

Creation of a Unified Cloud Readiness Assessment Model to Improve Digital Transformation Strategy

Daniel Reed Smith

School of Technology, Northcentral University, Scottsdale, the United States

Email address:

d.smith1909@o365.ncu.edu

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Abstract: Digital transformation can disrupt any organization in any industry, but few organizations have successfully transformed. For an organization to transform digitally, a firm must adopt new technologies that enable it to change how it creates value. One of the most crucial new technologies organizations need to facilitate digital transformation is Cloud services. Cloud-based technologies are necessary for digital transformation because they allow a firm to cost-effectively obtain needed infrastructure capacity, processing, and developmental flexibility to support advanced analytical tools and methods. Implementing and adopting cloud services can be challenging and requires firm leaders and transformation teams to have an effective strategy that requires understanding a company's cloud readiness. Multiple organizational factors can impact cloud readiness, and depending on a firm's strengths or weaknesses, each element will support or hinder the adoption of cloud services. Understanding a firm's cloud readiness has been shown to improve an organization's adoption of cloud services, but assessing readiness can also be challenging since different assessment models determine readiness in varying ways. Readiness assessment models range from generic technology adoption models to specific cloud services readiness models, and a unified approach is needed that combines the strengths of each model to create a more comprehensive assessment model. A meta-analysis of current readiness assessment models was conducted to identify what crucial factors of an organization need to be assessed. The findings show that there seems to be significant agreement that a company's strategy, current technology, existing operations, and external factors are crucial readiness factors. More recent assessment models also identify gaps in past models, especially on human capital capabilities, system flexibility needs, and security. A more unified cloud assessment model is proposed based on the analysis showing that a firm's readiness should be based on seven crucial factors: strategy, technology, current operations, external requirements, human capital, system flexibility, and security. The new proposed assessment model provides a more comprehensive assessment of a firm's cloud readiness and enables organizations to create an improved adoptions strategy that will better support a company's digital transformation.

Keywords: Cloud Services, Data Science, Cloud Readiness, Innovation, Digital Transformation, Technology Readiness

1. Introduction

The need for digital transformation impacts almost every industry, and the technology and methods can disrupt and change practically any business model, service, or product [1, 2]. For an organization to digitally transform requires a firm to adopt and integrate new technology, tools, skills, and even change infrastructure to modify its business model and create new value not possible before transformation [2]. One of the most fundamental technologies companies need to adopt is cloud services due to its superior capabilities and lower costs [3]. Adoption of cloud services can involve many new

technologies, from virtualized systems, networks, and data storage to integrated advanced analytical tools and methods such as big data and artificial intelligence [3, 4]. Despite the potential advantages of cloud services, many firms and industries have struggled to adopt cloud services due to various challenges, required changes to a firm's technology architecture, and poor implementation strategies [2, 5]. Organizational leaders can accelerate the adoption of cloud technology and their organization's digital transformation by creating an improved cloud implementation strategy that

assesses a firm's cloud readiness to identify likely challenges that will inhibit cloud technology adoption [6, 7]. Despite the possible value of determining a firm's cloud readiness within an adoption strategy, assessing readiness can be challenging, and researchers differ on what factors should be evaluated to determine cloud readiness.

This research builds upon prior cloud readiness assessment work using meta-analysis to propose a unified and comprehensive cloud readiness assessment model. The proposed new model incorporates the critical elements of previous models, wherein scholars mostly agree while also helping reconcile differences in past assessment models. The proposed unified cloud readiness assessment model should better identify a firm's cloud readiness to assist leaders, and digital transformation teams create an improved cloud implementation strategy.

2. Digital Transformation and Cloud Services

2.1. Digital Transformation

Digital transformation tends to describe the use of innovative technologies that can dramatically change a firm's performance, operational efficiency, and offerings [8]. Some argue that digital transformation requires more than just technology, but there seems to be a consensus that digital transformation is impossible without adopting new technologies [9–11]. The new technologies that may be adopted as part of a company's digital transformation can be vast, ranging from robotics to internet of things (IoT) devices to complete hardware and software infrastructure changes [12]. Even though digital transformation technologies can vary, cloud-based services are one of the core technologies that enable digital transformation.

