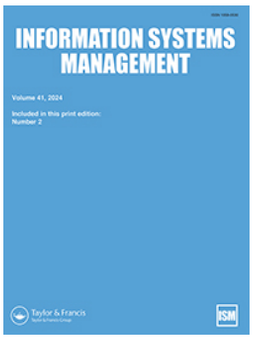

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An Exploration of Factors Influencing Work from Home During Covid-19

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ABSTRACT
This research presents a field survey of 328 individuals' perceptions of their work from home (WFH) during Covid-19. This study challenges prior research that assumed most people were not suited for WFH and addresses a gap by looking at technology and support for WFH. The results led to a new model of technology resources and individuals' satisfaction with the resources as they relate to WFH success.

KEYWORDS
Work from home; WFH; covid-19; DeLone & McLean; information quality; resource usage satisfaction; service satisfaction; cybersecurity satisfaction; added resources satisfaction; work success

Introduction

Covid-19 prompted a shift in workplace environments from in-person offices to work from home (WFH). This shift caused a rethinking of the ways in which modern organizations offer working arrangements to their employees. Remote work was an unfulfilled promise of the last century, when the internet and networks provided the technological infrastructure for employees to WFH (Nilles et al., 1976; Potter, 2003). Resistance toward WFH focused on social and managerial beliefs that working from home lowered productivity, hampered collaboration, and was not suitable for most people (Bloom et al., 2015; Hill et al., 2003; Nguyen, 2021). The COVID-19 pandemic abruptly accelerated the move toward WFH, creating something of a worldwide social experiment. As an outcome of forced WFH, organizations rapidly reconfigured their hardware and software infrastructure to provide a virtual approximation of the traditional office for their employees. Information systems (IS) that work at the core of modern organizations and had been extensively studied for their role in successfully achieving office task outcomes now had to achieve the same outcomes for WFH workers.

The DeLone and McLean (D&M) model of Information Systems Success, first developed in 1992, studied how system reliability, system output quality, information quality, and service quality impacted individual performance, and consequently, contributed to organizational success. Over the past three decades, the D&M model has been extensively supported in various contexts for understanding how employees' experiences with new and existing information systems impact workplace efficiency (DeLone & McLean, 1992, 2003; Petter et al., 2013). The D&M model has over 25,000 citations (DeLone & McLean, 1992, 2003; Petter & McLean, 2009; Petter et al., 2013) and over 10,000 supporting studies (Petter & McLean, 2009) making it one, if not the most, cited and supported model in information technology research. The D&M model has changed several times over the years to adjust to changes in the environments of computing from mainframes to distributed systems but has focused primarily on success of applications as they move from development to production.

Though telecommunications enabled remote work since the 1980s, few companies supported staff WFH. In 2019, less than 6% of the U.S. working population worked from home at least one day a week (U.S. Census Bureau, 2022). Research before COVID-19 rarely attended to technology for WFH with fewer than 10% of studies mentioning any technology significance (Nicklin et al., 2016). This is a gap in past research on how the stage was set to enable successful WFH. The availability of hardware, software, internet access, and communications technology was assumed adequate or found to be underused by researchers in the 50 years of studies we evaluated (cf. Allen et al., 2013; Bailey & Kurland, 2002; Bloom et al., 2015; Hill et al., 2003; Nicklin et al., 2016; O'Rourke, 2021; Olson, 1989; Olson & Primps, 1984; Pratt, 1984, 1988, 1993, 2000; Ramsower, 1983; Suh & Lee, 2017). Prior research focused on what work was performed, emotional and work issues that arose, and the potential future for WFH but the foundational assumption that technology was

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adequate for the work was never questioned. This research addresses that gap.

Because of the gap between WFH and work in an office, the D&M model does not address all needs of WFH. First, virtually every day, some organization reports a digital break-in or shutdown from a global hacker organization (Privacy Rights Clearinghouse, 2021), requiring heightened security (Conger, 2020). In addition, jobs have changed such that knowledge work now represents most work in organizations, resulting in all workers having personal computers, and often personal printers, copiers, and job-specific software to perform their work (Napoleon & Gaimon, 2004). Moreover, WFH requires job-specific, user-centered technology (Twomlow et al., 2022) and 24×7 service support (Conger, 1994). As a result, the generic mainframe-oriented technology areas that were studied in D&M's model are no longer completely adequate to accommodate a WFH model of work. Specifically, the WFH locale and context differ significantly from prior evaluations of the D&M model in terms of employee responsibilities for their entire workspace and satisfaction with cybersecurity, work resources, and service support for WFH.

In this research, we extend the D&M model to focus on aspects of individual WFH information systems (IS) success during the COVID-19 pandemic using D&M's IS model as the basis. The research question is *to what extent does COVID-19 impact WFH success as it relates to system reliability, system output quality, information quality, service quality, and satisfaction with resource usage, support, cybersecurity, and added resources*? This research is important because many managers and researchers long have assumed that technology was completely adequate for the work being performed at home and that a substantial portion of workers did work that was not suitable for WFH, that most individuals were not disciplined enough for WFH, and that most employees could not bear the social isolation for successful WFH (Bloom et al., 2015; Hill et al., 2003; Nicklin et al., 2016). In addition, this research expands the applicability of the D&M model to the WFH context, adding new constructs to modernize the model for WFH issues.

Background

In this section, the need for WFH is developed by a discussion of the history of telework that has morphed into WFH, originally with little emphasis on technology and more emphasis on the work to be conducted. Then, we develop each of the constructs and describe the model tested in this research.

History of work from home

Work from home (WFH), developed from many movements, alternatively referred to as telecommuting, remote work, distance work, telework, mobile work, virtual office, work from anywhere, and many others (Bailey & Kurland, 2002; Hill et al., 2003; J. Lee, 2016; Nicklin et al., 2016; Nilles et al., 1976). In all of these types of work, the individual does not "commute" to an "office" but rather works from a remote location that might include a home office, hotel room, coffee shop or other venue. Ironically, before the Industrial Revolution, most workers worked at home; eventually, industrial technologies forced workers to go to a workplace, often for up to 16 hours a day (J. Lee, 2016). As computers and networking matured, workers were again freed of the work*place* to work anywhere, and new patterns of work locations once again emerged. While telework is not well defined, its definition generally excludes the self-employed, contractors, freelancers, and mobile workers and includes individuals who are employed by companies, who report to others, and get work assignments from others (Bailey & Kurland, 2002; Hill et al., 2003; Nicklin et al., 2016; Pratt, 1993).

The conditions of WFH are quite flexible in terms of time, location, collaboration with others, and autonomy (Deci & Ryan, 2000; Nicklin et al., 2016). Pros and cons apply to the organization and the individual. For instance, because of those allowed to WFH, organizations experience reduced overhead, reduced turnover, an increased talent pool, some loss of control over remote staff, higher demand on computing resources, and increased cybersecurity issues (Bailey & Kurland, 2002; Hill et al., 2003; Nicklin et al., 2016). Individuals who WFH reported increased job autonomy and job satisfaction, lower stress, and increased flexibility on many aspects of job and life; but some also experienced higher life stress, social and work isolation, missed work opportunities, and work/life imbalance and conflicts (Kurland & Bailey, 1999; Nicklin et al., 2016; Pratt, 1993). Moreover, many managers believed that most workers would not effectively WFH because of a wrong temperament, attitude, or other impediment (Bailey & Kurland, 2002; Bloom et al., 2015; Hill et al., 2003). WFH research focused on user perspectives, ignoring technology. When technology was

mentioned, it was not granular enough to allow an assessment of its effect on user work success (cf. Allen et al., 2013; O'Rourke, 2021; Olson, 1989; Olson & Primps, 1984; Pratt, 1984, 1988, 1993, 2000; Ramsower, 1983; Suh & Lee, 2017; Thompson, 2017). This research seeks to evaluate the extent to which business employees felt their work relationships and work quality were affected by WFH.

