to articulate that SaaS can save time and improve productivity and revenue by improving the capabilities and agility of firms. These organizations might be able to stop in house development of non-core functions and use SaaS instead. Thus, freeing up in-house IT resources to do more strategic work to improve on core capabilities and subsequent firm performance (Benlian & Hess, 2011; Garrison et al., 2015). Consulting firms could help companies move aggressively toward SaaS, alleviating the burden of maintaining non-core systems like email, Human Resources, Accounting, Customer Relationship Management and others, and move those resources to more productive core work to develop difficult to duplicate capabilities that give the firm a sustainable, competitive advantage.

CHAPTER 8: CONCLUSION

In conclusion, this research has opened a new dimension to our understanding of SaaS and its impact on firm performance. This research, to the best of our knowledge, is the first time SaaS has been examined using objective firm performance and has been linked to several specific capabilities within firms. The understanding of how SaaS contributes to firm performance through specific capabilities gives more depth to how organizations can improve their financial performance through their use of cutting edge, easier to implement, cloud-based SaaS. This study examined how diffusion of SaaS can impact objective firm performance giving organizations hope that higher levels of SaaS proliferation can positively impact operating income.

We also saw the specific capabilities in a firm that can be developed which can subsequently improve revenues and productivity in firms. Lastly, we investigated how Capabilities mediated the positive relationship between deployment of SaaS in non-core and core areas, and improved firm performance. Findings were positive.

This study demonstrated that Agility and Capabilities fully mediated the positive relationship between experience with SaaS (Years of SaaS Use) and Revenue, Costs and Productivity. We also saw that the Role of Technology, Innovation and New Projects partially mediated the positive relationship between SaaS Percentage in the Budget and Revenue and Productivity, Agility partially mediated the positive relationship between SaaS Percentage in the Budget and Revenue, Costs and Productivity. Further, we saw that Innovation partially mediated the positive relationship between SaaS Percentage in the Infrastructure and Revenue and Productivity while Agility and New Projects partially mediated the positive relationship between

SaaS Diffusion and Firm Performance

The significance of the positive relationships between the mediators in this study and firm performance further demonstrate that SaaS is a strong, embedded, and complementary resource in

the organization thus supporting RBV. For theorists of resource-based theory, this study contributes to a better understanding of how SaaS and a multi-tenant architecture, although not unique in and of themselves, can assist in providing firms with unique and difficult to imitate offerings through organizational Capabilities, Agility and Innovation to improve financial performance.

We also saw that where SaaS was deployed mattered as well. Where SaaS was deployed to core areas of the business, we saw stronger significant relationships between Capabilities and Revenue contradicting our RBV theory around unique assets.

The hope is that this study encourages other firms to examine the potentially game changing results SaaS brought to a Midwest manufacturer. The road to transformation will not be an easy one and changing the culture of IT organizations that are “Shackled to the Status Quo” (Polites & Karahanna, 2012) will be challenging. If firms can capture the capabilities and agility presented in this study, however, it will make the effort entirely worthwhile. This can be especially true during these unprecedented times when work from home is a necessity and IT staffs are essential in providing ubiquitous business tools, SaaS can help to pave the way to new levels of productivity and firm performance.

APPENDIX A: ADVANTAGES OF SAAS AND CLOUD

Advantage	Author
Improved Productivity	(Fakieh et al., 2016; Widyastuti & Irwansyah, 2018)
Access to Best Practices	(Benlian & Hess, 2011; Garrison et al., 2015; Gupta et al., 2013; Haag & Eckhardt, 2014b; Kaltenecker et al., 2015; Seethamraju, 2015)
Access to cutting edge software	(Abdel-Basset et al., 2018; Amini, 2014; Benlian & Hess, 2011; Bieber et al., 2015; Garrison et al., 2015; Gupta et al., 2013; Haag & Eckhardt, 2014a; Kaltenecker et al., 2015; Kiblawi & Khalifeh, 2015; Kyriakou & Loukis, 2017; Rodrigues et al., 2014; Seethamraju, 2015)
Access Ubiquity/Mobility	(Abdollahzadegan et al., 2013; Amini, 2014; Asatiani, 2015; Bieber et al., 2015; Buyya et al., 2018; Buyya et al., 2008; Buyya et al., 2009; Chihande & van der Poll, 2017; Fakieh et al., 2016; Gupta et al., 2013; Haag & Eckhardt, 2014b; Kaltencker et al., 2013; W. Kim, 2009; Midha et al., 2017; Oliveira et al., 2014; Rodrigues et al., 2014; Stadtmueller, 2013; Yeboah-Boateng & Essandoh, 2014)
Agility	(Abdollahzadegan et al., 2013; Alrokayan, 2017; Bardsiri & Hashemi, 2014; Fakieh et al., 2016; Kyriakou & Loukis, 2017; Liu et al., 2018; Mitra et al., 2018; Oliveira et al., 2014; Salleh et al., 2018; Schniederjans & Hales, 2016; Yeboah-Boateng & Essandoh, 2014; Zhang et al., 2017a)
Business Continuity/Reliability	(Bardsiri & Hashemi, 2014; Chihande & van der Poll, 2017; Goscinski & Church, 2015; Gupta et al., 2013; Haag & Eckhardt, 2014b; Midha et al., 2017; Misra & Mondal, 2011; Salleh et al., 2018; Widyastuti & Irwansyah, 2018; Z. Yang et al., 2015; Yeboah-Boateng & Essandoh, 2014)
Business Efficiency	(Alrokayan, 2017; Liu et al., 2018; Mitra et al., 2018; Oliveira et al., 2014; Widyastuti & Irwansyah, 2018)
Collaboration	(Abdel-Basset et al., 2018; Chihande & van der Poll, 2017; Gupta et al., 2013; Haag & Eckhardt, 2014b; Liu et al., 2018; Loukis et al., 2019; Schniederjans & Hales, 2016; Widyastuti & Irwansyah, 2018)
Competitiveness	(Carr, 2005; Chihande & van der Poll, 2017; Liu et al., 2018; Martins et al., 2016; Mitra et al., 2018; Widyastuti & Irwansyah, 2018)
Continuous and Automatic Upgrades	(Chihande & van der Poll, 2017; Midha et al., 2017; Seethamraju, 2015; Stadtmueller, 2013; Stuckenberg & Beiermeister, 2012)
Cost Advantages – Pay as you go	(Abdel-Basset et al., 2018; Abdollahzadegan et al., 2013; Alharbi, Atkins, Stanier, & Al-Buti, 2016; Alrokayan, 2017; Amini, 2014; Asatiani, 2015; Avram, 2014; Bardsiri & Hashemi, 2014; Benlian & Hess, 2011; Bieber et al., 2015; Butler, 2016; Buyya et al., 2018; Buyya et al., 2009; Chihande & van der Poll, 2017; Cho & Chan, 2015; Dubey & Wagle, 2007; El Alami et al., 2015; Fakieh et al., 2016; Fox et al., 2009; Garrison et al., 2015; Goscinski & Church, 2015; Gupta et al., 2013; Haag &

Advantage	Author
	Eckhardt, 2014a; "IaaS Popularity Surges in 2018"; Jula et al., 2014; Kaltencker et al., 2013; K. Kim & Altmann, 2013; W. Kim, 2009; Knowledge@Wharton, 2009; Kyriakou & Loukis, 2017; Liu et al., 2018; Loukis et al., 2019; Low et al., 2011; S. Malladi & M. S. Krishnan, 2012; Marston et al., 2011; Martins et al., 2016; Midha et al., 2017; Mitra et al., 2018; Oliveira et al., 2014; Rodrigues et al., 2014; Schniederjans & Hales, 2016; Seethamraju, 2015; Stadtmueller, 2013; Waggener & Wheeler, 2009; W.-W. Wu et al., 2011; Xin & Levina, 2008; H. Yang & Tate, 2012; Z. Yang et al., 2015; Yeboah-Boateng & Essandoh, 2014; Zainuddin, 2012; Zhang et al., 2017a)
Enterprise Communication Alignment/Single Source of Truth/Better Decision Making	(Alrokayan, 2017; Fox et al., 2009; Mitra et al., 2018; Zhang et al., 2017a)
Flexibility	(Avram, 2014; Benlian & Hess, 2011; Dubey & Wagle, 2007; Haag, 2015; Kiblawi & Khalifeh, 2015; W. Kim, 2009; Waggener & Wheeler, 2009)
Improved IT performance	(Benlian & Hess, 2011; Chihande & van der Poll, 2017; El Alami et al., 2015; Garrison et al., 2015; Knowledge@Wharton, 2009; Seethamraju, 2015; W.-W. Wu et al., 2011; Z. Yang et al., 2015; Zhang et al., 2017a)
Internal Focus on Core Competencies	(Benlian & Hess, 2011; J. Wu et al., 2015) (Amini, 2014; Asatiani, 2015; Carr, 2005; Garrison et al., 2015; Gupta et al., 2013; Haag & Eckhardt, 2014b; Kiblawi & Khalifeh, 2015; Knowledge@Wharton, 2009; Misra & Mondal, 2011; Mitra et al., 2018; Seethamraju, 2015; Widyastuti & Irwansyah, 2018; W.-W. Wu et al., 2011; Yeboah-Boateng & Essandoh, 2014)
Internal Resources doing more strategic work	(Alharbi et al., 2016; Amini, 2014; Benlian & Hess, 2011; Chihande & van der Poll, 2017; El Alami et al., 2015; Garrison et al., 2015; Gupta et al., 2013; Haag & Eckhardt, 2014b; Low et al., 2011; Mitra et al., 2018; Seethamraju, 2015; Widyastuti & Irwansyah, 2018; W.-W. Wu et al., 2011)
SaaS and Green Computing	(Bieber et al., 2015; Buyya et al., 2018; Haag & Eckhardt, 2014b; Marston et al., 2011; Misra & Mondal, 2011; Mitra et al., 2018; Schniederjans & Hales, 2016; Widyastuti & Irwansyah, 2018; Yeboah-Boateng & Essandoh, 2014)
Short/Ease of Implementation	(Amini, 2014; Avram, 2014; Cho & Chan, 2015; Goscinski & Church, 2015; Haag & Eckhardt, 2014b; W. Kim, 2009; Low et al., 2011; Stadtmueller, 2013; Winkler & Brown, 2013; W.-W. Wu et al., 2011)

