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*Research Article*

# Predicting Antecedents of Employee Smart Work Adoption Using SEM-Multilayer Perceptron Approach

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The COVID-19 pandemic forced many organizations to move to telework and smart work (SW), and this practice is expected to continue even later in the postpandemic period. Hence, it is very important for managers and organizations to identify the motivating and deterrent factors in adopting smart work and plan to manage them. Therefore, the present study using an innovative methodology tried to identify and prioritize the factors influencing employee SW adoption. In the first stage, the conceptual model of the research was designed, inspired by the literature. In the next step, using structural equation modeling (SEM), antecedents whose effects on employee SW adoption were confirmed were identified. Finally, the output of the SEM model was considered as the input of the multilayer perceptron (MLP) model, which is an artificial neural network model, to determine the importance of each antecedent in the prediction of employee behavior. The present study provides quantitative empirical evidence that perceived value, institutional and technological support, perceived limited communication, and perceived cost are antecedents of employee SW adoption that are, respectively, important in predicting the behavioral intentions of employees in acceptance of SW. The findings of this study contribute to both the SW and the behavioral intention theory literature.

## 1. Introduction

A considerable influence has been made by the coronavirus disease (COVID-19) pandemic, which has affected people, organizations, and the society. It has caused remarkable disruption to people's life, including employment losses, career transitions, and problems to their physical and emotional health. As a result of various established practices being unsustainable and no longer feasible, organizations have been forced to pivot and divert resources into innovative ways of functioning. Aside from the use of long-term and periodic lockdowns, as well as the restructuring of employment and work [1], these measures have also restricted the flow of goods and services and hampered the interchange of commerce and services [2]. A change in workplace standards has occurred as a consequence of the pandemic, and organizations have been forced to adjust their operations to the new environment by adoption of digital technologies

[3]. One such adaptation is the development of smart work arrangements [4–6]. Smart work (SW) is a term that refers to a new way of arranging work that leverages telecommunications, mobile devices, and computer-based technology to enable workers to work from anywhere and at any time, including their homes and/or the firm's satellite offices [7, 8]. Companies begin to refer to SW as a set of organizational interventions aimed at fully unleashing the innovation potential of their employees by providing them with greater levels of autonomy in the choice of their working places, time, and tools, and in exchange, they ask for a strong commitment to achieving corporate goals in these extremely dynamic environments.

The transition to SW is not only about the readiness of organizations, in terms of infrastructure and feasibility, but also requires the readiness of employees to accept this transition [9]. Current studies, meanwhile, have focused more on organizations' readiness to move to SW. For example, Franken et al. [10] examine the effects of remote working on organizational performance and employee well-being. Eberhard et al. [11] investigate the skills needed by employees to prepare them for the SW, and Raguseo et al. [12] also design a model for organizations to move to SW, through which companies can increase the productivity of their labors. Ko et al. [13] also develop a model that examines the SW appropriation and its impact on the performance of organizations. Employees, on the other hand, are an important part of this equation, since they are the ones who are in the heart of such a transition [14]. Although Franken et al. [10] evaluate the effect of remote work on employee well-being, or employee satisfaction with SW has also been tested in the Ko et al. [13] study, there has been little research in the literature on employee adoption of SW and on the variables that affect their decision to adopt SW. To this end, the present study is conducted to address this gap in the literature and predict the variables that affect (stimuli and inhibitors) employee adoption of SW.

The COVID-19 pandemic imposes remote work on both employees and organizations [15], the findings of Grotto's [16] study show that ICT interruptions have a negative effect on the well-being of employees, and Segbenya and Okorley [17] also provide empirical evidence that telework can affect working conditions as well; therefore, studying the factors influencing SW adoption by employees can help organizations improve work quality and improve employee well-being. On the other hand, the findings of this research can be used in work organization and increasing labor productivity. Therefore, the main purpose of this study is to predict the key factors affecting employee behavior in SW adoption. The present study, with a comprehensive review of the literature, designs an original model by which it evaluates the behavior of employees and the factors influencing their decision to adopt SW. In order to test the proposed model, structural equation modeling (SEM) is applied. In the next stage of the study, a multilayer perceptron (MLP) model, which is an artificial neural network (ANN) model, is applied to identify the important model variables in predicting employee behavior in adoption of SW.