DeLone & McLean constructs

System quality is defined as the perceived performance desired by users when interacting with computer systems, whether mainframes, local servers, or networked personal computers (Wang & Liao, 2008). System quality is comprised of four underlying constructs – system reliability, application output quality, information quality, and service quality (DeLone & McLean, 2003). The four constructs – system reliability, system output quality, information quality, service quality – are the backbone of the D&M model (DeLone & McLean, 1992, see Figure 1) and are supported by research over a 30-year period that uses the constructs individually, integrated, or deconstructed in some way (Al-Hubaishi et al., 2017; Au et al., 2008; Barki & Hartwick, 2001; Chiu et al., 2007; Chua et al., 2012; Jaakkola et al., 2017; Jiang & Klein, 1999; Kettinger & Lee, 1994; Tan et al., 2013).

System reliability refers to the hardware, firmware, and networking aspects of systems (Barki & Hartwick, 2001). From an individual's point of view, system reliability for WFH requires constant computer access and system reliability provides that (Ding & Straub, 2008). When a system is not functioning properly, system reliability is not achieved.

Application output quality refers to data that has been manipulated by company-supplied applications and is output to users. Users assume that the data have been exhaustively and accurately edited and tested, that computations are perfect, and that they can rely on the computed data to make decisions and perform their daily tasks (Conger, 1994).

Information quality refers to system data presented in any form. Information quality includes attributes such as relevance, understandability, accuracy, and completeness (DeLone & McLean, 1992, 2003; Petter et al., 2008). Application output quality and information quality both assume that data, whether in applications or databases, is accurate and ready for use.

Service quality is determined by the extent to which the desired outcome is achieved at the desired level of quality in the time expected. "A service is a situated process that includes its context, governance and defined delivery quality" (Conger, 2012, p. 23). Service quality, in the form of help received using computing resources, comes from IS support staff and is important during lockdown and isolation. Thus, while D&M's model was developed for apps immediately after implementation, it seems appropriate for WFH as well.

Extended constructs

Several new constructs were developed for this research to update the D&M model for WFH conditions. The new constructs include satisfaction with resource usage, support, cybersecurity, and added resources. Each is defined and explained in this section. These constructs make sense because, if employees are not happy with these aspects of WFH, they are unlikely to be able or motivated to work at the same level of quality at which they worked in an office. Most research on data centers focuses on functioning and is normative or prescriptive, recommending best practices, key performance indicators, or ISO/IEC standards for optimal operational performance (cf. Beloglazov et al., 2012). These are one-sided and ignore the users' perspective. This perspective may result in efficient processes but ineffective support for users.

Similarly, management theories are not appropriate to this research. For instance, a google search for "job demands resources (JDR) during covid" for the period 2020 to 2023 yields over 190,000 results. JDR theory was developed to help explain burnout but eventually has applied to job crafting, the practice of customizing one's job by adjusting resources to better fit the job demands (Demerouti et al., 2001). The JDR model, theory, and questionnaire have been applied to numerous work situations in over 100 countries by many researchers, including during COVID-19 for WFH (cf. De Carlo et al., 2022; Falco et al., 2021; Moreno Cunha et al., 2022). Resources in JDR are inspecific and not granular enough to differentiate digital from physical computing resources and services. Therefore, they are not useful for the type of research we conducted. Similar arguments can be made for other management theories. The constructs we added are defined and explained in this section. If these new constructs

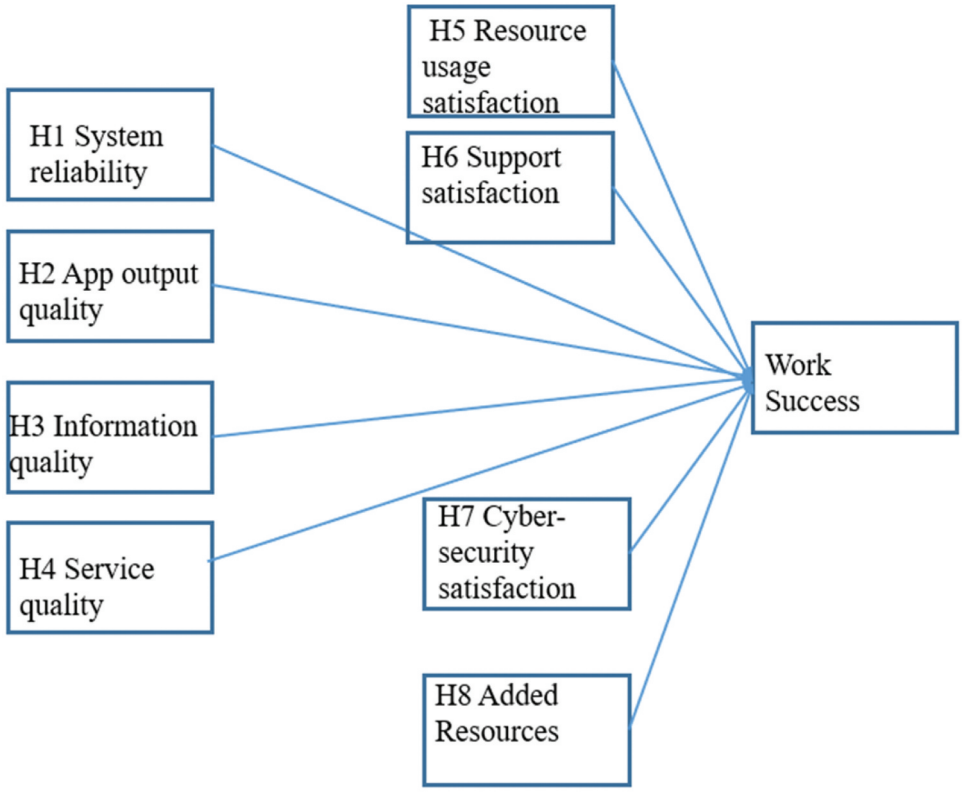

Figure 1. Hypothesized model.

are successfully tested, we can further develop the D&M Model to include them. The model to be tested is shown in Figure 1.

Resource usage satisfaction is the extent to which WFH employees are happy with company-provided hardware, apps, and communications equipment that they are provided for at-home work (Cousins & Varshney, 2009). Companies are expected to provide resources to employees so they may conduct their work. This is never questioned when employees are at a workplace. Employees who own PCs, a printer, pay for internet access, and have other computing resources, may have assumed they would use these to WFH. However, without explicit approval and cybersecurity vetting from their organization, not only is there a cybersecurity liability but also there is a cost to the employee in doing so. Conversely, some employees may live in areas without easy access to the internet and may not own a computer, thus requiring the organization to provide those resources (Conger, 2020). Moreover, communications software, virtual private network (VPN) access hardware and software, and other software may be needed to provide full functionality for these employees to WFH. Resource usage satisfaction with provided resources is important to IS work success because if employees do not have satisfactory resources for their WFH, their work quality and innovativeness may not equal that of the office (Napoleon & Gaimon, 2004). In addition, dissatisfaction with WFH resources could lead to poor relationships between work teams and managers.

Support satisfaction is the perceived quality of information technology (IT) support that employees receive from the IT Department, usually through the Service/Help Desk (hereafter Service Desk). The Service Desk is the organizational function that resolves outages, answers questions, resolves requests relating to IT usage, provides equipment and app provisioning, services requests to access protected or auditable data, and manages events that relate to monitoring for IT failures (Conger, 2016). After a project is initiated, the Service Desk is the main entry to the IT Department. Support satisfaction is the outcome of the IT Services Management (ITSM) process for service desks that were standardized in the ISO/IEC 20,000 ITSM standard in 2005 and updated several times (ISO/IEC, 2018).