Advantage	Author
Access to Computing Resources	(Abdel-Basset et al., 2018; Amini, 2014; Avram, 2014; Benlian & Hess, 2011; Fox et al., 2009; Garrison et al., 2015; Goscinski & Church, 2015; Gupta et al., 2013; Haag, 2015; Haag & Eckhardt, 2014b; Jayatilaka et al., 2003; Kaltenecker et al., 2015; W. Kim, 2009; S. Malladi & M. S. Krishnan, 2012; Marston et al., 2011; Rodrigues et al., 2014; Seethamraju, 2015; Stadtmueller, 2013; Waggener & Wheeler, 2009; Widyastuti & Irwansyah, 2018; J. Wu et al., 2015; Yeboah-Boateng & Essandoh, 2014; Zainuddin, 2012)
Innovation through new capabilities	(Abdollahzadegan et al., 2013; Avram, 2014; Benlian & Hess, 2011; Dubey & Wagle, 2007; Haag, 2015; Haag & Eckhardt, 2014b; Jayatilaka et al., 2003; Kaltenecker et al., 2015; K. Kim & Altmann, 2013; S. Malladi & M. S. Krishnan, 2012; Marston et al., 2011; Rodrigues et al., 2014; Stuckenberg & Beiermeister, 2012; Waggener & Wheeler, 2009)
Lowering barriers to innovation	(Alrokayan, 2017; Amini, 2014; Asatiani, 2015; Fakieh et al., 2016; Fox et al., 2009; Gupta et al., 2013; Loukis et al., 2019; Mitra et al., 2018; Rodrigues et al., 2014; Widyastuti & Irwansyah, 2018; J. Wu et al., 2015; Yeboah-Boateng & Essandoh, 2014)
Quality	(Bardsiri & Hashemi, 2014; Benlian & Hess, 2011; Bieber et al., 2015; Buyya et al., 2009; Dubey & Wagle, 2007; Fox et al., 2009; Haag, 2015; Haag & Eckhardt, 2014b; Kaltenecker et al., 2015; Kyriakou & Loukis, 2017; Loukis et al., 2019; Low et al., 2011; Oliveira et al., 2014; Rodrigues et al., 2014; Seethamraju, 2015; Widyastuti & Irwansyah, 2018; W.-W. Wu et al., 2011; Z. Yang et al., 2015; Yeboah-Boateng & Essandoh, 2014)
SaaS and Improved firm performance	(Amini, 2014; Chae et al., 2018; Chihande & van der Poll, 2017; Garrison et al., 2015; Haag & Eckhardt, 2014b; Kyriakou & Loukis, 2017; Loukis et al., 2019; Mitra et al., 2018; Rodrigues et al., 2014; Schniederjans & Hales, 2016; Seethamraju, 2015; Stadtmueller, 2013; Widyastuti & Irwansyah, 2018; W.-W. Wu et al., 2011; Zhang et al., 2017a)
Scaling	(Abdollahzadegan et al., 2013; Alrokayan, 2017; Amini, 2014; Asatiani, 2015; Avram, 2014; Bardsiri & Hashemi, 2014; Benlian & Hess, 2011; Bieber et al., 2015; Buyya et al., 2018; Buyya et al., 2008; Buyya et al., 2009; Chihande & van der Poll, 2017; Cho & Chan, 2015; El Alami et al., 2015; Fakieh et al., 2016; Fox et al., 2009; Garrison et al., 2015; Gupta et al., 2013; Haag & Eckhardt, 2014b; W. Kim, 2009; Knowledge@Wharton, 2009; Kyriakou & Loukis, 2017; Liu et al., 2018; Low et al., 2011; Marston et al., 2011; Midha et al., 2017; Mitra et al., 2018; Rodrigues et al., 2014; Salleh et al., 2018; Schniederjans & Hales, 2016; Seethamraju, 2015; Widyastuti & Irwansyah, 2018; J. Wu et al., 2015; Xin & Levina, 2008; Yeboah-Boateng & Essandoh, 2014)

Advantage	Author
Security	(Amini, 2014; Bardsiri & Hashemi, 2014; Chihande & van der Poll, 2017; Fakieh et al., 2016; Gupta et al., 2013; Haag & Eckhardt, 2014b; Jula et al., 2014; Knowledge@Wharton, 2009; Midha et al., 2017; Mitra et al., 2018; Rodrigues et al., 2014; Seethamraju, 2015; Widyastuti & Irwansyah, 2018; H. Yang & Tate, 2012)
Simplicity	(Abdel-Basset et al., 2018; Abdollahzadegan et al., 2013; Amini, 2014; Chihande & van der Poll, 2017; Dubey & Wagle, 2007; Fakieh et al., 2016; Gupta et al., 2013; Haag & Eckhardt, 2014b; Kaltencker et al., 2013; Kiblawi & Khalifeh, 2015; Liu et al., 2018; Rodrigues et al., 2014; Salleh et al., 2018; Widyastuti &
	Irwansyah, 2018; Winkler & Brown, 2013; Z. Yang et al., 2015; Yeboah-Boateng & Essandoh, 2014)
Speed	(Abdollahzadegan et al., 2013; Alrokayan, 2017; Amini, 2014; Asatiani, 2015; Bardsiri & Hashemi, 2014; Benlian & Hess, 2011; Bieber et al., 2015; Buyya et al., 2018; Chihande & van der Poll, 2017; Fakieh et al., 2016; Garrison et al., 2015; Gupta et al., 2013; Haag & Eckhardt, 2014b; K. Kim & Altmann, 2013; Liu et al., 2018; Loukis et al., 2019; Marston et al., 2011; Midha et al., 2017; Misra & Mondal, 2011; Mitra et al., 2018; Oliveira et al., 2014; Rodrigues et al., 2014; Schniederjans & Hales, 2016; Seethamraju, 2015; Stadtmueller, 2013; Tippins & Sohi, 2003; Widyastuti & Irwansyah, 2018; J. Wu et al., 2015; YeboahBoateng & Essandoh, 2014; Zainuddin, 2012; Zhang et al., 2017a)
Usability	(Abdel-Basset et al., 2018; Abdollahzadegan et al., 2013; Chihande & van der Poll, 2017; Gupta et al., 2013; Haag & Eckhardt, 2014b; "IaaS Popularity Surges in 2018," ; Kaltencker et al., 2013; Rodrigues et al., 2014; Widyastuti & Irwansyah, 2018; Winkler & Brown, 2013; Z. Yang et al., 2015; Yeboah-Boateng & Essandoh, 2014; Zainuddin, 2012)
SaaS and Business Agility	(Amini, 2014; Avram, 2014; Day, 1994; Garrison et al., 2015; S. Malladi & M. S. Krishnan, 2012; Marston et al., 2011)
SaaS and IT efficiency	(Avram, 2014; Garrison et al., 2015; S. Malladi & M. S. Krishnan, 2012; Marston et al., 2011)