The following is how the paper is organized: The literature analysis of comparable research on SW is presented in Section 2. The suggested hypotheses and research model are outlined in Section 3. Section 4 describes the methods employed, while Section 5 discusses data analysis and research findings. Finally, in Section 6, we go through the many implications of the findings.

## 2. Research Background

There are many models in the literature that examine behavioral intent. For example, the proposed models of technology acceptance measure the factors influencing the user intentions in the acceptance of a technology by users. In this regard, Wei et al. [18] employed two technology acceptance model predictors (perceived usefulness and perceived ease of use) and included direct effect of additional variables such as social influence, trust, and perceived cost on consumer intention to use m-commerce when assessing the drivers of m-commerce adoption in Malaysia. Although research on the employee acceptance of SW has not yet reached maturity, there are studies that have attempted to highlight aspects of this phenomenon. Eom et al. [19], for instance, introduce a model that examines the acceptance of SW by the South Korean government. This model actually includes the cost of commuting, cost of business trips, expected work productivity and efficiency, institutional and technological supports, burden of supporting a family, job unsuitability, expected isolation and lack of communication, and unfriendly leadership and management. Malik et al. [20] also propose a model that assesses the factors influencing the intentions of users to use SW Hubs in Australia. In this model, they consider the perceived value as a factor influencing the attitude of users and provide evidence that users' attitude influences their intentions in using SW hubs. Using technology adoption models, Ko et al. [13] also identify trust and motivation as factors influencing appropriation of SW and provide quantitative empirical evidence that appropriation of SW affects employee job satisfaction. They describe "appropriation" as the process of using ICT in a variety of ways to accomplish organizational objectives.

There are other studies in the literature that do not provide a model for predicting employees' behavioral intention in accepting SW but studying various aspects of the transition to SW. For example, Franken et al. [10] provide qualitative empirical evidence on the effects of remote work on technology, work-life balance, workspace, workload, and team relationships. Raguseo et al. [12] also identify the models that organizations use to implement SW and increase their labor productivity. They categorize organizations according to their structure, ICT, and human resource readiness into four categories: inconsistent, analogical, digital, and complete SW, respectively, where inconsistent organizations are organizations that have the lowest readiness for SW and complete SW organizations are those organizations that are the most prepared for SW. In another study, Hu [21] examines the benefits of switching to SW and the barriers organizations face to moving to SW. Hu [21] claims

that work-life balance and increased productivity are two of the most important benefits of SW, while he cites poor ICT infrastructure and resistance to change as the two main factors holding back organizations in transition to SW.

While several inward-looking and organizational views exist emphasizing the advantages and problems of SW, little is known about how employees react to possibilities given by external factors. As a result, this study will attempt to address the following research questions:

RQ1: what are the key antecedents of employee SW adoption?

## 3. Conceptual Model of the Study

Through SW, employees can perform their work tasks from any place and at any time. In order for employees to embrace SW and prefer it to the former workplace, they expect SW to receive higher benefits and value. The perceived usefulness variable in the technology acceptance model also implies that if the use of new technology gives users a higher value (for example, to increase their performance and their productivity), this will affect their decision on adopting a new technology [22].

Franken et al. [10] debate that this work practice increases the quality of life of employees and their well-being by creating a work-life balance. Employees can spend more time with family members, receive emotional support, and reduce work stress [10]. On the other hand, Malik et al. [20] believe that remote work increases employee flexibility and productivity and ultimately increases satisfaction, and Ko et al. [13] also provide evidence that the SW increases employee satisfaction. Therefore, it can be concluded that creating a work-life balance and increasing employees' productivity and performance are values that influence employees' decision to accept SW.

In this study, these values are evaluated by a variable defined as perceived value, and it is expected that the more employees understand the perceived values of the SW, the more they will welcome the SW. Malik et al. [20] also use this variable as an influential variable on the behavior of SW hub users and believe that the family value and work value that employees perceived from using SW hubs affect their decision to accept SW hubs. Therefore, the first hypothesis of this study is designed as follows:

H1: perceived value has a positive and significant effect on employee adoption of SW

One of the other variables that is considered in behavioral decision theory, for example, in TAM, is perceived costs [23]. In other words, when the user intends to accept a new phenomenon, he first compares the costs and benefits of past practices with the adoption of new ones. Hence, in the literature, this variable is mentioned as an influential variable in behavioral intention [24]. Eom et al. [19] consider commuting costs and business trip costs as factors influencing the acceptance of SW in the Korean government. Wu and Wang [25] also state that the costs incurred by users negatively affect their behavioral intentions. In other words, the higher the cost to users of using the new technology, the less likely they are to adopt that technology. Therefore, it is expected that if the cost of SW for employees is higher than working in the former workplace, it will reduce the likelihood of accepting SW and vice versa. Business trip costs, commuting costs, the cost of providing the devices needed for the SW, and other ancillary expenses such as the Internet and electricity are the costs that the present study examines their impact on employee decision-making behavior. Hence, the second hypothesis of this research is written as follows.