Support satisfaction is differentiated from IS service quality in that they measure different aspects of support. Support satisfaction is a broader concept measuring physical (hardware), logical (software), communications, and operational aspects of support whereas service quality relates only to specific software support. Support satisfaction is important to work success because support delays slow or stop the individual

from proceeding until a resolution of the issue is provided. The longer the delay, the less satisfaction exists. If the individual is a team member, the entire team is impacted by support delays and the less likely they are to rely on the Service Desk in the future.

Cybersecurity is defined as activities that protect systems and data (Kim & Solomon, 2018). Cybersecurity is measured by its overall defense-in-depth structure for computing resources and by cybersecurity awareness training provided to employees. Cybersecurity is a crucial IS component due to the increasing number of breaches, sophistication of cybersecurity attacks, and the burgeoning market for hacked information (Jouini et al., 2014; Kappelman et al., 2020; Privacy Rights Clearinghouse, 2021). While there is an ISO security standard – ISO/IEC 27,001, it is supplemented by significant other hardware and software and processes to fully guard an organization's operational computing environment (ISO/IEC, 2022). Remote work adds additional requirements and complexities for both monitoring and software for cybersecurity needs and moves a portion of the cybersecurity burden to individuals who WFH. Thus, those who WFH need to be satisfied with both cybersecurity training and the setup of the cybersecurity they manage while working from home (Vijayan, 2021). As a result, cybersecurity satisfaction was developed to identify the extent to which WFH individuals are to be not only knowledgeable enough but satisfied that they can manage their cybersecurity duties.

Added resources are company-provided hardware, apps, or other resources that employees use to perform their tasks. Added resources at work are an organizational responsibility understood as part of the employment contract (International Labour Organization, 2020; Napoleon & Gaimon, 2004). This construct identifies actual resources provided, where resource usage satisfaction identifies how satisfied employees are with the resources provided. Company-provided resources improve employee productivity and may improve employee job satisfaction, reducing the probability of an employee quitting; therefore, companies provide computing resources as customized for each position (Napoleon & Gaimon, 2004).

Work success, the outcome construct, is of interest in this research because individual work must happen for organizational outcomes to develop. Work success is defined in this research as including individual work quality, work innovativeness, workgroup innovativeness, relationship with the workgroup, and relationship with the manager. These are important because WFH naysayers believed that average workers' work quality and productivity would decline with WFH (Chadee et al., 2021; Lister, 2021; O'Rourke, 2021).

The above constructs are important for WFH during COVID-19 because they contribute to work success. The constructs added to the D&M model seek to show how work success has changed because of Covid-19's need for WFH. Work success is an individual level construct that seeks to measure the extent to which an individual's work quality, innovativeness, team innovativeness, team relationships, and manager relationships prosper during COVID-19 WFH. These indicators differ from D&M's model as their concern was successful use of an application as it transitioned into production.

Hypotheses

H1: System reliability

IS reliability (See Figure 1) is defined as the "probability that the system works successfully in achieving its objectives" (Zahedi, 1987, p. 196). A reliable IS should be available, error free, and functional (Barki & Hartwick, 2001). When IS reliability is at least on par with that of the office, we should expect work success to be about the same. Thus,

H_1: System reliability relates positively to WFH work success.

H2: Application output quality

Application output refers to data that has been manipulated by company-supplied applications. App output must be credible for users to rely on it for decision-making and most users assume they can automatically take the app-supplied information as credible (e.g., Fichman, 2011; Fogg, 2003; Pe-Than et al., 2015). Users generally accept app quality based on inspection, appearance, third-party referrals, and their experience (Fogg, 2003; Fogg et al., 2002). IT Departments strive to meet these user assumptions to achieve WFH success on par with that of the office. Thus,

H_2: Application output quality relates positively to WFH work success.

H3: Information quality

Information quality is perceived when end users have the required information to perform their jobs when it is needed and in the needed form (Au et al., 2008; Karimi

et al., 2004). Employees who WFH expect the information quality of the organization's IS to be of the same level as they experienced while working from the office. Thus,

H_3: Information quality relates positively to WFH work success.

H4: Service quality

When all components of services work, they contribute to employee work success (Al-Hubaishi et al., 2017; Conger, 2012; Kettinger & Lee, 1994; Tan et al., 2013). Service quality in the D&M environment relates to question answering for a specific app for the first six months of its productive life. Service quality in the WFH environment is continuous, encompasses many services, and reinforces that the organization cares about its employees and is invested in their professional success. Thus,

H_4: Service quality relates positively to WFH work success.

H5: Resource usage satisfaction

Resource usage satisfaction relates to acceptance of computing resources, enabling employees to complete their work. Technology resources for WFH improve employee job satisfaction, which contributes to work quality (Napoleon & Gaimon, 2004; Singh & Jain, 2013). Thus,

H_5: Resource usage satisfaction relates positively to WFH work success.

H6: Support satisfaction

Support satisfaction derives from the ease of help on problems during WFH with computers. Support is dependable, prompt, responsive, accessible, and accurate. WFH workers require the same or increased levels of service as they navigate the layers of network access from their home environments. The perceived quality of IS support improves employee satisfaction with the organization's ISs (Ghobakhloo et al., 2010). IS support is one of the main links to the employee's organization, contributing to employee job success (Singh & Jain, 2013). Thus,

H_6: Support satisfaction relates positively to WFH work success.

H7: Cybersecurity satisfaction

Employees need to be satisfied with cybersecurity knowledge and processes they are required to master to sustain work success since an organization's systems are subject to a variety of attacks that can be debilitating (Jouini et al., 2014; Kankanhalli et al., 2003). IS that enables WFH must have cybersecurity as a primary consideration and provide multi-level defense-in-depth to prevent unauthorized access (Jouini et al., 2014). In addition, cybersecurity training is required to prevent staff from inadvertently providing information to hackers and to feel comfortable with WFH responsibilities for maintaining security standards (Vijayan, 2021). Thus,

H_7: Cybersecurity relates positively to WFH work success.

H8: Added resources

Added resources are provided by companies for employees who WFH. Home-office environments often lack the computing resources available in the office and need the company-supplied resources (Napoleon & Gaimon, 2004; Twentyman, 2012). These include resources that enable access to the employer's network, hardware resources such as printers and computers, and apps for computing and communications. To the extent that added resources enable work, they enable work success. Thus,

H_8: Added resources relate positively to WFH work success.

Methodology

WFH research prior to COVID-19 assumed and found that many people were not suited for WFH for a variety of reasons (Du et al., 2018; Nicklin et al., 2016; Yasenov, 2020). We set out to evaluate assumptions about WFH suitability and designed a survey to evaluate the hypotheses. The survey used Likert 5-point scales for most questions unless they were demographics, open-ended, or were originally designed with a different scale.

The survey was tested during February and March 2021 on a convenience sample of 24 university faculty, staff, and alumni. Questions were moved to clarify their purpose based on feedback from the group and several attention questions were added. The survey was launched on Qualtrics May 21, 2021, and responses were fully obtained by May 25, 2021. Respondents consisted of a Qualtrics panel selected to fit our criteria as

Table 1. Summary of constructs, survey questions sources and questions.