APPENDIX B: OBSTACLES TO CLOUD COMPUTING DIFFUSION

Obstacle	Author
Application Availability	(Avram, 2014; Benlian & Hess, 2011; Chihande & van der Poll, 2017; K. Kim & Altmann, 2013; W. Kim, 2009; Midha et al., 2017)
Bandwidth	(Abdollahzadegan et al., 2013; Asatiani, 2015; Avram, 2014; Benlian & Hess, 2011; Bieber et al., 2015; Buyya et al., 2018; Chihande & van der Poll, 2017; Dubey & Wagle, 2007; Fox et al., 2009; Marston et al., 2011; Midha et al., 2017; Seethamraju, 2015; Widyastuti & Irwansyah, 2018)
Changes to IT Roles	(Avram, 2014; Bieber et al., 2015; Haag & Eckhardt, 2014b; Hirschheim & Newman, 1988)
Hidden Costs/Rising Costs	(Avram, 2014; Benlian & Hess, 2011; Chihande & van der Poll, 2017; Fox et al., 2009)
Data Loss	(Bieber et al., 2015; Chihande & van der Poll, 2017)
Entrenched Incumbents	(Marston et al., 2011; Z. Yang et al., 2015)
Fear	(Avram, 2014; Benlian & Hess, 2011; Hirschheim & Newman, 1988; Lapointe & Rivard, 2005; Oliveira et al., 2014)
Fear of Job Loss	(Avram, 2014; Benlian & Hess, 2011; Haag & Eckhardt, 2014b; Hirschheim & Newman, 1988; Marston et al., 2011)
Global Politics	(Avram, 2014; Buyya et al., 2008)
Inertia/Resistance to Change	(Asatiani, 2015; Buyya et al., 2008; Carr, 2005; Haag & Eckhardt, 2014b; Hirschheim & Newman, 1988; Marston et al., 2011; Oliveira et al., 2014; Z. Yang et al., 2015)
Lack of Customization	(Chihande & van der Poll, 2017; Haag & Eckhardt, 2014b; Xin & Levina, 2008)
Legal Issues/Compliance	(Abdollahzadegan et al., 2013; Asatiani, 2015; Avram, 2014; Bieber et al., 2015; Fox et al., 2009; Haag & Eckhardt, 2014b; W. Kim, 2009; Marston et al., 2011; Seethamraju, 2015; H. Yang & Tate, 2012; Yeboah-Boateng & Essandoh, 2014)
Loss of Critical Skills	(Abdollahzadegan et al., 2013; Asatiani, 2015; Benlian & Hess, 2011; Haag & Eckhardt, 2014b; Hirschheim & Newman, 1988)
Power Issues	(Benlian & Hess, 2011; Haag & Eckhardt, 2014b; Hirschheim & Newman, 1988; Lapointe & Rivard, 2005)
Threat of Government Spies	(Haag & Eckhardt, 2014b)
Performance of the vendor/application	(Asatiani, 2015; Avram, 2014; Benlian & Hess, 2011; Bieber et al., 2015; Buyya et al., 2018; Fox et al., 2009; Haag & Eckhardt, 2014b; W. Kim, 2009)
Security	(Asatiani, 2015; Avram, 2014; Benlian & Hess, 2011; Buyya et al., 2018; Chihande & van der Poll, 2017; Cho & Chan, 2015; Dubey & Wagle, 2007; Fox et al., 2009; George & Nazeh, 2019; Haag & Eckhardt, 2014b; W. Kim, 2009; Marston et al., 2011; Salleh et al., 2018; Seethamraju, 2015; Widyastuti & Irwansyah, 2018; H. Yang & Tate, 2012; Z. Yang et al., 2015; Ye et al., 2006; Yeboah-Boateng & Essandoh, 2014)
Risk Aversion	(Benlian & Hess, 2011; Buyya et al., 2008; Hirschheim & Newman, 1988)

Obstacle	Author
Strategic (need more here)	(Abdollahzadegan et al., 2013; Benlian & Hess, 2011)
Lack of Standards	(Asatiani, 2015; Haag & Eckhardt, 2014b; Midha et al., 2017)
Contractual Concerns	(Abdollahzadegan et al., 2013; Fox et al., 2009; W. Kim, 2009; Marston et al., 2011)
Interoperability Concerns	(Avram, 2014; W. Kim, 2009)
Lack of Control Concerns	(Abdollahzadegan et al., 2013; Amini, 2014; Asatiani, 2015; Avram, 2014; Benlian & Hess, 2011; Fox et al., 2009; Hirschheim & Newman, 1988; Lapointe & Rivard, 2005; Marston et al., 2011; Seethamraju, 2015; Widyastuti & Irwansyah, 2018; Z. Yang et al., 2015; YeboahBoateng & Essandoh, 2014)
Vendor lock-in	(Asatiani, 2015; Bieber et al., 2015; Haag & Eckhardt, 2014b; Salleh et al., 2018; Widyastuti & Irwansyah, 2018; Ye et al., 2006; Yeboah-Boateng & Essandoh, 2014)

APPENDIX C: MEASUREMENT CONSTRUCTS IN THE LITERATURE

Measurement Constructs	Measurement Type	Data Type	Author
IT Infrastructure → IT Capability → KM (Knowledge Management) Capability → • Perceived Organizational Performance • Sustained Competitive Advantage Control Variables: Organizational Size Organizational Type	SEM	Survey – Senior Managers	(Akram et al., 2018)
IT Capability → Superior Business Performance → Sustained Superior Business Performance • Bharadwaj – Significant relationship • Santhanam – Financial Halo • Chae – No longer significant • Choi – Mixed Findings • Chae – Mixed findings – Role of Industry	T-tests	InfoWeek 500	(Bharadwaj, 2000; Chae et al., 2018; Chae et al., 2014; Choi & George, 2016; Santhanam & Hartono, 2003)
Use of SaaS → IT enabled Innovation	SEM	InfoWeek 500	(S. Malladi & M. S. Krishnan, 2012)
Cloud computing → Business Model Innovation		Case Study	(J. Wu et al., 2015)
SaaS → Enables Agility → Business Model Innovation (BMI) → Competitive Advantage (Start-ups) SaaS → Enables Market Insights → Business Model Innovation (BMI) → Competitive Advantage (Start-ups) SaaS → Enables Cost Efficiency → Business Model Innovation (BMI) → Competitive Advantage (Start-ups)	Qualitative	Interviews – Literature This is a dissertation	(Alrokayan, 2017)
SaaS → Enables Scalability → Business Model Innovation (BMI) → Competitive Advantage (Start-ups)			

Measurement Constructs	Measurement Type	Data Type	Author
SaaS → Innovation (Open innovation leveraging collective intelligence within the SaaS network)	SEM		(K. Kim & Altmann, 2013)
Firm Size impacts SaaS use (larger firms are slower to adopt)	No Model		(Kaltenecker et al., 2015)
Firm Size impacts SaaS use (larger firms have more resources and are more likely to take risks)	No Model		(Abdollahzadegan et al., 2013, p. 71)
Visionary Top Management impacts SaaS use	No Model		(Kaltenecker et al., 2015)
Cloud computing → Collaboration → Improved Economic Performance (supply chain activities)	SEM	Survey	(Schniederjans & Hales, 2016, pp. 78-79)
Cloud Infrastructure (Flexibility and Integration) → (Operational, Partnering, Customer Agility) Control Variables: **Firm Size, Industry Type** Moderator: IT spending based on cloud computing	SEM	Survey – (p. 104)	(Liu et al., 2018, p. 103 & 107)
SaaS Opportunities and Risks → Adoption Measuring: Risks, Opportunities, Flexibility, Focus on Core Competencies, Access to Specialized Resources, Quality Improvements, Control Variables: Adopters, Non-Adopters Characteristics: Firm Size, Number of Employees	SEM	Survey	(Benlian & Hess, 2011, pp. 239-242)
IT competency → Organizational Learning → Firm Performance Industry: Manufacturing SIC codes 35 – 38 (Not about SaaS) Control Variables: Market Power, Firm Size Measures: Organizational Learning, IT Competency, Information Acquisition, Information Dissemination, Shared Interpretation, Declarative Memory, Procedural Memory, Firm Performance	SEM	Survey	(Tippins & Sohi, 2003, pp. 752-755)

Measurement Constructs	Measurement Type	Data Type	Author
Constructs: TOE (Technology, Organization, Environment) Theory • IT Infrastructure • Top Management Support • Relative Advantage • Simplicity • Compatibility • Experience • Competitor Pressure • Partner Pressure → • Organizational Readiness • Technological Readiness • Environmental Readiness	SEM	Survey	(Low et al., 2011, pp. 1014-1018; Martins et al., 2016; Z. Yang et al., 2015, pp. 256-261)
→ • SaaS Readiness → • Attitude toward SaaS • Intention to Use SaaS Characteristics: SaaS use/non-use, Number of Employees,			
Managerial IT capability Technical IT Capability Relational IT Capability → Cloud Success → Firm Performance Control Variables: Firm Size, Annual Sales, Industry	SEM	Survey	(Garrison et al., 2015)
Cost Savings Ease of Use Reliability Sharing and Collaboration Security and Privacy → Cloud Adoption in SMBs	SEM	Survey	(Gupta et al., 2013, pp. 866-871)
Cloud Computing and ROI – Mathematical Model • Increase in Profit • Increase in Customer Satisfaction • Focus on Core Competencies • Disaster Recovery	Mathematical ROI Model		(Misra & Mondal, 2011)