H2: perceived cost has a negative and significant effect on employee adoption of SW

Transition to SW requires skills in using technologies, devices, and software that employees may not have used in the past. The use of these technologies and software requires employees to have new skills that can perform their tasks properly. López-Bassols [26] calls these ICT skills as applied ICT skills and defines it as the ability to use ICT in a non-ICT job. ICT adoption is important in technology adoption [27], and Raguseo et al. [12] measure the readiness of the organization in terms of ICT infrastructure to implement the SW. Therefore, it is expected that the higher a person's skills in ICT, the easier it is to welcome the SW. Hence, the third hypothesis of this study is written as follows.

H3: ICT skills have a positive and significant effect on employee adoption of SW

Hu [21] points out that one of the main problems of the transition to SW is the resistance of employees to change. Rainey and Chun [28], however, believe that organizational support can break down these resistances and motivate employees to accept SW. Hence, Eom et al. [19] emphasize the importance of institutional and technological support in accepting SW and bring this variable in their proposed model. The research disclosed that e-learning systems, customer relationship management (CRM), and enterprise resource planning (ERP) encourage telework [8]. Therefore, the fourth hypothesis of this study is provided as follows.

H4: institutional and technological support has a positive and significant effect on employee adoption of SW

In SW, due to telework, the possibility of employees' face-to-face social interactions with colleagues and customers is minimized, and these interactions are mainly limited to virtual interactions as much as possible. In the literature, this isolation and the decline of social interaction have been mentioned as factors that hinder the acceptance of SW by employees [29, 30]. Therefore, it is expected that the limited communication imposed on the individual by SW will influence their decision to accept SW. Thus, the fifth hypothesis of this study is designed as follows.

H5: perceived limited communication has a negative and significant effect on employee adoption of SW

Based on these arguments, it is disclosed that perceived value, perceived cost, ICT skills, institutional and technological support, and perceived limited communication are antecedents of employee smart work adoption. Accordingly, the proposed conceptual model for the hypothesis testing on the antecedents of the adoption (intention behavior) of SW is depicted in Figure 1.

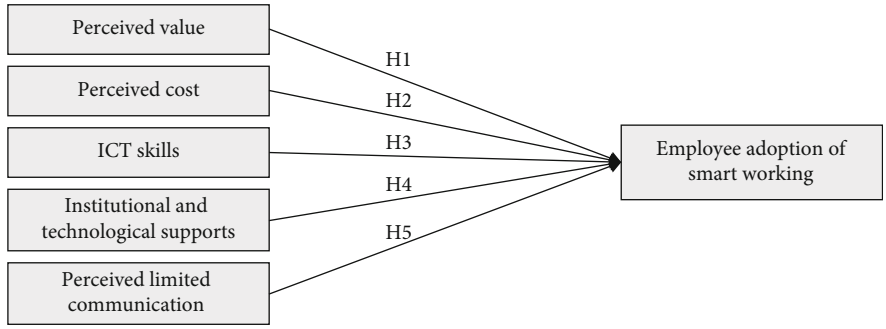


Figure 1: The conceptual model of the study.

## 4. Material and Methods

*4.1. Data Collection.* In order to test the proposed model of this study, a questionnaire was designed. This questionnaire contains 17 items designed by the researchers of the current study. Table 1 lists the items of this questionnaire in addition to the source from which they were inspired to design the questions. It should be noted that a five-point Likert scale was used in the design of this questionnaire, where one means "Strongly Disagree," two means "Disagree," three means "Neutral," four means "Agree," and finally five means "Strongly Agree." The participants in this research were assured that the data of this questionnaire will only be used to conduct this research, and all their information will be completely confidential and will not be exposed to anyone or any institution.