Construct	# of Questions	Questions Adapted from these References	Question Topic
System Reliability	5	Barki and Hartwick (2001)	The extent to which the apps and systems are reliable, up and running accurate, doing what they were supposed to do, easy to use
App Output Quality	3	Barki and Hartwick (2001)	The extent of system output information as precise, complete, update to date
Information Quality	6	Au et al. (2008)	The extent of information quality as accurate as expected/experienced, accessible as expected/experienced, accurate as expected/experienced
Service Quality	2	Sethi and King (1999)	The extent of quality of communications with IT staff, systems changes in a timely manner
Resource Usage Satisfaction	3	Sethi and King (1999)	The extent you are satisfied with computer, network, and printer access
Support Satisfaction	4	Teo et al. (2008)	The extent you are satisfied that support is dependable, prompt, responsive, accessible, and accurate
Cybersecurity	6	Sethi and King (1999)	Cybersecurity training, overall security of computing resources, compliance with cybersecurity policies, maintaining compliance regulations, application security, access to sensitive information
Added Resources	4	Sethi and King (1999)	The extent you are satisfied with hardware, software, applications, mobile phones, collaboration apps
Work Success	3 2	Griffin et al. (2007), Hsu and Kernohan (2006)	The quality of your work is high, work is innovative, team's work is innovative (Griffin et al., 2007). The quality of your relationship with your supervisor is good, relationship with peers is good (Hsu & Kernohan, 2006)

discussed below. Warp-PLS 7.0 was used for the structured equation model (SEM) to test the hypotheses. This section provides details of the survey development and sample.

Survey questions

Four constructs summarized the initial 1992 D&M model and included system reliability, app output quality, information quality, and service quality. Five questions on system reliability were adapted slightly from work by Barki and Hartwick (2001, See Table 1). App output quality used three questions from Barki and Hartwick (2001) which were adapted slightly (See Table 1).

Six of 18 questions on information quality from Au et al. (2008), were trimmed to six most relevant to the COVID-19 WFH situation (See Table 1). For service quality, two questions from Sethi and King (1999) were adapted to apply to WFH (See Table 1).

Sethi and King (1999) studied satisfaction with IS and, in their research, asked about satisfaction with different types of computing capabilities, people, resources, and activities. These were used as the basis for two questions relating to resource usage satisfaction, two questions relating to support quality, three questions relating to cybersecurity, and three questions relating to added resources (See Table 1).

Four questions from Teo et al. (2008) were adapted for service satisfaction, relating to dependability and responsiveness (See Table 1).

Five work success questions were based on work from Griffin et al. (2007) and Hsu and Kernohan (2006). Open-ended questions were asked about how companies and IT Departments could improve their IS support.

Sample

We had requested the sample to include 300 respondents with 50 in each age decade beginning with 20–29 and ending with 70–79; this target was originally met with 359 completed surveys and was exceeded in several cases. After cleaning the data, the final sample was $N = 328$ and several categories fell short of the 50 participants. Table 2 shows the age distribution of respondents, indicating that respondents were roughly evenly distributed except for the 20–29 age group, which was underrepresented relative to the other groups and the 60–69 group, which was overrepresented relative to the other groups.

Respondents included 160 (49.2%) men, 165 (50.8%) women, and three unreported (0.01%). Two hundred twenty-six (68.9%) respondents had been vaccinated; 99 (30.2%) respondents had not been vaccinated.

Table 3 shows respondent education as having a mostly normal distribution peaking with four-year degrees. Similarly, Table 4 indicates that most respondents had salaries lower than $100,000, which is representative of the general population. We had sought to mirror the general population in the sample both in socio-economic status and education so that their responses would be as close to an average citizen as possible. Responses to demographics were not required; responses to model survey questions were required.

Table 5 indicates the marital status of the sample with 63.7% married and 10.1% either separated or divorced and another 11% giving no response; 3.7% of the group were widowed and 1.2% never married.

Occupations varied as shown in Table 6. While the "Other" group accounted for the largest number of professions with 36.1% of responses, Finance and Accounting had the largest number of responses of

Table 2. Respondent age.

Age	Number of Respondents	Percent
20–29	19	2.7%
30–39	66	2.1%
40–49	49	14.9%
50–59	65	19.8%
60–69	83	25.3%
70–79	46	14.0%
N/A	10	3.2%
Total	328	100%

Table 3. Respondent education.

Education	# Respondents	Percent
Less than high school	4	1.2%
High school graduate	31	9.4%
Some college	51	16.2%
2-year degree	41	12.4%
4-year degree	117	35.6%
Professional degree	70	21.3%
Doctorate	14	4.3%
Total	328	100%

Table 4. Respondent salaries.

Salary	# Respondents	Percent
Less than $10,000	14	4.3%
$10,000–$49,999	102	31.1%
$50,000–$99,999	116	35.4%
$100,000–$149,999	50	15.2%
$150,000–$199,999	29	8.8%
More than $200,000	17	5.2%
Total	328	100%

Table 5. Respondent marital status.

Marital Status	#	Percent
Divorced	33	1.1%
Married	209	63.7%
Never married	4	1.2%
Separated	33	1.1%
Widowed	12	3.7%
No response	37	11.1%
Total	328	99.9%100%

Table 6. Respondent occupations.

Job Title	#	Percent
Finance and accounting	41	12.5%
Healthcare	39	11.9%
Education and training	26	08.0%
Cybersecurity and all other IT occupations	24	07.3%
Marketing and sales	23	07.0%
Human resources	12	03.7%
Supply Chain Management	12	03.7%
Chief Executive Officer	10	03.0%
Legal	7	02.1%
Politics, community, and social services	6	01.8%
Architecture and Engineering	5	01.5%
Military and protective services	4	01.2%
Other	119	36.3%
Total	328	100%

listed professions with 12.5% of responses. Healthcare was the second largest group of respondents with 11.9% of the sample. Along with the next three groups – education (8%), cybersecurity (7.3%), and marketing/sales (7.0%), these five groups accounted 46.7% of the sample.

Results

The proposed model was comprised of reflective constructs that were evaluated using Warp-PLS v.7.0, and default partial least squares (PLS) regression for the outer model, Warp3 for the inner model, and Stable-3 resampling (Kock, 2021). PLS was an appropriate method for analysis because the model is speculative and exploratory and with several constructs that are newly developed as a result of the COVID-19 pandemic (Hair et al., 2020). In addition, the data are not linear and PLS structural equation modeling (SEM) is preferred for non-linear data (Hair et al., 2020). Thus, PLS analysis was selected.

When using PLS, the measurement model is confirmed before analyzing the structural model. Reflective measurements require five steps of analysis: item reliability, construct reliability, convergent validity, average variance extracted (AVE), and discriminant validity (Hair et al., 2019). We considered a failure at any of these steps a stopping point that required revision of the model before going forward; the model required several iterations to meet all the criteria.

Measurement model

Iteration one

The hypothesized model, with seven control variables, was tested and even though it was significant with R^2 =.830 ($p < .001$, see Figure 2), it contained multicollinear relationships (See Figure 3). Analysis of construct correlations identified the following issues and their resolutions as follows:

- System reliability (H_1) overlapped and was multicollinear with output quality (H_2) and information quality (H_3). Correlation analysis of individual indicators identified nine indicators correlated at .70 or higher ($p < .001$) to 11 or more other exogenous indicators (excluding their own indicators and those of the dependent construct). These overlaps resulted in deleting the two constructs for system reliability (H_1) and app output quality (H_2), which were then not supported.