Measurement Constructs	Measurement Type	Data Type	Author
Cloud Computing Benefits and Firm Performance • Contractual Governance • Relational Governance • Absorptive Capacity • SaaS Adoption → SaaS Operations Benefits SaaS Innovational Benefits → Firm Performance • Control Variables: Firm Size, Human Capital	SEM	Survey – Dutch Firms	(Loukis et al., 2019, pp. 4345)
Cloud Computing → Collaboration → Economic Performance Environmental Performance	SEM	Survey	(Schniederjans & Hales, 2016, pp. 79-80)
• ICT (Information Communication and Technology) personnel has a positive effect on the BV (Business Value) generated from CC (cloud computing)	SEM	Survey	(Kyriakou & Loukis, 2017)
• The general human capital has a positive effect on the business value generated from CC The internal ICT relationship (the relationship between the ICT unit and the business unit) has a positive effect on the BV generated from CC			
• Cloud-based services' adoption in any form, i.e. SaaS, IaaS, and PaaS would have high impact on economic flexibility. • Cloud-based services' adoption in any form, i.e. SaaS, IaaS, and PaaS would have high impact on process flexibility. • Cloud-based services' adoption in any form, i.e. SaaS, IaaS, and PaaS would have high impact on performance flexibility. • Cloud-based services' adoption in any form, i.e. SaaS, IaaS, and PaaS would have high impact on market flexibility.	Empirical	Interviews	(Liu et al., 2018)
Availability of organizations resources → Successful utilization of cloud computing → • Achieving competitive advantage	Descriptive Statistics	Survey	(Fakieh et al., 2016)

Measurement Constructs	Measurement Type	Data Type	Author
SaaS → Business Model Innovation • Value Proposition Improvement • Market Insights Improvement and Validation • Financial Aspects which lower barriers • Operations Automation → Competitive Advantage	Qualitative	Interview/ Literature This is a dissertation	(Alrokayan, 2017)
Technical Agility (cloud computing) → Customer Agility Enterprise Operations Agility Partner Agility → Business Agility • Adaptive Systems – Business Process Management, Business Intelligence, Simulation Modeling, Enterprise Resource Planning, HR, Finance • Specialized Systems – Customer Service, Sales Support, Job Scheduling, Product Design, Customer Relations • Interconnection System – internet, EDI, Wireless, Social Networking, Instant Messaging → Business Performance	Literature Research Method	McKinsey Survey	(Zhang et al., 2017a)

APPENDIX D: CONSTRUCT COUNTS WITHIN MEASUREMENT MODELS

Construct	Frequency	
IT Capability/Competency	4	
Managerial IT Capability	1	
Relational IT Capability	1	
IT Infrastructure	1	
Use of SaaS or Use of cloud computing	9	
Availability of Organizational Resources	1	
Firm Size	1	It comes up more often as a control variable
Visionary Top Management	1	
TOE Constructs • IT Infrastructure • Top Management Support • Relative Advantage • Simplicity • Compatibility • Experience • Competitor Pressure • Partner Pressure	3	

APPENDIX E: KEY CONSTRUCT/DIMENSIONS

Construct/ Dimensions	Definition	Items	Source	Operationalization
Corporate and Participant Information Company Information Participant Information	General Information to assist in Bloomberg research. Part II of the study. Company Name, Industry Participant Name and Title to ensure the participant has specific information about SaaS usage at the Firm	**Company Information: (CORP)** Q3: What is your company name? **Participant Information: (PERS)** Q1: What is your name? Q2: What is your job title?	Chae, H.-C., Koh, C. E., & Prybutok, V. R. (2014). Information technology capability and firm performance: contradictory findings and their possible causes. *MIS quarterly, 38*(1), 305-32.	Q2: This question includes a pull-down menu that includes; CIO, IT Executive/Mgmt, IT – Responsible for cloud computing, Responsible for cloud computing, Other. Q2 allows us to determine if the participant is qualified to answer the questions **Support for H1 and H2**
SaaS Adoption and Diffusion SaaS Adoption Percentage of SaaS adoption Percentage of IT budget allocated to SaaS	Indication that the organization has adopted SaaS Indication of how much SaaS has been adopted. This helped us to determine whether more or less SaaS effects performance. Indication of organizational commitment to SaaS	**SaaS Adoption (ADOPT)** Q5: Do you use SaaS in your organization? **SaaS Diffusion (DIFFUSE)** Q6: What percentage of your information technology infrastructure consists of SaaS? Q7: What percentage of your information technology budget is spent on SaaS?	Malladi, S., & Krishnan, M. S. (2012). *Does Software-as-a- Service (SaaS) has a role in IT-enabled innovation? – An empirical analysis.* Paper presented at the 18th Amer. Conf. Inf. Sys. 2012, AMCIS 2012 IDG. (2018). 2018 Cloud Computing Survey. Retrieved from https://www.idg.com/tools for-marketers/2018cloud computing-survey/	Q5: A binary variable (yes, no) Q6: A slide bar from 0% – 100%. *This was collapsed during analysis into quadrants.* Q7: A slide bar from 0%- 100% I looked at whether the % of budget allocated to SaaS impacts firm performance. **Support for H1 and H2**

Construct/ Dimensions	Definition	Items	Source	Operationalization
IT Role in Industry (INDUS) Specific Industry IT Role in Industry	Looking at whether particular industries have better/worse performance with SaaS adoption. This construct extends the 2018 Chae research by asking the participant whether they think that that role of IT in their organization is to automate, informate or transform.	Q4: What is your industry? Q12: What is the role of information technology in your organization?	Chae, H.-C., Koh, C. E. & Park, K. O. (2018). Information technology capability and firm performance: Role of industry. *Information & Management, 55*(5), 525-546.	Q4: This is a dropdown list of popular industries provided by the survey tool. **Support for H3** Q7: This is a drop down menu with the Chae 2018 definitions: -Information technology helps us to automate by replacing human labor with automated business processes. -Information technology helps us with information to empower management and employees -Information technology fundamentally transforms our business and industry processes and relationships. A drop down menu provides the items for selection.
Organizational Learning (LEARN) Previous experience with SaaS	This is consistent but extends Malladi to update how previous experience and	Q15: How many years have you had SaaS in your organization.	Malladi, S., &Krishnan, M. S. (2012). *Does Software-as-a-Service (SaaS) has a role in IT-enabled innovation? – An empirical analysis.*	Q15 is a slider bar from 0 -15 years
SaaS improves an organizations insights	specific organizational processes improves chances of success and subsequent firm performance	Q16: Our organization has developed specific processes for deploying SaaS.	Paper presented at the 18th Amer. Conf. Inf. Sys. 2012, AMCIS 2012 Widyastuti, D., & Irwansyah, I. (2018).	Q16 is a 5-point Likert scale from 134trongly agree to Strongly disagree Q1 leveraged a 5point Likert scale

Construct/ Dimensions	Definition	Items	Source	Operationalization
		Q17: Once SaaS is deployed we gain new insights about our business.	Benefits and challenges of cloud computing technology adoption in small and medium enterprises (SMEs). *Bandung Creative Movement (BCM) Journal, 4*(1). p.244 Section 4.3.10 And Empirical work at Ford	from 134trongly agree to Strongly disagree **Support for H8**
Focus on Core Competency (CORE) SaaS off-loads finite IT resources	There is much literature that speaks of the advantage of off-loading non-core work to SaaS so that the organization can deploy its finite resources on its core competency resulting in improved firm performance.	Q11: In what areas of your business do you leverage SaaS? Q21: Adopting SaaS	(Benlian & Hess, 2011; Garrison et al., 2015; Gupta et al., 2013; Misra & Mondal, 2011; Widyastuti & Irwansyah, 2018; Yeboah-Boateng & Essandoh, 2014) (Benlian & Hess, 2011)	Q12: The answers to the question were: -We use SaaS in noncore areas of the business such as: A manufacturer or publishers might have CRM, Purchasing, Expense management, email and HR as noncore areas. -We use SaaS in Core areas of our business such as: a manufacturer's core competency might be plant floor management or product design. -We use SaaS in Core and non-core areas of our business.
Focus on Core Competency allows firms to better compete		applications is a good way to foster the company's concentration on its core competencies.		-We do not use SaaS. They checked all that applied Q21 leveraged a 5point Likert scale from strongly agree to strongly disagree.