2.2. Cloud Services Needed for Digital Transformation

Effective adoption and use of transformational technologies require that an organization has tremendous flexibility in its information technology (IT) infrastructure. The flexibility includes an ability for a firm to scale processing power, on-demand expansion of data storage, rapid deployment of applications, tight integrations in hardware and software, and the ability to control the environments and devices within the IT infrastructure more centrally [13]. Digital transformation requires an organization to effectively utilize all the data it has access to, internally and externally, and even from sources not customarily utilized like text and sensor data [14]. Effective use of organizational information is not limited to just data storage but also includes the ability to organize, analyze, and leverage data as an enterprise asset utilizing advanced analytical, machine learning, artificial intelligence tools, and methods [4, 15, 16]. Cloud services are crucial to digital transformation because adoption of the services enables a firm to rapidly support various new technologies and provide the needed flexibility related to processing power, software deployments, and data storage at a

lower cost [17, 18]. Cloud services also can immediately improve a firm's infrastructure from legacy and often "on-premise" systems with tightly integrated advanced analytical, machine learning, and artificial intelligence tools and services that would be difficult, if not impossible, to replicate in an on-premise environment [4, 19–21]. Even though cloud services needed for digital transformation can be easier to implement and scale than on-premise systems, implementation can still be challenging.

2.2.1. Common Challenges with Cloud Implementation

Cloud implementation challenges can vary by industry and the chosen deployment methods. Some difficulties may be more significant depending on the industry; however, implementation challenges have many commonalities. For example, highly regulated industries like banking may have even more challenges related to external environments since banking can have more legal and regulatory requirements [22]. Industries like manufacturing have unique challenges in incorporating machines, robotics, and managing physical goods [23]. How a firm chooses to implement its cloud services can significantly impact complexities and readiness depending on whether deployment involves public, community, private, hybrid, multiple providers, or some blended cloud deployment model [24]. Even though challenges may vary, common themes or categories of challenges tend to arise.

Researchers may utilize different terms to identify challenges; however, cloud implementation difficulties are mostly related to organizational norms or culture, strategy, executive support, technology, security, operations, human capital, or external factors [5, 24–28]. Perception challenges relate to the perceived value or difficulty the leaders or other decision-makers have about cloud services or the requirements to implement the technology [26, 27]. Strategy challenges involve implementation problems due to misalignments or lack of involvement of cloud services with the company's strategy [5]. Executive support challenges relate to the issues that come from a lack of executive leadership support for cloud implementation [5]. Technology challenges tend to include gaps, misalignments, or limitations that the organization currently must make cloud implementation more complex [26, 27]. Security challenges involve all the difficulties, risks, and additional overhead required to protect all systems a firm migrates to the cloud services [28]. Security obstacles also include problems with the control and privacy of cloud data and systems [28, 29]. Operational challenges include all challenges that come from effectively integrating cloud services into the company's operations [26, 27]. Human capital challenges relate to human-related difficulties such as lack of skill base or human capital resource limitations [5, 27, 30]. External challenges involve all the problems or complexities from external forces such as market competition, legal, regulatory, or social pressures [31, 32]. Organizations can minimize challenges and improve implementation success if leaders understand the firm's current cloud readiness.

2.2.2. Cloud Readiness Assessments and Improved Implementation Strategy

Technology implementation strategies help translate

organizational leadership objectives into goals, objectives, and tactics that produce the desired outcomes [6, 33]. Strategic planning IT and innovative technology require understanding the current state and articulating the plan to move the organization from its current state to the desired future state [9, 34]. Technology readiness assessments are a valuable part of implementation strategy planning because they can help organizational leaders understand the organization's current state, and they can help enable the implementation teams to incorporate mitigation strategies into the implementation plan [35, 36]. Since many organizations understand the value of cloud services, several assessment models have been created.

3. Cloud Assessment Models or Frameworks

Technology assessment models tend to be generic or focused. Generic technology acceptance models assess a firm's general readiness to accept new technology and can be

used for a specific technology, but a particular context is not needed [37, 38]. Focused assessment models may center on a particular technology, like cloud services, or for more specific applications, like cloud services in manufacturing [23, 39]. Cloud assessment models have been created in more recent years as demand for cloud services and implementations have increased; however, cloud assessment models began to surface in research after cloud services, and the related technologies were first commercialized.

Early cloud assessment tools seemed to focus on whether a company would adopt the technology at all or if the technology could be viable or valuable [40, 41]. More recent assessments assume that cloud services are a possible technology that an organization should strive to integrate [24, 27, 42]. Recent readiness assessments incorporate the valuable aspects of historical models while incorporating more model factors that impact organizations and align with current digital transformation trends making model assessment tools preferable to historical models.

Table 1. Existing Cloud Readiness Assessment Models.