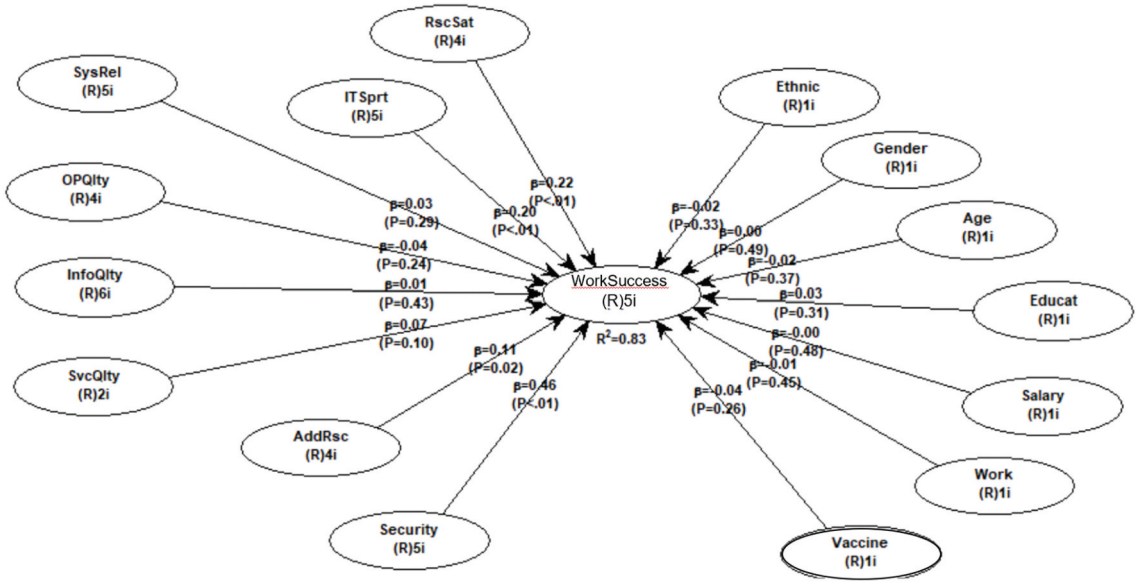

Figure 2. Iteration 1 – the hypothesized output model.

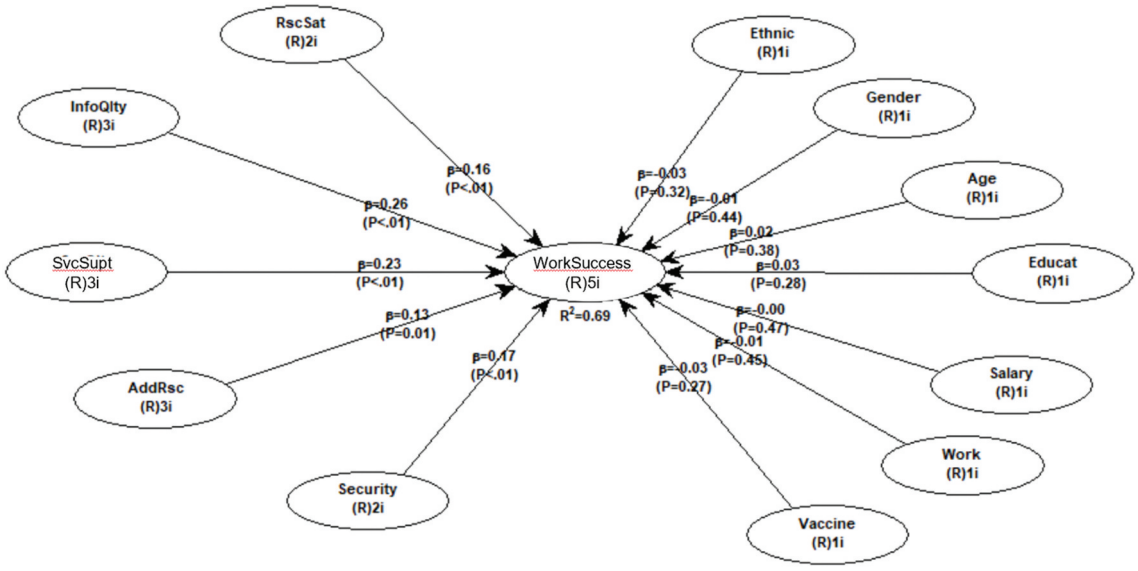

Figure 3. Iteration 2 with control variables.

- Service quality (H_4) overlapped and was multicollinear with support satisfaction (H_6) and information quality (H_3). Support satisfaction (H_6) had two indicators with 11 correlations with other indicators and the two indicators had variance inflation factors (VIFs) over 5.0. The two problem indicators were removed and the two constructs, since they both deal with service were combined into a single construct renamed "service support" but maintained as H_4.
- Two indicators from resource usage satisfaction (H_5) were removed as being highly correlated (over .70, $p < .001$) with other indicators.
- Information quality (H_3) had all six indicators highly correlated with nine other construct indicators (.70, $p < .001$, see above discussion of system reliability and information quality). The information quality VIFs were evaluated to ensure that they were under 5.0 to be kept; two indicators with VIFs over 5.0 were removed but because the system

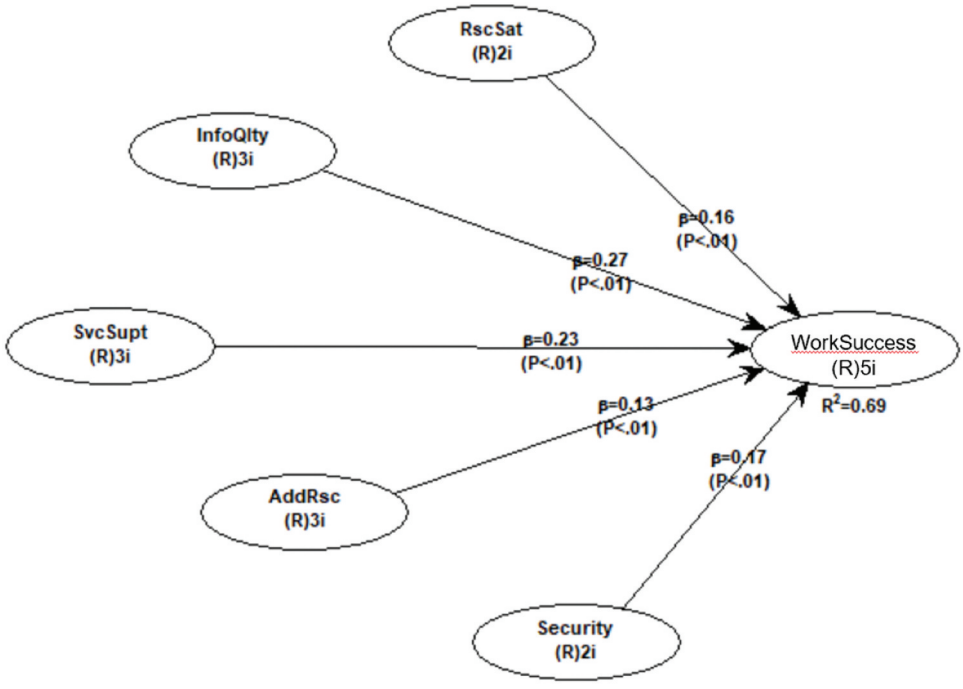

Figure 4. Final trimmed model.

reliability and information quality constructs were removed, no other actions were taken on this construct.

None of the control variables (ethnicity, gender, age, education, salary, type of work, and vaccination status) were significant but they were not eliminated as it was decided that until multicollinearity was reconciled in the model, their status could not be properly assessed.

Iteration two

This iteration indicated no multicollinearity. The last step was the analysis of the control variables to determine if they had any significance. The two least significant control variables were removed in stages in case they affected each other – salary/gender, work type/age, ethnicity/education, and finally vaccination status. No control variables proved significant. The final model is shown without the control variables (see Figure 4) and is the model that was analyzed completely for all required measurement model statistics.

Item Reliability: Indicator reliability is the first measure of acceptability for the measurement model – analysis of indicator loadings with outer loadings > 0.7; in addition, no indicators should cross- load at more than .50 on other indicators (Hair et al., 2019, see Table 4). All indicators passed this test (See Table 7).

Construct Reliability. The full set of reliabilities show that they meet the threshold .70 criteria for reliability with values all above .796 (Cronbach, 1951, see Table 8). These are all acceptable values. Both composite and Cronbach's reliability measures are shown. Cronbach's alpha is traditional while many researchers have replaced it with composite reliability as it is weighted based on the individual indicator loadings and is more accurate than Cronbach's alpha which produces lower values (Hair et al., 2019).