Construct/ Dimensions	Definition	Items	Source	Operationalization
Focus on Strategic Initiatives IT leaders and firm performance	Do IT leaders have better firm performance than non-IT leaders. Is IT a core competency?	Q13: Adopting SaaS allows our organization to enhance capabilities that distinguish us from our competitors Q14: By adopting SaaS our company can concentrate more on putting our core strategies into action. Q18: Our organization uses information technology more effectively than of competitors.	(Benlian & Hess, 2011) (Benlian & Hess, 2011) Chae, H.-C., Koh, C. E., & Prybutok, V. R. (2014). Information technology capability and firm performance: contradictory findings and their possible causes. *MIS quarterly, 38*(1), 305-326.	Q13 leveraged a 5point Likert scale from strongly agree to strongly disagree. Q14 leveraged a 5point Likert scale from strongly agree to strongly disagree. Q18 leveraged a 5point Likert scale from strongly agree to strongly disagree. **Support for H7**
Innovation (INNOV) SaaS improves innovation	Much literature associates the advantage of improved innovation with the diffusion of SaaS.	Q10: SaaS improves our ability to innovate.	(Asatiani, 2015; Avram, 2014; Benlian & Hess, 2011; S. Malladi & M. S. Krishnan, 2012; Marston et al., 2011; Waggener & Wheeler, 2009)	Q10 leveraged a 5point Likert scale from strongly agree to strongly disagree. **Support for H5**

Construct/ Dimensions	Definition	Items	Source	Operationalization
New Projects (NEWPR) New Projects facilitate innovation	This question extends the Malladi and Krishnan study on SaaS and IT enabled innovation	Q8: What share of IT budget is allocated to new projects? Q9: What percentage of new projects leverage SaaS	Malladi, S., & Krishnan, M. S. (2012). *Does SaaS (SaaS) has a role in IT-enabled innovation? – An empirical analysis.* Paper presented at the 18th Amer. Conf. Inf. Sys. 2012, AMCIS 2012 p. 4	Q8 had a sliding scale from 0% - 100%. Q9 had a sliding scale from 0% - 100%. **Support for H6**
Speed (SPEED) Agility contributes to firm performance	Much literature speaks of SaaS contributing to the speed that a firm can react to market changes and competitive threats.	Q19: SaaS speeds up our ability to make decisions Q20: SaaS speeds up our ability to react to market pressures.	Benlian, A., & Hess, T. (2011). Opportunities and risks of software-as-a-service: Findings from a survey of IT executives. *Decision support systems, 52*(1), 232-246. Garrison, G., Wakefield, . L., & Kim, S. (2015). The effects of IT capabilities and delivery model on cloud computing success and firm performance for cloud supported processes and operations. *International Journal of Information Management, 35*(4), 377-393. Seethamraju, R. (2015). Adoption of software as a service (SaaS) enterprise resource planning (ERP) systems in small and medium sized enterprises (SMEs). *Information Systems Frontiers, 17*(3), 475-492.	Q19 leveraged a 5point Likert scale from strongly agree to strongly disagree. Q20 leveraged a 5point Likert scale from strongly agree to strongly disagree. **Support for H4**

APPENDIX F: FINANCIAL RATIO EXPLANATION TABLE

Ratios in Bharadwaj Chae	Formula	Notes
ROA	Net Income (Earnings)/Total Assets	
ROS	Net Income (Earnings)/Total Revenue (Sales)	
OI/A	OI (EBIT)/Total Assets	Operating Income is defined in (Chae et al., 2014, p. 310) as Earnings before Income and Taxes (EBIT)
OI/S	OI (EBIT)/Sales (Revenue)	
OI/E	OI (EBIT)/Employee	
COG/S	Cost of Goods/Sales (Revenue)	
SGA/S	Selling and General Administrative Expenses/Sales (Revenue)	
OPEXP/S	Operating Expenses/Sales (Revenue)	Operating Expenses are defined as the sum of cost of goods (COG) and selling and general administrative expenses (SGA) (Bharadwaj, 2000)
Additional Productivity Measures		
Revenue per Employee	Sales/Employee	
NI/E	Net Income (Earnings)/Employee	

APPENDIX G: STANDARD ANNUAL INCOME STATEMENT EXAMPLE

Revenue
Returns, Refunds, Discounts

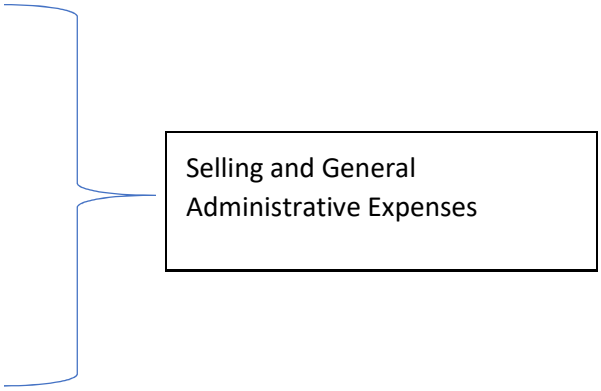
Total Net Revenue (Sales)

Cost of Goods Sold

Gross Profit

Expenses
Advertising & Promotion
Depreciation & Amortization
Insurance
Maintenance
Office Supplies
Rent
Salaries, Benefits & Wages
Telecommunication
Travel
Utilities
Other Expense 1
Other Expense 2

Total Expenses **(SGA)**



Earnings Before Interest & Taxes (EBIT)

Interest Expense

Earnings Before Taxes

Income Taxes

Net Earnings (Income)

APPENDIX H: SURVEY COUNTS

Table H1: Title/Job Responsibility Survey Counts

Title/Job responsibility	Number of Respondents	Percentage of respondents
Responsible for all Information technology decisions/ Chief Information Officer (CIO)	257	46.4
Information technology Executive/Management	221	39.9
Information technology responsible for cloud computing	30	5.4
Responsible for cloud computing decisions	4	.7
Evaluate and Influence cloud computing decisions	12	2.2
Other	30	5.4
Missing		
Total	554	100%

Table H2: SaaS Diffusion Measures Survey Count

Quartiles	SaaS in the Infrastructure	% of respondents	Percentage of IT budget spent of SaaS	% of respondents
0%-25%	21	3.8	46	8.3
25%-50%	105	19	111	20
51%-75%	170	30.7	141	25.5
76%-100%	258	46.6	256	46.2
Missing	0	0	0	0
Total	554	100%	554	100

Table H3: Previous Experience With Saas (Years of Saas Use) Survey Counts

Years of SaaS Use	Number of Respondents	Percentage of Responses
0-1 years	13	2.3
1-2 years	35	6.3
2-3 years	82	14.8
3-5 years	140	25.3
5-7 years	99	17.9
7-8 years	46	8.3
8-10 years	71	12.8
10 or more years	68	12.3
Missing	0	0
Total	554	100%

Table H4: SaaS Specific Processes Survey Counts

Likert Response	Number of Respondents	Percentage of Responses
Strongly agree	361	65.2
Somewhat agree	155	28
Neither agree nor disagree	29	5.2
Somewhat disagree	7	1.3
Strongly disagree	2	.4
Missing	0	0
Total	554	100%

Table H5: The Role of Technology Survey Counts

Role of Technology (Chae et al., 2018)	Number of Respondents	Percentage of Respondents
Information technology helps us automate	296	53.4
Information technology helps us to empower	126	22.7
Information technology fundamentally transforms	132	23.8
Total	554	100%

Table H6: SaaS and New Insights Survey Counts

Likert Response	Number of Respondents	Percentage of Responses
Strongly agree	257	46.4
Somewhat agree	228	41.2
Neither agree nor disagree	56	10.1
Somewhat disagree	10	1.8
Strongly disagree	3	.5
Missing	0	0
Total	554	100%

Table H7: SaaS in Core and Non-Core Survey Counts

Areas of SaaS use	Number of respondents	Percentage of responses
We use SaaS in **Non-core** areas of the business	286	51.6
We use SaaS in **Core** areas of the business	196	35.4
We use SaaS in **Non-core and Core** areas of the business	72	13
We do not use SaaS	0	0
Missing	0	0
Total	554	100%

Table H8: SaaS Fosters Concentration on Core Survey Counts

Likert Response	Number of Respondents	Percentage of Responses
Strongly agree	237	42.8
Somewhat agree	239	43.1
Neither agree nor disagree	66	11.9
Somewhat disagree	9	1.6
Strongly disagree	3	.5
Missing	0	0
Total	554	100%

Table H9: Adopting SaaS in Non-Core and Core and Strategies into Action Survey Counts

Likert Response	Number of Respondents	Percentage of Responses
Strongly agree	217	39.2
Somewhat agree	258	46.6
Neither agree nor disagree	64	11.6
Somewhat disagree	9	1.6
Strongly disagree	6	1.1
Missing	0	0
Total	554	100%

Table H10: SaaS and Enhanced Capabilities Survey Counts

Likert Response	Number of Respondents	Percentage of Responses
Strongly agree	342	61.7
Somewhat agree	152	27.4
Neither agree nor disagree	51	9.2
Somewhat disagree	6	1.1
Strongly disagree	3	.5
Missing	0	0
Total	554	100%

Table H11: SaaS and More Effective than Competitors Survey Counts

Likert Response	Number of Respondents	Percentage of Responses
Strongly agree	286	51.6
Somewhat agree	172	31
Neither agree nor disagree	79	14.3
Somewhat disagree	13	2.3
Strongly disagree	4	.7
Missing	0	0
Total	554	100%

Table H12: SaaS and Innovation Survey Counts

Likert Response	Number of Respondents	Percentage of Responses
Strongly agree	371	67
Somewhat agree	139	25.1
Neither agree nor disagree	33	6.0
Somewhat disagree	8	1.4
Strongly disagree	3	.5
Missing	0	0
Total	554	100%

Table H13: SaaS and New Projects Survey Counts

Quartiles	New Projects leveraging SaaS	% of respondents
0%-25%	46	8.3
25%-50%	92	16.6
51%-75%	155	28
76%-100%	261	47.1
Missing	0	0
Total	554	100

Table H14: SaaS and Decision Speed Survey Counts

Likert Response	Number of Respondents	Percentage of Responses
Strongly agree	344	62.1
Somewhat agree	159	28.7
Neither agree nor disagree	43	7.8
Somewhat disagree	7	1.3
Strongly disagree	1	.2
Missing	0	0
Total	554	100%