Model Name	Authors/Yr	Readiness Factors
Cloud Readiness Assessment Framework	Alemeye and Getahun (2015)[42]	a. Observable result b. Compatibility with existing practices c. Perceived usefulness d. Executive support
A Cloud Readiness Assessment Framework: For Enterprise Content Management and Social Software in SMEs	Colicchio et al. (2015) [43]	a. Organization b. Strategy c. Mobility and velocity d. Technical e. Growth and scalability f. Data and content g. Software h. Process
Cloud Maturity Assessment Model	Conway et al. (2017) [39]	a. Strategic planning b. Governance, regulatory, and legal c. Data management d. Costs e. Suppliers f. Agility
Adoption Readiness Assessment Model	Workineh et al. (2017) [44]	a. Technology b. Organization culture c. Strategy d. People e. Financial f. External environments
Metrics Suite of Cloud Computing Adoption Readiness	Kauffman et al. (2018) [45]	a. Technology b. Organization c. Strategy d. Economic and valuation e. Regulation and environment
Cloud Migration Readiness Assessment (CMRA)	Alshdadi et al. (2020) [46]	a. Reliability b. Security c. Interoperability d. Organizational area e. SLA requirements f. Migration plan g. Compliance and regulations

Table 1 summarizes some of the most prominent cloud assessment models and each model's related readiness factors. The selected cloud readiness models are recent, not overly

focused on any given industry, and primarily created to assess a firm's cloud service implementation readiness.

Alemeye and Getahun's [42] "Cloud Readiness Assessment

Framework" was based on original survey research of organizational leaders and what they identified as crucial readiness factors for cloud integration. The first model found that organizations are more ready for cloud integration if integration provides observable outcomes. It has compatibility with existing practices, perceived usefulness (including a relative or competitive advantage to using the technology), and executive support implementation. Colicchio et al.'s [43] "*A Cloud Readiness Assessment Framework: For Enterprise Content Management and Social Software in SMEs*" model was created utilizing semi-structured interviews with cloud integration subject matter experts. This second model incorporated levels of readiness in addition to the various identified factors [43]. Colicchio et al.'s [43] model had general readiness categories relating to an organization's receptiveness to cloud technologies based on strategy, technical, data, software, and processes elements. The researchers also include an organization's need for mobility and velocity of software and data, the types of data it utilizes, and the growth and scalability requirements of the organization [43]. Conway et al.'s [39] "*Cloud Maturity Assessment Model*" used a similar methodology as the prior model and leveraged cloud subject matter experts and related academic thought leaders to create the readiness model. The third model also identified firms with the flexibility and agility needs, data management, and aligned strategy as more ready while including factors like governance and regulations, costs, and even supplier capabilities [39]. Workineh et al.'s [44] "*Adoption Readiness Assessment Model*" was developed from multiple adoption theories and aligned with other assessment models while adding new people, financial, and external factors.

The fourth model also identifies technology, strategy, costs (e.g., financial), and even external factors like laws and regulations while emphasizing the people or human factors like organizational culture and the skills of internal talent [44]. Kauffman et al.'s [45] "*Metrics Suite of Cloud Computing Adoption Readiness*" was developed through exploratory interviews with senior leaders who integrated cloud services. The fifth model identified many factors relating to technology, the organization, strategy, costs, and external environments [45]. Alshdadi et al.'s [46] "*Cloud Migration Readiness Assessment (CMRA)*" was created utilizing a case study of organizations that integrated cloud services. The last model shared similarities with other models, including factors relating to current technology (e.g., interoperability), the operations (e.g., organizational area), and compliance and regulations but also included some new factors like reliability, security, service level agreement (SLA) requirements, and migration plans [46]. A review of the readiness assessment models shows similarities and differences in the readiness models.

Comparing and contrasting the cloud readiness assessment models identifies significant agreement in many relevant factors to integrating cloud services. Almost all models identify a firm's strategy and current technology as crucial for cloud readiness. There is also significant agreement that costs

or financial aspects, organizational culture or operational environments, and external environment (e.g., laws and regulations) are good readiness indicators. Some researchers emphasized the human or people, data, and system flexibility (e.g., agility, scalability, interoperability). There seem to be several factors that were relevant by some researchers but not others, such as perceived value, supplier requirements, security reliability, and migration planning. An effective unified assessment model should include all the factors that had substantial overlap or consensus while including additional factors that help comprehensively assess a firm's readiness.

4. Recommended New Unified Cloud Assessment Model

An improved assessment model is proposed based on predominant models, needs relating to digital transformation, and factors that can increase challenges with implementing cloud technologies creating a more unified model. Figure 1 illustrates the seven recommended factors in the proposed "Unified Cloud Readiness Assessment Model." The first four factors of strategy, technology, current operations, and external are the dimensions that have significant overlap between the predominant current cloud readiness models. Some assessment models found the remaining factors, including (e.g., human capital, flexibility, and security, in more recent ones).