Convergent Validity: "Convergent validity is the extent to which a construct converges to explain the variance of its items" (Hair et al., 2020, p. 104) and is explained through the average variance extracted (AVE), which is the mean value of the squared loadings of a construct's indicators. Table 9 shows the construct AVEs are acceptably higher than the threshold of .50 (Fornell & Larcker, 1981; Kock, 2021).

Discriminant Validity. To demonstrate discriminant validity, multiple methods are evaluated: the indicator correlations with the square roots of the AVEs (Hair et al., 2019; Henseler et al., 2015) and the heterotrait–monotrait ratio (HTMT, Fornell & Larcker, 1981).

Table 10 shows the indicator cross-loadings with the square roots of the AVEs in bold print on the diagonals. The AVE square roots are compared to the correlations in the rest of the column to ensure that no values are higher than the AVE square roots (Fornell & Larcker, 1981). If that is true, the first test passes (Kock, 2021). All the AVEs passed the Fornell–Larcker test.

Table 7. Indicator loadings and cross-loadings.

	Work Success	Resource Usage Satisfaction	Cybersecurity Satisfaction	Added Resources Satisfaction	Informa-tion Quality	Service Support	VIF	ES
9-1YourWork Qlty	0.791	−0.024	−0.144	−0.108	0.299	−.106	1.816	0.158
9-2YourSup Relations	0.932	−0.081	0.113	0.023	−0.018	−.085	3.204	0.211
9-3Peer Relations	1.088	−0.052	−0.059	0.008	−0.138	−.018	3.219	0.211
9-4YourWork Innovation	0.838	0.13	−0.015	0.032	−0.075	.015	3.795	0.215
9-5TeamQlty Innovation	0.655	0.023	0.087	0.03	−0.028	.182	3.436	0.205
7-4RscCntlSat	−0.068	0.612	0.094	0	0.09	.265	1.779	0.5
7-3PrintAccess Satisfaction	0.068	1.211	−0.094	0	−0.09	−.265	1.779	0.5
7-5CyberTrng	0.007	0.052	1.023	0.011	−0.178	.016	2.601	0.5
7-6SecuritySat	−0.007	−0.052	0.866	−0.011	0.178	−.016	2.601	0.5
10-2AddAppSW	0.085	−0.134	0.09	0.929	−0.063	.01	3.249	0.345
10-3AddCollab SW	0.04	−0.128	−0.132	0.901	0.162	.08	2.763	0.33
10-4AddCell	−0.128	0.267	0.041	0.907	−0.098	−.09	2.585	0.325
4-1InfoQlty Accuracy Expectations	0.113	−0.191	−0.026	0.012	0.902	.111	2.966	0.324
4-2InfoQltyOntime Expectations	−0.072	0.115	−0.022	−0.002	1.002	−.096	3.877	0.341
4-3AccessExpec	−0.039	0.072	0.048	−0.01	0.881	−.012	3.534	0.335
5-1ISComm Productive	−0.026	−0.01	−0.033	0.031	−0.05	1.008	3.27	0.341
5-2ISChange Timely	−0.042	−0.042	−0.095	0.009	0.046	1.021	3.179	0.338
6-4ISStaff Accessible	0.069	0.053	0.132	−0.041	0.004	.715	2.534	0.321

Loadings and cross-loadings are oblique-rotated. VIF = Variance inflation factor; VIF < 3.3 is desired, < 5.0 is acceptable (Hair et al., 2019). ES = Effect size .2 = small, .5 = medium, .8 = large, 1.2 = very large, 2 = huge (Sawilowsky, 2009).

Table 8. Reliability coefficients.

	Work Success	Resource Usage Satisfaction	Cyber-security Satisfaction	Added Resources Satisfaction	Informa- tion Quality	Service Support
Composite reliability	0.935	0.908	0.943	0.937	0.950	0.940
Cronbach's alpha	0.913	0.796	0.879	0.900	0.920	0.904

Table 9. Average variances extracted (AVEs).

Work Success	Resource Usage Satisfaction	Cyber-security Satisfaction	Added Resources Satisfaction	Information Quality	Service Support
0.913	0.796	0.879	0.900	0.920	0.904

Acceptable threshold AVE value is .50 (Fornell & Larcker, 1981).

Table 10. Latent variable correlations with square roots of AVEs on the diagonals.

	Work Success	Resource Usage Satisfaction	Cyber-security Satisfaction	Added Resources Satisfaction	Information Quality	Service Support
Work success	**0.862**	0.696	0.719	0.408	0.740	0.733
Resource usage satisfaction	0.696	**0.912**	0.703	0.387	0.712	0.702
Security Satisfaction	0.719	0.703	**0.945**	0.370	0.734	0.728
Added Resources Satisfaction	0.408	0.387	0.370	**0.913**	0.338	0.415
Information Quality	0.740	0.712	0.734	0.338	**0.929**	0.738
Service Support	0.733	0.702	0.728	0.415	0.738	**0.916**

The next test is the heterotrait–monotrait ratio (HTMT) that evaluates the mean of all indicator correlations across constructs relative to the mean of the average indicator correlations measuring the same construct (Henseler et al., 2015). An HTMT over .90 indicates a lack of discriminant validity, i.e., that at least two constructs are not distinct. If constructs are conceptually more distinct, Henseler et al. (2015) recommend a more conservative threshold of .85. As Table 11 indicates, the HTMT ratios show that all the ratios meet the conservative threshold, thus passing the discriminant validity test. At this point, the structural model can be assessed.

Structural Model analysis

Evaluating the structural model involves examining path relationships between constructs and predictive capabilities. The structural model was assessed for collinearity, significance, size of the path coefficients, and relative predictive power (Hair et al., 2020). After the size and significance of the path coefficients in the

Table 11. HTMT ratios.

	Work Success	Resource Usage Satisfaction	Cyber-security Satisfaction	Added Resources Satisfaction	Information Quality	Service Support
Work success						
Resource usage satisfaction	0.817***					
Security Satisfaction	0.802***	0.840**				
Added Resources Satisfaction	0.447***	0.458***	0.416***			
Information Quality	0.809***	0.832***	0.816***	0.372***		
IS Service & Support Satisfaction	0.807***	0.828***	0.817***	0.460***	0.809***	

**$p<.002$, ***$p<.001$; Note: Values are considered acceptable if < 0.90, best if < 0.85 (Henseler et al., 2015).

structural model were confirmed, key metrics (R^2, f^2, Q^2, and q^2) were assessed to determine the model's predictive ability.

Variance inflation factors (VIFs) were used to assess collinearity of the independent variables, looking for values under 5.0, but conservatively are preferred to be under 3.0 (Hair et al., 2020). The construct VIFs are shown in Table 12 and are under 5.0 with several under 3.0. Thus, there was no issue with multi-collinearity.

Further, "the occurrence of a VIF greater than 3.3 is proposed as an indication of pathological collinearity, and also as an indication that a model may be contaminated by common method bias. Therefore, if all VIFs resulting from a full collinearity test are equal to or lower than 3.3, the model can be considered free of common method bias" (Kock, 2015, p. 7). As Table 12 shows, all VIFs are under 3.3; thus, common method bias should not be considered an issue.

Information quality (InfQlt and H_3) was significantly, positively related to Work success (WorkSuccess) as hypothesized with a ß=.266 ($p < .001$). The relationship was the most significant in the model and one of the original D&M constructs. H_3 was supported (See Figure 4).