Table H15: SaaS and Reacting to Market Pressure Survey Counts

Likert Response	Number of Respondents	Percentage of Responses
Strongly agree	272	49.1
Somewhat agree	221	39.9
Neither agree nor disagree	46	8.3
Somewhat disagree	13	2.3
Strongly disagree	2	.4
Missing	0	0
Total	554	100%

Table H16: SaaS and Firm Performance (Self-Reported) Survey Counts

Likert Response	SaaS has helped increase our overall revenue	Percentage of Responses	SaaS has helped us reduce costs	Percentage of Responses	SaaS has improved our productivity	Percentage of Responses
Strongly agree	346	62.5	239	43.1	327	59
Somewhat agree	145	26.2	242	43.7	175	31.6
Neither agree nor disagree	53	9.6	58	10.5	43	7.8
Somewhat disagree	8	1.4	13	2.3	7	1.3
Strongly disagree	2	.4	2	.4	2	.4
Missing	0	0	0	0	0	0
Total	554	100%	554	100%	554	100%

APPENDIX I: SAAS IN CORE VS NON-CORE AREAS AND THE IMPACT ON FIRM PERFORMANCE – MULTI-GROUP RESULTS (GASKIN, 2018)

	Non Core		Core		
Relationship	Estimate	p	Estimate	p	z score
SaaS Budget → Capabilities	.145	.001	.061	.131	-1.383
SaaS Budget → Tech Role	-.227	.000	-.190	.000	.570
SaaS Budget → Innovation	.234	.000	.037	.507	-2.408*
SaaS Budget → Agility	.193	.000	.056	.244	-1.907+
SaaS Budget → New Projects	14.553	.000	12.206	.000	-1.1560
SaaS Infrastructure → Capabilities	.202	.000	.222	.000	.299
SaaS Infrastructure → Innovation	.100	.124	.162	.011	.672
SaaS Infrastructure → Agility	.185	.001	.190	.000	.060
SaaS Infrastructure → New Projects	.655	.126	.771	.240	.149
Years of SaaS → Capabilities	.001	.907	.040	.004	2.1*
Years of SaaS → Tech Role	.055	.012	.042	.112	-.376
Years of SaaS → Agility	.001	.951	.041	.010	1.852+
Years of SaaS → New Projects	.655	.126	.771	.240	.149
Capabilities → Revenue	.153	.096	.452	.000	2.303*
Capabilities → Costs	.497	.000	.418	.000	-.532
Capabilities → Productivity	.508	.000	.119	.154	-2.803**
Tech Role → Revenue	-.088	.026	-.035	.379	.935
Tech Role → Productivity	-.044	.362	.078	.032	2.026*
Innovation → Revenue	.347	.000	.155	.011	-2.326*
Innovation → Productivity	-.047	.484	.171	.002	2.493*
Agility → Revenue	.346	.000	.262	.000	-.771
Agility → Costs	.363	.000	.429	.000	.527
Agility → Productivity	.320	.000	.493	.000	1.501
New Projects → Revenue	.002	.427	-.001	.567	-.979
New Projects → Productivity	.003	.255	.003	.076	-.071
New Projects → Costs	.000	.998	-.003	.085	-1.113
SaaS Budget → Revenue	.048	.366	.105	.023	.811
SaaS Budget → Costs	-.029	.634	.076	.180	1.267
SaaS Budget → Productivity	.020	.759	.039	.351	.256
SaaS Infrastructure → Revenue	.070	.170	.018	.726	-.734
SaaS Infrastructure → Costs	.034	.561	.019	.755	-.170
SaaS Infrastructure → Productivity	.000	.995	-.048	.295	-.619
Years of SaaS → Revenue	-.006	.685	-.013	.476	-.286
Years of SaaS → Costs	.001	.933	-.006	.768	-.285
Years of SaaS → Productivity	-.011	.535	.011	.515	.896

Notes: *** p-value < .01; ** p-value < .05; * p-value < .01; + p-value < .10

APPENDIX J: INDUSTRY TO ROLE OF TECHNOLOGY CROSSTAB

Industry		Automate	Empower	Transform	
Agriculture	Count	3	0	1	4
	%	75	0	25	100
Automotive	Count	3	0	2	5
	%	60	0	40	100
Construction	Count	21	7	11	39
	%	53.8	17.9	28.2	100
Education	Count	13	6	5	24
	%	54.2	25	20.8	100
Finance	Count	24	21	11	56
	%	42.9	37.5	19.6	100
Information and Culture	Count	44	11	15	70
	%	62.9	15.7	21.4	100
Management of Companies	Count	7	6	4	17
	%	41.2	35.3	23.5	100
Manufacturing	Count	14	6	18	38
	%	36.8	15.8	47.4	100
Medical	Count	9	4	5	18
	%	50	22.2	27.8	100
Mining	Count	2	1	0	3
	%	66.7	33.3	0	100
Scientific and Technical	Count	12	6	9	27
	%	44.4	22.2	27.8	100
Publishing	Count	0	3	0	3
	%	0	100	1	100
Real Estate	Count	0	0	1	1
	%	0	0	100	100
Retail Trade	Count	5	7	5	17
	%	29.4	41.2	29.4	100
Technology	Count	131	42	37	210
	%	62.4	20	17.6	100
Transportation	Count	1	4	2	7
	%	14.3	57.1	28.6	100
Utilities	Count	5	2	5	12
	%	41.7	16.7	41.7	100
Wholesale Trade	Count	2	0	1	3
	%	66.7	0	33.3	100
Totals	Count	296	126	132	554
	%	53.4	22.7	23.8	100

APPENDIX K: SAAS PERCENTAGE IN THE INFRASTRUCTURE ANOVA RESULTS

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
COGS 2016	Between Groups	464210013581.735	3	154736671193.912	0.415	0.743
	Within Groups	15294740460583.300	41	373042450258.130		
	Total	15758950474165.100	44			
SGA 2016	Between Groups	146951941072.721	3	48983980357.574	0.474	0.702
	Within Groups	3719297874431.490	36	103313829845.319		
	Total	3866249815504.210	39			
COG/S 2016	Between Groups	829.732	3	276.577	0.436	0.729
	Within Groups	27938.689	44	634.970		
	Total	28768.420	47			
SGA/S 2016	Between Groups	568.487	3	189.496	0.720	0.546
	Within Groups	10262.779	39	263.148		
	Total	10831.266	42			
COGS 2017	Between Groups	537457696700.176	3	179152565566.725	0.420	0.739
	Within Groups	17894338123279.200	42	426055669601.885		
	Total	18431795819979.400	45			
SGA 2017	Between Groups	166050672357.518	3	55350224119.173	0.504	0.682
	Within Groups	4067343990584.540	37	109928215961.744		
	Total	4233394662942.060	40			
COG/S 2017	Between Groups	1347.410	3	449.137	1.021	0.393
	Within Groups	18478.569	42	439.966		
	Total	19825.980	45			
SGA/S 2017	Between Groups	278.963	3	92.988	0.392	0.759
	Within Groups	8774.846	37	237.158		
	Total	9053.808	40			
COGS 2018	Between Groups	14492522776.405	3	4830840925.468	0.406	0.750
	Within Groups	452151547091.490	38	11898724923.460		
	Total	466644069867.895	41			
SGA 2018	Between Groups	2078837521.145	3	692945840.382	1.293	0.293
	Within Groups	18224885868.780	34	536026054.964		
	Total	20303723389.924	37			
COG/S 2018	Between Groups	1384.896	3	461.632	0.960	0.422
	Within Groups	18277.842	38	480.996		
	Total	19662.738	41			
SGA/S 2018	Between Groups	58.544	3	19.515	0.079	0.971
	Within Groups	8401.888	34	247.114		
	Total	8460.432	37			
COGS 2019	Between Groups	17554954898.856	3	5851651632.952	0.416	0.742