This questionnaire was administered among knowledge-based companies (KBO) operating in Tehran, Iran, and data were collected from June 2021 to September 2021. In order to collect data, first, the list of KBOs was extracted from the centers of knowledge-based companies, Tehran, Iran, which revealed that a total of 6359 KBOs are operating in Iran, of which 3355 are operating in Tehran. An attempt was made to call the managers of all KBOs operating in Tehran to obtain a preliminary agreement to participate in this research. Companies that agreed to participate in the study were asked to distribute the online link to the designed questionnaire, which was emailed to them, among their employees, and to ask their employees to complete the questionnaire. 432 companies agreed to participate in the study, but 268 of the online questionnaires were eventually completed, of which 234 were usable and fully completed. Table 2 presents the demographic information of the participants in this study.

*4.2. Data Analysis Methods.* The data analysis was performed in three stages in this study. Firstly, the convergent and discriminant validity, the composite reliability, and Cronbach's alpha index were examined using confirmative factor analysis for analyzing the reliability and validity of the hypothesized research model. To test hypotheses in the second stage of this study, structural equation modeling (SEM) was used using maximum likelihood estimation. In the third phase, we used multilayer perceptron (MLP) to validate the intensity of the influence of independent factors on dependent variables whose significance were validated using SEM analysis. The data was analyzed using the Statistical Package for Social Sciences (SPSS 20) and AMOS 18.

In fact, the third analytical phase (that is, the use of the MLP model) of this research provides a model for predicting the acceptance of SW. For this purpose, MLP first examines the impact of each of the input variables, which are the same

Table 1: Questionnaire items.

| Factors | Sources |
|---|---|
| Perceived value | |
| (i) Smart work helps me balance my work and life | [10] |
| (ii) My productivity in smart work is higher | [20] |
| (iii) My work performance in smart work is higher | [20] |
| Perceived cost | |
| (i) Smart work imposes more business trips costs on me | [19] |
| (ii) Smart work imposes more commuting to work costs on me | [19] |
| (iii) Smart work imposes more Internet, equipment, and electricity costs on me | [25] |
| ICT skills | |
| (i) I have the adequate resources (Internet, devices, and required software) to do smart work | [31] |
| (ii) I have the adequate knowledge to use smart work equipment (Internet, devices, and required software) | [31] |
| (iii) The smart work equipment is not compatible with office work equipment I used to work with | [31] |
| Institutional and technological support | |
| (i) In smart work, my superiors are on hand to answer the ambiguities that arise in my duties | [19] |
| (ii) In smart work, my organization provides the necessary technology support in smart work | [19] |
| (iii) My organization is available to answer the technological ambiguities arise in smart work | [19] |
| Perceived limited communication | |
| (i) Smart work has reduced my social interactions | [19] |
| (ii) With smart work, I feel more alone | [30] |
| Employee adoption of smart work | |
| (i) I intent to welcome the doing smart work in the next 6 months | [31] |
| (ii) I predict to do smart work in the next 6 months | [31] |
| (iii) I plan to do smart work in the next 6 months | [31] |

Table 2: Demographic features of the sample.

| | Number | % |
|---|---|---|
| Gender | | |
| Male | 153 | 65.4 |
| Female | 81 | 34.6 |
| Age | | |
| 18-24 | 45 | 19.2 |
| 25-34 | 57 | 24.4 |
| 35-44 | 96 | 41 |
| <45 | 36 | 15.4 |
| Work experience | | |
| >5 years | 30 | 12.9 |
| 5-10 | 132 | 56.4 |
| <10 | 72 | 30.7 |
| Position | | |
| Top manager | 25 | 10.7 |
| Middle manager | 53 | 22.6 |
| Supervisor | 43 | 18.4 |
| Employee | 113 | 48.3 |
| Education | | |
| Bachelor's degree | 46 | 19.6 |
| Master's degree | 131 | 56 |
| PhD or equivalent | 57 | 24.4 |

factors that influence the decision of employees to accept SW, on the output variable, which is employee adoption of SW. In other words, modeling the SW adoption using the MLP model provides the possibility of predicting the adoption of SW based on the input variables confirmed in the SEM stage. ANN models outperform the conventional linear statistical techniques such as multiple regression analysis (MRE) in both identifying nonlinear relationships [32–35] and finding causal relationships [36]. Therefore, firstly SEM was used to test the proposed conceptual model of the study and identify significant predictors which shapes the inputs of the MLP model to determine the importance of each predictor variable. MLP, as a typical neutral network, includes three hierarchical layers, i.e., one input layer, one or more hidden layers, and one output layer. The decision to choose the number of hidden layers depends on the complexity of the problem. In the present study, one hidden layer was used. The input layer contains neurons whose number of neurons is equal to the number of model input variables. In this study, the variables whose effect on employee SW adoption was confirmed in the SEM analysis phase are considered as input variables (or input neurons). The number of output layer neurons is the same as the model dependent variable, which is employee SW adoption.