Service support (SvcSupt, H_4, See Figure 4) was hypothesized to be positively related to WFH success. This construct was combined with H_6 because they were both related intellectually and had multicollinear relationships. When the two were combined, we changed the name to service support, keeping the H_4 designation. The service support relationship was the second most significant in the model with ß=.231 ($p < .001$), supporting H_4. We can say that the original D&M IS service quality construct was supported but it is not strictly true as service support was not significant without the two items from the service satisfaction construct. WFH needs more than just question answering about specific apps and, because it is at a distance, needs fast answers to a complex variety of issues that go beyond what was required in the 1980s and 1990s when much of the D&M research was conducted. Modern service desks provide a broad variety of services such as provisioning of equipment and software, solving hardware, communications, application, and software package usage problems, answering questions relating to the use of computing resources (e.g., how to use the VPN to logon remotely), and who to contact for IT problems outside the service desk scope (Conger, 2016). These tasks are beyond those of D&M research which addressed only the needs of software being implemented and not the full range of data center support. Thus, the broader scope of IS service quality more aptly addresses WFH and remote work in addition to including more modern service desk responsibilities (Conger, 2016; ISO/IEC, 2018).

H_5 hypothesized that resource usage satisfaction (RscSat) would be positively related to work output (WorkSuccess). This relationship was significant with a ß=.164 ($p = .001$). This is a new construct developed to support WFH satisfaction with company-supplied computing hardware and software.

Cybersecurity satisfaction (Cybersecurity, H_7, See Figure 5) was hypothesized to be positively related to work success. The cybersecurity construct was significant with ß=.166 ($p = .001$); thus, H_7 was supported. The cybersecurity construct was developed to address the responsibilities individuals took on when they moved from the office to WFH.

Added resources (AddRsc, H_8, See Figure 5) was hypothesized to relate positively to work success. The added resources construct was significant with ß=.126 ($p = .01$); thus, H_7 was supported. The added resources construct was developed to identify the number and types of resources provided by companies for their WFH employees.

To summarize, of the eight hypothesized relationships, five were fully supported, one of which was in combination with another construct and two were not supported. No control variables were significant.

Table 12. Full collinearity VIFs.

Work Success	Resource Usage Satisfaction	Cyber-security Satisfaction	Added Resources Satisfaction	Information Quality	Service Support
3.007	2.654	2.927	1.259	3.143	3.073

Figure 5. Revised model of work from home success.

Structural model value

The structural model assessment evaluates the predictive ability of the model. The model R^2= .687 (See Table 13), which essentially means that approximately 70% of the data fit the regression model. The adjusted R^2= .676 is considered between a medium and highly substantial outcome. These values are subjective and have changed regularly since 1988 when R^2=.26 was considered a substantial outcome (Cohen, 1988), while by 2021, mathematicians advocated a move to R^2=.75 as substantial (Hair et al., 2020).

The model overall has a high predictive ability as assessed by Q^2 =.686, which indicates a large predictive relevance (Hair et al., 2020). When we consider the effect size (f^2) for the four constructs, however, the results are modest. The model f^2 values are all between .130 and .272, thus all having small effects. The standardized root mean residual (SRMR) = .063 and is acceptably < 0.10 (Hair et al., 2019). An SRMR value under .08 is considered a good model fit (Hu & Bentler, 1998).

The effects of the f^2 and q^2 at the model level (top row, Table 13.), determine the impact of removing the weakest significant relationship from the model. The resulting f^2=.037 and q^2=.044 indicate weak effects on any change to the resulting model should the added resources construct be omitted. Thus, with Q^2 = .686,

Table 13. Structural model predictive ability assessment.

Construct	Hypothesized Relationship	Q^2 (1-SSE/SSO)	R^2 (1-SSE/TSS)	Adj. R^2	f^2 (R^2–included- R^2–excluded/(1-R^2)	q^2 (Q^2_included-Q^2–excluded/ (1-Q^2)
Work success		0.686***	0.686***	0.681***	.037*	0.044*
	Resource satisfaction ➔ work output				0.164* (.001)	
	Service quality ➔ work output				0.224** (<.001)	
	Information quality ➔ work output				0.272** (<.001)	
	Cybersecurity satisfaction ➔ work output				0.166* (.001)	
	Added resources ➔ work output				.130* (.009)	

Note: SSO = sum of squared observations; SSE = sum of squared error; TSS = total sum of squares; p-values for f^2 of latent variable paths are under the values; Q^2, f^2, and q^2 values of * .02, **.15, and ***.35, respectively, represent small, medium, and large effects (Cohen, 1988, as in; Hair et al., 2020, p. 201). R^2-value coefficients of determination equal to .25, .50 and .75 are considered as weak, medium, and substantial, respectively (Hair et al., 2019).
For Indicators, p-values are in parentheses; asterisks indicate effect sizes.

Table 14. Hypothesized relationship results.

Hypothesis	β	p – value	Supported?
H1: Systems reliability relates positively to work success.	-	-	N
H2: Application output quality relates positively to work success.	-	-	N
H3: Information quality relates positively to work success.	.272	<.001	Y
H4: Service quality relates positively to work success.	.231	<.001	Y
H5: Resource usage satisfaction relates positively to work success.	.164	.001	Y
H6: Support satisfaction relates positively to work success.	Combined with H_4		
H7: Security relates positively to work success.	.166	.001	Y
H8: Added resources relate positively to work success.	.130	.009	Y

the predictive ability of the overall model is substantial and, if added resources were to be removed, the impact on the predictive ability of the model would be negligible.

Discussion

This research sought to evaluate the research question *to what extent did COVID-19 impact work success as it relates to system reliability, system output quality, information quality, service quality, resource usage satisfaction, support satisfaction, cybersecurity satisfaction, and added resources*. Eight hypotheses were posed; five were supported and indicate that changes to D&M model appear necessary for work at home. With an $R^2 = .686$ ($p < .001$) and adjusted $R^2 = .681$ ($p < .001$) the model is strong and supported. Testing for individual work quality, relationship with manager and work group, and individual and work group innovation indicate that respondents' work thrived during the pandemic. These are discussed in this section.

Supported Hypotheses

Information quality (H_3), one of the supported hypotheses (see Table 14) in the trimmed model originated from the D&M model (DeLone & McLean, 1992, 2003). Service quality (H_4), also supported and from the D&M model, was combined with questions from the IS support construct (H_6) that was created to address service support satisfaction for WFH.

The constructs of information quality and service quality have been supported more often than not in research over the last 30 years (Al-Hubaishi et al., 2017; Au et al., 2008; DeLone & McLean, 1992, 2003; Karimi et al., 2004; Kettinger & Lee, 1994; Liebowitz, 1999; Ojo, 2010; Petter et al., 2008, 2013; Tan et al., 2013). Information quality is important for organizational decision accuracy and quality. Moreover, organizations' information users assume that data they need for work is available as needed in the format and summary level required (Al-Hubaishi et al., 2017; Ojo, 2010; Tan et al., 2013).

IS service (H_4) questions merged with IS support (H_6) questions after the first round of model testing to reduce multicollinearity issues. By merging the questions, the hypotheses H_4 and H_6 also merged into a single hypothesis – H_4 – IS service-support satisfaction (shortened to service support for discussion). Iranzadeh et al. (2009) found technical and process service support were critical to acceptance of banking services in Iran. Several generic service process models from business theory might be applicable to information service support but they would need further development for application to support the diversity of all aspects of IS service support (cf. Grönroos & Ojasalo, 2005; Rust & Huang, 2012; Scerri & Agarwal, 2013; Schmenner, 2004, 1986). With our results explaining only 26% of the variance for services, there is significant improvement that can be made in defining service support as the construct relates to WFH; research exploring other assessments of service such as Iranzadeh et al. (2009) and business research might add to explanations of WFH work success.