	Within Groups	534162966832.263	38	14056920179.796		
	Total	551717921731.119	41			
SGA 2019	Between Groups	2154850500.069	3	718283500.023	1.205	0.323
	Within Groups	20267606636.339	34	596106077.539		
	Total	22422457136.408	37			
COG/S 2019	Between Groups	717.747	3	239.249	0.516	0.674
	Within Groups	17159.144	37	463.761		
	Total	17876.891	40			
SGA/S 2019	Between Groups	256.470	3	85.490	0.314	0.815
	Within Groups	9252.813	34	272.142		
	Total	9509.283	37			
Operating Income - EBIT 2016	Between Groups	6507241307.130	3	2169080435.710	0.561	0.643
	Within Groups	197211044126.623	51	3866883218.169		
	Total	203718285433.753	54			
Net Income - NI 2016	Between Groups	1878506260.999	3	626168753.666	0.664	0.578
	Within Groups	49010173274.496	52	942503332.202		
	Total	50888679535.495	55			
Return on Assets ROA 2016	Between Groups	303.685	3	101.228	1.207	0.317
	Within Groups	4276.113	51	83.845		
	Total	4579.799	54			
Net Income/Sales ROS 2016	Between Groups	1422.433	3	474.144	2.615	0.061
	Within Groups	9428.627	52	181.320		
	Total	10851.061	55			
Operating Income to Net Sales - OI/S 2016	Between Groups	4446.466	3	1482.155	4.769	0.005
	Within Groups	16162.012	52	310.808		
	Total	20608.478	55			
Sales Per Employee R/E 2016	Between Groups	10918479113788.600	3	3639493037929.540	0.091	0.965
	Within Groups	2005006993228110.000	50	40100139864562.100		
	Total	2015925472341900.000	53			
Operating Profit Per	Between Groups	161217686593.826	3	53739228864.609	0.135	0.939
Employee OI/E 2016	Within Groups	19949678591097.200	50	398993571821.943		
	Total	20110896277691.000	53			
Net Income Per Employee NI/E 2016	Between Groups	30496473098.818	3	10165491032.939	0.070	0.976
	Within Groups	7264363037121.280	50	145287260742.426		
	Total	7294859510220.100	53			
Operating Income EBIT 2017	Between Groups	9089277139.217	3	3029759046.406	0.605	0.615
	Within Groups	265533417956.460	53	5010064489.745		
	Total	274622695095.676	56			
Net Income NI 2017	Between Groups	4686064475.024	3	1562021491.675	0.759	0.522
	Within Groups	109077037812.149	53	2058057317.210		

	Total	113763102287.173	56			
Return on Assets ROA 2017	Between Groups	711.876	3	237.292	2.145	0.106
	Within Groups	5752.868	52	110.632		
	Total	6464.744	55			
Net Income/Sales ROS 2017	Between Groups	2782.683	3	927.561	3.939	0.013
	Within Groups	12479.368	53	235.460		
	Total	15262.052	56			
Operating Income to Net Sales OI/S 2017	Between Groups	2618.754	3	872.918	4.261	0.009
	Within Groups	10857.583	53	204.860		
	Total	13476.337	56			
Sales Per Employee R/E 2017	Between Groups	12267828330755.900	3	4089276110251.960	0.094	0.963
	Within Groups	2185578864371870.000	50	43711577287437.400		
	Total	2197846692702630.000	53			
Operating Profit Per Employee OI/E 2017	Between Groups	137289835965.290	3	45763278655.097	0.113	0.952
	Within Groups	20174460690721.400	50	403489213814.427		
	Total	20311750526686.700	53			
Net Income Per Employee NI/E 2017	Between Groups	153059386247.745	3	51019795415.915	0.492	0.690
	Within Groups	5186670279918.150	50	103733405598.363		
	Total	5339729666165.890	53			
Operating Income EBIT 2018	Between Groups	2126568827.170	3	708856275.723	0.895	0.451
	Within Groups	38819428084.054	49	792233226.205		
	Total	40945996911.224	52			
Net Income NI 2018	Between Groups	1073416572.335	3	357805524.112	0.660	0.581
	Within Groups	26572471527.543	49	542295337.297		
	Total	27645888099.878	52			
Return on Assets ROA 2018	Between Groups	109.060	3	36.353	0.513	0.676
	Within Groups	3262.133	46	70.916		
	Total	3371.193	49			
Net Income/Sales ROS 2018	Between Groups	535.195	3	178.398	0.482	0.696
	Within Groups	18132.381	49	370.049		
	Total	18667.576	52			
Operating Income to Net Sales OI/S 2018	Between Groups	1511.603	3	503.868	1.129	0.347
	Within Groups	21876.606	49	446.461		
	Total	23388.209	52			
Sales Per Employee R/E 2018	Between Groups	7756068609988.470	3	2585356203329.490	0.469	0.705
	Within Groups	248129675285835.000	45	5513992784129.660		
	Total	255885743895823.000	48			
Operating Profit Per Employee OI/E 2018	Between Groups	50022946934.987	3	16674315644.996	0.088	0.966
	Within Groups	8496351134332.230	45	188807802985.161		
	Total	8546374081267.210	48			

Net Income Per Employee NI/E 2018	Between Groups	25068141273.247	3	8356047091.082	0.069	0.976
	Within Groups	5462823372757.180	45	121396074950.160		
	Total	5487891514030.430	48			
Operating Income EBIT 2019	Between Groups	1678629538.862	3	559543179.621	0.558	0.646
	Within Groups	49168350209.950	49	1003435718.570		
	Total	50846979748.812	52			
Net Income NI 2019	Between Groups	1154698327.455	3	384899442.485	0.539	0.658
	Within Groups	34984700281.165	49	713973475.126		
	Total	36139398608.620	52			
Return on Assets ROA 2019	Between Groups	314.112	3	104.704	1.222	0.312
	Within Groups	4197.202	49	85.657		
	Total	4511.315	52			
Net Income/Sales ROS 2019	Between Groups	1933.942	3	644.647	1.922	0.138
	Within Groups	16437.183	49	335.453		
	Total	18371.125	52			
Operating Income to Net Sales OI/S 2019	Between Groups	1767.846	3	589.282	1.816	0.157
	Within Groups	15902.250	49	324.536		
	Total	17670.096	52			
Sales Per Employee R/E 2019	Between Groups	8640242366923.500	3	2880080788974.500	0.559	0.645
	Within Groups	242213430066927.000	47	5153477235466.540		
	Total	250853672433851.000	50			
Operating Profit Per Employee OI/E 2019	Between Groups	88208396091.144	3	29402798697.048	0.221	0.881
	Within Groups	6253746327654.300	47	133058432503.283		
	Total	6341954723745.440	50			
Net Income Per Employee NI/E 2019	Between Groups	81672931262.652	3	27224310420.884	0.287	0.835
	Within Groups	4462526399993.560	47	94947370212.629		
	Total	4544199331256.210	50			

APPENDIX L: SAAS PERCENTAGE IN THE BUDGET ANOVA

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
COGS 2016	Between Groups	647098642652.12	3	215699547550.71	0.585	0.628
	Within Groups	15111851831512.90	41	368581751988.12		
	Total	15758950474165.10	44			
SGA 2016	Between Groups	179999845284.48	3	59999948428.16	0.586	0.628
	Within Groups	3686249970219.73	36	102395832506.10		
	Total	3866249815504.21	39			
COG/S 2016	Between Groups	1040.90	3	346.97	0.551	0.650
	Within Groups	27727.52	44	630.17		
	Total	28768.42	47			
SGA/S 2016	Between Groups	1044.01	3	348.00	1.387	0.261
	Within Groups	9787.25	39	250.96		
	Total	10831.27	42			
COGS 2017	Between Groups	747545116325.13	3	249181705441.71	0.592	0.624
	Within Groups	17684250703654.20	42	421053588182.24		
	Total	18431795819979.40	45			
SGA 2017	Between Groups	200999318152.06	3	66999772717.35	0.615	0.610
	Within Groups	4032395344790.00	37	108983657967.30		
	Total	4233394662942.06	40			
COG/S 2017	Between Groups	1622.88	3	540.96	1.248	0.304
	Within Groups	18203.10	42	433.41		
	Total	19825.98	45			
SGA/S 2017	Between Groups	527.14	3	175.71	0.762	0.522
	Within Groups	8526.67	37	230.45		
	Total	9053.81	40			
COGS 2018	Between Groups	18912967439.41	3	6304322479.80	0.535	0.661
	Within Groups	447731102428.48	38	11782397432.33		
	Total	466644069867.89	41			
SGA 2018	Between Groups	1531876137.51	3	510625379.17	0.925	0.439
	Within Groups	18771847252.42	34	552113154.48		
	Total	20303723389.92	37			
COG/S 2018	Between Groups	1652.33	3	550.78	1.162	0.337
	Within Groups	18010.41	38	473.96		
	Total	19662.74	41			
SGA/S 2018	Between Groups	426.17	3	142.06	0.601	0.619
	Within Groups	8034.27	34	236.30		