MLP is a supervised learning ANN that stores the identified patterns in the network and iteratively tests them to identify patterns in the model and increase the predictive power of the model. There is no set rule for selecting the number of hidden layer neurons. The network with the lowest number of hidden layer neurons that had the highest performance in the training phase is considered as the network in the test phase. In this study, Sigmoid activation function is employed for both hidden and output layers, and all the variables were normalized to the range (0, 1) to shorten training times and increase the prediction performance [37]. The root mean square of error (RMSE) was used to evaluate the predictive power of the model.

Table 3: The results of validity and reliability tests of the model.

| Factors | Cronbach's alpha | CR |
|---|---|---|
| Perceived value | 0.842 | 0.89 |
| Perceived cost | 0.801 | 0.93 |
| ICT skills | 0.931 | 0.92 |
| Institutional and technological support | 0.788 | 0.92 |
| Perceived limited communication | 0.811 | 0.86 |
| Employee adoption of smart work | 0.876 | 0.83 |

## 5. Results and Discussion

*5.1. Measurement Model Test.* In the SEM, two criteria of reliability and validity are measured to evaluate the measurement model. Two criteria of Cronbach's alpha and composite reliability (CR) are used to evaluate the model reliability. According to Nunnally [38], the desirable values for Cronbach's alpha are values higher than 0.7 [39]. Table 3 reveals that all Cronbach's alpha values for all the variables of the model are higher than 0.7 implying the sufficient reliability of the model. In addition, the CR values of all factors are higher than threshold value of 0.6 [40].

According to Fornell and Larcker [41], average variance extracted (AVE) should be examined to evaluate the convergent validation of the measurement model, and the values higher than 0.5 are acceptable for AVE. In addition, the matrix of intercorrelations is designed for examining the discriminant validity of the model. Table 4 discloses that discriminant validity values for the model variables vary from 0.39 to 0.72, and the value of AVE for all the variables is higher than 0.5.

The values of the goodness-of-fit indices were examined to assess the fit of the suggested model.

Table 5 shows that the $X^2$/df is 2.05, which is less than the 3 suggested by Carmines [42], and goodness-of-fit index (GFI) and adjusted goodness-of-fit index (AGFI) values are 0.783 and 0.759, respectively, that represent the model has good fit. Besides, root mean square error of approximation (RMSEA) value is likewise within the desired range of 0.05 to 0.08 [43].

*5.2. Structural Model Test.* Testing the hypotheses is the same as examining the relationships between the latent variables of the model. The conceptual model presented in this study has five independent variables (which are perceived value, perceived cost, ICT skills, institutional and technological support, and perceived limited communication) and a dependent variable (i.e., employee SW adoption). In other words, testing hypotheses in the SEM is the same as testing structural models. To test the hypotheses and confirm the existence of a relationship in a structural model, it is

Table 4: Intercorrelation matrix.

| | 1. Perceived value | 2. Perceived cost | 3. ICT skills | 4. Institutional and technological support | 5. Perceived limited communication | 6. Employee adoption of smart work |
|---|---|---|---|---|---|---|
| 1 | 1 | | | | | |
| 2 | 0.64 | 1 | | | | |
| 3 | 0.63 | 0.39 | 1 | | | |
| 4 | 0.57 | 0.58 | 0.71 | 1 | | |
| 5 | 0.59 | 0.51 | 0.54 | 0.48 | 1 | |
| 6 | 0.41 | 0.49 | 0.44 | 0.72 | 0.63 | 1 |
| AVE | 0.81 | 0.84 | 0.71 | 0.81 | 0.83 | 0.77 |

Table 5: The results of fit testing of the proposed model.