IS resource usage satisfaction (H_5), cybersecurity satisfaction (H_7), and added resource usage satisfaction (H_8) are the new constructs that were supported. We created the resource usage satisfaction construct because we believed many people working from home for the first time would need to be fully satisfied with their company-supplied computing resources to be at their most productive (Klein et al., 2001; Singh & Jain, 2013). Resource usage satisfaction results are consistent with expectations and prior research on company-supplied resources and their effects on work success (Napoleon & Gaimon, 2004; Singh & Jain, 2013).

WFH cybersecurity satisfaction is supported by research showing its importance in industry (Jouini et al., 2014; Kankanhalli et al., 2003; Kappelman et al., 2020). Cybersecurity will continue to be critical in industry as breaches and security incidents are expected to grow as an area for future research. Because of Covid-19, WFH forced zero-trust security architectures making home workers become more aware of, and responsible for, larger aspects of cybersecurity (Spadafora, 2021; Vijayan, 2021). Thus, training and continuing sophistication in cybersecurity for WFH will continue to be significant.

Added resources satisfaction results identify different types of resources that are company provided,

customized to the tasks, and the extent to which employees are satisfied with them. Prior research identified the importance of such resources (ILO, 2020; Napoleon & Gaimon, 2004) but we did not find prior research verifying that satisfaction with company-supplied resources was important to work success. Our results support this notion and, though weak, indicate that continued research using this construct is warranted.

Overall, the results empirically support the idea that services provided by the company for its employees are of crucial importance in ensuring WFH work success. The D&M model constructs from mainframe days – system reliability, app output quality, and service quality that supports a single application – are not relevant for WFH. In the WFH context, services for company provided resources, IS support, and cybersecurity are essential to successful work from home. The results are consistent with WFH research that finds individuals working remotely need company information (information quality) support on demand that answers all questions and needs (service support), and with equipment that is customized to individuals' work requirements (added resources and resource usage satisfaction) (H. Lee & Park, 2016; Pratt, 1993).

This research had write-in questions in which displeasure about unavailable service staff was specific and bitter, clearly identifying intolerance for untimely or incorrect answers. Similarly, those who had low responses on cybersecurity satisfaction had write-ins like "what security training?" to show their frustration with new duties with which they were uncomfortable. Past research sought to show that WFH for most of the workforce would fail and this research shows that is not the case. Further, it is supported by a growing body of work both old (cf. Belanger & Collins, 1998; O'Neill et al., 2009; Pratt, 1984) and new (Galanti et al., 2021; H. Lee & Park, 2016; Teodorovicz et al., 2021).

There is a body of work that argues that not everyone is content with WFH, which makes sense for those with small children and no childcare support, small or crowded apartments, noisy home environment, many people trying to work in small spaces, or other impediments to successful work from home (Bloom, 2020; Hill et al., 2003). When asked if they intended to work from home in twelve months, this sample was split with 124 (38%) wanting to go back to the office, 147 (45%) intending to WFH, and 57 (17%) undecided. Research samples that span the socio-economic spectrum and surveys that include questions about living conditions are needed to explore this issue more fully.

Based on the findings of this research, the revised model suggested for WFH is shown in Figure 5 and includes the five significant constructs. Rather than extending the D&M model, this is a new model of WFH success that focuses on technology resources and individual satisfaction with the resources as they relate to work success.

Limitations and Future Research

This research has several limitations that provide opportunities for future research. The goal of these research efforts would be to develop a theory of support for WFH that includes technology, personal, and job aspects.

First, a theoretical limitation exists because there is no similar pandemic-timed research based on the D&M model on which to compare this research. Future research based on this model needs to prove the continuing relevance of the constructs to new technology, new contexts, new apps, WFH, and business interruptions like pandemics. We believe this research has added valuable new constructs and extends the construct on services support, but further research is needed to support the other D&M constructs for them to stay relevant.

The revised model suggests that there are missing constructs and a need to start from qualitative research to develop a new theory of what companies require for WFH support (Dubin, 1978). From research to date, both ours and others, physical and digital resources, support for those resources, and significant communications to maintain company "tethers," culture, and accurate project understanding are all required (Bloom, 2020; Galanti et al., 2021). Bloom (2020), in particular, whose research throughout 2020 as the pandemic began, consistently recommended regular communications of managers with their staff throughout the day to ensure maintenance of culture and feelings of attachment to the company. For example, one company found that long meetings were ineffective as staff were anxious to get to work; they found that 10-minute "stand-up" meetings were effective in ensuring work understanding (Conger, 2020).

Other missing constructs that could strengthen the model might relate to personal characteristics of the respondents. Most research on WFH focuses on personal aspects but ignores technology. Future research should include a construct related to personal issues that summarizes the main WFH distractions, such as family needing home care for some members, working conditions and number of people sharing the work site, and specific technology requirements (Galanti et al., 2021; Patanjali & Bhatta, 2022). Moreover, a construct related to job satisfaction that summarizes satisfaction

with aspects of career, compensation, opportunities, and company commitment should also be investigated (Patanjali & Bhatta, 2022).

The research design in this study assumes a specific causal ordering but there is a potential for reciprocal effects of work success with the exogenous constructs that should be evaluated in the future. This research identified the need for physical and digital resources customized to the work and 24×7 support for those resources to support WFH. In addition, because of the potential relationship of endogenous construct relationships with work success, especially relationships with work groups and managers, longitudinal research that looks at lagged effects of those relationships would be able to identify reciprocity between constructs.

Service support, another area for future research, might completely redefine the construct. We recommend beginning with focus groups to determine how users perceive information system support services and which areas are most significant to them. The Jaakkola et al. (2017) taxonomy of service intensities (routine, technical, contact, and knowledge), or Chau and Hu's (2002) three contexts (implementation, technology and individual), or personal service desk failures, such as those identified by our respondents, could be used to initiate focus group discussion of improvements needed for WFH. Several broad industry types could be selected as the basis for focus group selection as well as selecting participants from different countries. The focus group outcomes then could be used to redevelop added or new questions for surveys.

At a lower level of granularity, study of alternatives for various digitally-supported activities could be evaluated for their impact on WFH. For instance, communication alternatives for text, such as Slack, SMS, Chat, and so on could be evaluated for their feature used and how well they meet the needs of their user populations, evaluating samples of clerical, white collar, managerial, and blue-collar workers to evaluate the efficacy and effectiveness of their use. The actual exchanges that take place in the computer-mediated alternatives for communications with coworkers, service support providers, managers, etc. could be evaluated to define the type of language, language simplicity/complexity, formality and so on. Other types of software such as artificial intelligences, business games, or simulations that may impact exchange outcomes could be evaluated as well. Different aspects of work could be matched to different types of hardware or software for this type of research.

A case study could analyze both technology, quality and productivity of output, and attitudes toward work by both managers and their WFH staff. 360° assessments of the WFH workforce by both peers and their managers in addition to technology assessments by all three groups could provide more insight into WFH than prior research.

Several of the constructs, added resources, support satisfaction, resource satisfaction, and cybersecurity satisfaction did not have large ranges of responses. Though the results were significant, they led to weak overall effect sizes for those constructs. This situation might have been avoided had we used 7-point scales rather than 5-point scales in the survey as they provide improved response reliability. Therefore, future research should use the 7-point Likert-like scales as it improves granularity of responses and provides the least "loss of information accuracy" as tested by Cicchetti et al. (1985, p. 35).

Conclusion

This study expands knowledge on work from home support in the form of digital and hardware assets as critical to individuals being able to successfully work from home. Overall, the results are encouraging for further research in the work from home area, with or without a pandemic. The changes to the DeLone and McLean model led to a new work from home model for work success. From other Covid-19-related research, more and frequent communication between staff and managers, context of WFH, and attitude toward workers' jobs should be included in future research. This research demonstrates that work from home, increasing from approximately 9% to 69% of the population during the pandemic, was more successful than naysayers predicted.

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