	Total	8460.43	37			
COGS 2019	Between Groups	24990690260.61	3	8330230086.87	0.601	0.618
	Within Groups	526727231470.51	38	13861242933.43		
	Total	551717921731.12	41			
SGA 2019	Between Groups	1775943687.65	3	591981229.22	0.975	0.416
	Within Groups	20646513448.76	34	607250395.55		
	Total	22422457136.41	37			
COG/S 2019	Between Groups	1811.24	3	603.75	1.390	0.261
	Within Groups	16065.65	37	434.21		
	Total	17876.89	40			
SGA/S 2019	Between Groups	339.84	3	113.28	0.420	0.740
	Within Groups	9169.44	34	269.69		
	Total	9509.28	37			
Operating Income - EBIT 2016	Between Groups	2400603280.17	3	800201093.39	0.203	0.894
	Within Groups	201317682153.59	51	3947405532.42		
	Total	203718285433.75	54			
Net Income - NI 2016	Between Groups	733381012.25	3	244460337.42	0.253	0.859
	Within Groups	50155298523.24	52	964524971.60		
	Total	50888679535.49	55			
Return on Assets ROA 2016	Between Groups	199.82	3	66.61	0.776	0.513
	Within Groups	4379.98	51	85.88		
	Total	4579.80	54			
Net Income/Sales ROS 2016	Between Groups	772.85	3	257.62	1.329	0.275
	Within Groups	10078.21	52	193.81		
	Total	10851.06	55			
Operating Income to Net Sales - OI/S 2016	Between Groups	1832.65	3	610.88	1.692	0.180
	Within Groups	18775.83	52	361.07		
	Total	20608.48	55			
Sales Per Employee R/E 2016	Between Groups	98581933767834.30	3	32860644589278.10	0.857	0.470
	Within Groups	1917343538574060.00	50	38346870771481.20		
	Total	2015925472341900.00	53			
Operating Profit Per Employee OI/E 2016	Between Groups	1129067601623.97	3	376355867207.99	0.991	0.405
	Within Groups	18981828676067.00	50	379636573521.34		
	Total	20110896277691.00	53			
Net Income Per Employee NI/E 2016	Between Groups	285971358519.50	3	95323786173.17	0.680	0.568
	Within Groups	7008888151700.60	50	140177763034.01		
	Total	7294859510220.10	53			
Operating Income EBIT 2017	Between Groups	5436975894.72	3	1812325298.24	0.357	0.784
	Within Groups	269185719200.95	53	5078975833.98		
	Total	274622695095.68	56			

Net Income NI 2017	Between Groups	3354464366.07	3	1118154788.69	0.537	0.659
	Within Groups	110408637921.11	53	2083181847.57		
	Total	113763102287.17	56			
Return on Assets ROA 2017	Between Groups	404.61	3	134.87	1.157	0.335
	Within Groups	6060.13	52	116.54		
	Total	6464.74	55			
Net Income/Sales ROS 2017	Between Groups	1285.42	3	428.47	1.625	0.195
	Within Groups	13976.63	53	263.71		
	Total	15262.05	56			
Operating Income to Net Sales OI/S 2017	Between Groups	1235.55	3	411.85	1.783	0.162
	Within Groups	12240.79	53	230.96		
	Total	13476.34	56			
Sales Per Employee R/E 2017	Between Groups	101761545123589.00	3	33920515041196.50	0.809	0.495
	Within Groups	2096085147579040.00	50	41921702951580.70		
	Total	2197846692702630.00	53			
Operating Profit Per Employee OI/E 2017	Between Groups	1084887562494.67	3	361629187498.22	0.940	0.428
	Within Groups	19226862964192.00	50	384537259283.84		
	Total	20311750526686.70	53			
Net Income Per Employee NI/E 2017	Between Groups	217338395047.60	3	72446131682.53	0.707	0.552
	Within Groups	5122391271118.29	50	102447825422.37		
	Total	5339729666165.89	53			
Operating Income EBIT 2018	Between Groups	1204401272.45	3	401467090.82	0.495	0.687
	Within Groups	39741595638.78	49	811052972.22		
	Total	40945996911.22	52			
Net Income NI 2018	Between Groups	919240672.33	3	306413557.44	0.562	0.643
	Within Groups	26726647427.55	49	545441784.24		
	Total	27645888099.88	52			
Return on Assets ROA 2018	Between Groups	168.31	3	56.10	0.806	0.497
	Within Groups	3202.89	46	69.63		
	Total	3371.19	49			
Net Income/Sales ROS 2018	Between Groups	577.81	3	192.60	0.522	0.669
	Within Groups	18089.76	49	369.18		
	Total	18667.58	52			
Operating Income to Net Sales OI/S 2018	Between Groups	1192.65	3	397.55	0.878	0.459
	Within Groups	22195.56	49	452.97		
	Total	23388.21	52			
Sales Per Employee R/E 2018	Between Groups	5477822882195.59	3	1825940960731.86	0.328	0.805
	Within Groups	250407921013628.00	45	5564620466969.50		
	Total	255885743895823.00	48			

Operating Profit Per Employee OI/E 2018	Between Groups	110359743466.74	3	36786581155.58	0.196	0.898
	Within Groups	8436014337800.48	45	187466985284.46		
	Total	8546374081267.22	48			
Net Income Per Employee NI/E 2018	Between Groups	58526339289.53	3	19508779763.18	0.162	0.922
	Within Groups	5429365174740.89	45	120652559438.69		
	Total	5487891514030.43	48			
Operating Income EBIT 2019	Between Groups	670146430.34	3	223382143.45	0.218	0.883
	Within Groups	50176833318.47	49	1024017006.50		
	Total	50846979748.81	52			
Net Income NI 2019	Between Groups	485543265.14	3	161847755.05	0.222	0.880
	Within Groups	35653855343.48	49	727629700.89		
	Total	36139398608.62	52			
Return on Assets ROA 2019	Between Groups	414.99	3	138.33	1.655	0.189
	Within Groups	4096.32	49	83.60		
	Total	4511.31	52			
Net Income/Sales ROS 2019	Between Groups	1114.95	3	371.65	1.055	0.377
	Within Groups	17256.17	49	352.17		
	Total	18371.12	52			
Operating Income to Net Sales OI/S 2019	Between Groups	1128.82	3	376.27	1.115	0.352
	Within Groups	16541.27	49	337.58		
	Total	17670.10	52			
Sales Per Employee R/E 2019	Between Groups	5202096431800.46	3	1734032143933.49	0.332	0.802
	Within Groups	245651576002050.00	47	5226629276639.37		
	Total	250853672433851.00	50			
Operating Profit Per Employee OI/E 2019	Between Groups	81047540801.04	3	27015846933.68	0.203	0.894
	Within Groups	6260907182944.40	47	133210791126.48		
	Total	6341954723745.44	50			
Net Income Per Employee NI/E 2019	Between Groups	90843736539.12	3	30281245513.04	0.320	0.811
	Within Groups	4453355594717.09	47	94752246696.11		
	Total	4544199331256.21	50			

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ABSTRACT

SOFTWARE AS A SERVICE: THE MEDIATING ROLE OF CONSEQUENCES OF SAAS DIFFUSION ON FIRM PERFORMANCE

by

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There are ample studies that support a positive link between information technology and firm performance. Bharadwaj (2000) and Chae (2014, 2018) are two examples that provided a foundation for this work. These scholars looked at how capabilities associated with information technology contribute to improved financial performance using a specific set of financial ratios. In addition, there are studies that examine a positive link between Software-as-a-Service (SaaS) and firm capabilities like innovation. Malladi and Krishnan (2012) also provided substantiation for this work. My 30 years of work in the technology field as a practitioner gave me a daily view of how some firms harnessed the power of technology while others stay mired in the clutches of status quo bias. My experience with SaaS exaggerated that view and propelled me on a quest to understand more about this technology and its impact on firm performance. The scholarly work from Bharadwaj, Chae, Malladi and many others gave me the background to pursue this additional area of granularity. Specifically, does the diffusion of SaaS, lead to firm competencies such as; innovation, agility organizational learning, speed, focus on core competency, and new projects. Do those competencies contribute to higher levels of firm performance? Using data from over 550 firms across the US, we examined both subjective and objective firm performance and indeed

found a positive link between higher levels of SaaS diffusion and improved firm performance, namely operating income/sales and net income/sales. In addition, we found strong mediation links between SaaS diffusion, specific firm capabilities like innovation and agility among others and improved revenue and productivity. These links contribute to a noticeable gap in the academic literature examining SaaS vs the often examined but more vague cloud computing. It also gives practitioners and IT executives a place to start in moving their organizations toward the diffusion of SaaS and encouraging their organizations to develop enhanced skills that contribute to higher firm performance.

AUTOBIOGRAPHICAL STATEMENT

Cristina Recchia has spent her most of her career as a successful sales executive in the technology industry. After graduating from Michigan State University's James Madison College, she began her career at IBM in Detroit, Michigan on the General Motors Account Team.

In the mid-1990s she was recruited to join Sun Microsystems, where she spent eleven successful years embroiled in business disruptions. In the mid-2000s she left the technology industry for a few years to pursue work in marketing with various firms. In 2012, she joined Salesforce.com where she developed an appreciation for how SaaS could transform business practices.

For decades she was exposed to the disruptions of innovations in the business world and developed a keen interest in understanding how to anticipate and manage innovation and technology change. She became interested in education that could help her advance the diffusion of innovation for the improvement of business. After completing her MBA at Wayne State University (WSU), she decided to pursue a PhD to understand more specifically how advanced technology and newer delivery methods like cloud-based SaaS impacted business performance. In 2019, Cristina started teaching customer relationship management (CRM) at Wayne State University's Mike Ilitch School of Business and innovation and technology change at the WSU School of Engineering as an adjunct faculty member.

Outside of work and school, Cristina and her husband, Robert Recchia live in Birmingham, MI. They have six children, and two Labrador therapy dogs. Cristina is a Master Gardener with Michigan State University Extension and works regularly with the boys of the Christ Child House in Detroit in a horticulture and animal therapy program. Cristina will continue to pursue research, writing and teaching about advanced technology and its impact on business performance.