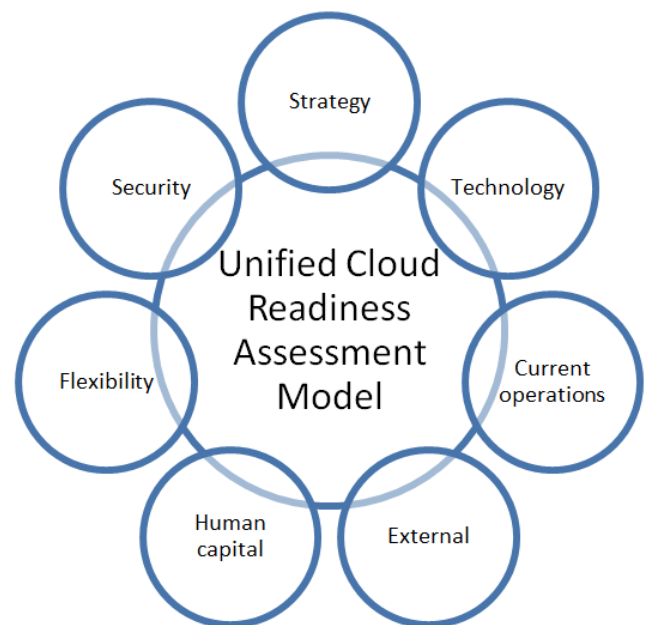


Figure 1. Unified Cloud Readiness Assessment Model.

A firm's strategy remains a critical factor because if the company's strategy is aligned with using cloud services, implementation will need executive support. Additionally, a company will not be ready to adopt cloud technologies if it has not identified how to incorporate cloud services into its strategy or if its leadership does not understand the value of

integrating cloud services. Technology factors are a broad element that directly relates to a firm's readiness. Firms with outdated technology are less ready to utilize cloud systems with more modern systems or partial cloud use. Current operations also can highly influence cloud readiness because if the current operational culture limits adoption of new technology or is heavily reliant on manual processes is less ready than ones with more IT integrated or used within operations. External factors relating to rapidly changing laws, regulations, and standards that have significantly increased in recent years make firms that already have risk and governance standards more ready to adopt cloud than those that do not. It is also important to note that external factors are crucial since external requirements can significantly limit a firm's readiness, especially in highly regulated industries. Human capital factors have become a more prevalent element identified in later assessment models. Human capital can cause a significant hindrance to effective implementation since new technologies, like cloud services, usually require new and unique skills that tend to be absent in organizations until a firm begins implementing the technology [24, 30, 44–46]. Flexibility is a multifaceted factor that incorporates a firm's need for agility, scalability, reliability, and interoperability. Firms that require greater flexibility are more ready for cloud integration since they will significantly benefit than firms that do not require higher levels of flexibility. Security was only minorly touched on by most readiness assessment models, surprising since security concerns and needs have been one of the most significant limiting factors of why leaders of some industries are resistant to moving to cloud environments [28, 29, 32]. Some security concerns may be reduced depending on how a firm deploys cloud services; however, security needs to be assessed since the technology introduces the firm to new risks that the firm will have to be prepared to manage.

5. Conclusion

Digital transformation of an organization is imperative for a firm to remain competitive, and the changes will likely impact every industry. As organizations seek to transform digitally, they will need to adopt cloud services to create the infrastructure and organizational capabilities required. A company's leaders and transformation teams will need to create a proper implementation strategy that requires a comprehensive assessment of a firm's readiness to adopt the various cloud services. As was shown, numerous readiness assessment models have been created; however, none are comprehensive, and each places importance on varying elements of the organization. Current assessment models show different degrees of overlap; however, none can be considered exhaustive. A unified cloud readiness assessment model is proposed that aligns and combines the various readiness assessment models to create a more comprehensive way for an organization to assess its readiness to adopt cloud services. It is important to note that the proposed unified approach does not emphasize the cost of clouds services even

though cost or financial factors are found in many of the assessment models. The proposed unified model omits financial or costs as a readiness factor, unlike prior assessment models because the migration to cloud services should decrease the long-run costs of an organization, is on-demand and only charged based on usage, and does not require upfront technology acquisition costs reducing the need to assess it as a readiness factor [3, 16, 24]. The unified model is based on seven crucial readiness factors: strategy, technology, current operations, external requirements, human capital, system flexibility, and security. Since cloud services adoption should help any organization digitally transform, it is anticipated that the new unified readiness assessment model will help any organization's leaders better formulate a firm's cloud integration strategy to support digital transformation.

6. Limitations and Future Research

One of the most significant limitations of this research was that the proposed new model was limited to a theoretical context without any validation or application. Additionally, the unified new assessment model is intended to be universal; however, unique factors (e.g., company size or industry) may need to be considered. Future research could be done in an applied setting to determine if the theoretical model has the anticipated utility. Additionally, new research could also be done using varying company sizes or industry applications to determine if the model should be adapted for varying contexts.

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