| Fit metrics | The model's value |
|---|---|
| $X^2$/df | 1.82 |
| GFI | 0.783 |
| AGFI | 0.759 |
| RMSEA | 0.059 |

important that the estimated statistics for each relationship be significant at least at the level of $p < 0.05$. As Table 6 shows, the estimates related to four out of five hypotheses are statistically significant. These findings show that the value that employees expect from adopting SW has a positive and significant relationship with their behavioral intention on SW adoption. Thereby, hypothesis H1 is supported. In other words, this finding illustrates that employees can spend more time with their families and that this remote work gives them more flexibility, encouraging them to adopt SW. Hypothesis H2 is also supported due to the statistically significant effect of the perceived cost on the employee SW adoption (estimate = −0.230, $p > 0.012$). Since the statistical confidence is negative, it means that this factor has a negative relationship with the intention of employees to adopt SW. In other words, the lower the perceived costs of SW, the higher the intention of employee to adopt SW. Smart working and remote working are expected to reduce staff-to-work commuting costs as well as business travel costs for employees. The results of this study show that this reduction in costs has made them welcome SW. Table 6 shows that hypothesis H3, which articulated the positive significant effect of ICT skills on employee adoption of SW, is not supported (estimate = 0.110, $p < 0.124$). In other words, the present study is unable to provide evidence that the ICT skills of employees are an influential factor in their decision to accept SW. This could mean that the skills needed to work remotely do not pose a new challenge to employees, the technologies required to perform tasks in SW do not require new skills from employees, and this factor cannot be effective in predicting employees' behavioral intentions. Testing the fourth hypothesis (i.e., H4) revealed that the "institutional and technological support" variable has a positive significant effect on the employee intention to adopt SW (estimate = 0.225, $p < 0.001$). In smart working, the chances of meeting supervisors and managers closely are much lower at times when there are ambiguities in the tasks. Therefore, the importance of this institutional and technological support in the SW seems necessary. Findings from the test of hypothesis H4 disclose that the more measured organizations have taken to support employees to clear up ambiguities and perform better tasks, the more they are willing to accept SW.

It has been also proved that perceived limited communication is a significant predictor of employee intention to adopt SW (estimate = −0.066, $p < 0.044$). Therefore, the hypothesis H5 is also supported. This finding implies that the higher perceived limited communication the employee has, the lower the chance he/she accepts SW. Remote work reduces employees' chances of connecting with coworkers and their social interactions in general, and if they cannot find a suitable alternative to meet their social needs (for example with family and friends), they feel lonely and isolated; therefore, they will not welcome SW. It is also important to point out that the independent variables explain 61.3% of variance in employee adoption of SW ($R^2 = 0.613$).

*5.3. Sensitivity Analysis.* Deciding about the number of neurons in the hidden layer in the MLP model is very important. The goal is to find the least neuron numbers that have the highest performance. Therefore, the model was run with three different neuron numbers (2, 3, and 4) [44]. The result showed that the optimal number of neurons is 2 because RMSE is the lowest for all model variables with 2 neurons in the hidden layer (see Table 7).

The output of the hypothesis test phase identified four antecedents for SW adoption, which are perceived value, perceived cost, institutional and technological support, and perceived limited communication. At this stage, these factors were entered as inputs to the MLP model and the importance of each of them in determining the dependent variable changes (i.e., employee SW adoption) was determined. Normalized importance is the ratio of the importance of each predictor to the highest value. The result of this sensitivity analysis is provided in Table 8. According to the results, perceived value has the greatest impact on employee behavior in SW adoption. It is also revealed that institutional and technological support, perceived limited communication, and perceived cost are, respectively, important in prediction of employee SW adoption.

Table 6: The results of structural equation modeling estimation.

| Hypotheses | Estimates | $p$ value | Standardized estimates | Hypothesis test |
|---|---|---|---|---|
| H1: perceived value➔ employee adoption of smart work | 0.145 | 0.001 | 0.167 | Supported |
| H2: perceived cost➔ employee adoption of smart work | -0.235 | 0.012 | -0.230 | Supported |
| H3: ICT skills➔ employee adoption of smart work | 0.091 | 0.124 | 0.110 | Not supported |
| H4: institutional and technological support➔ employee adoption of smart work | 0.187 | 0.001 | 0.225 | Supported |
| H5: perceived limited communication➔ employee adoption of smart work | -0.049 | 0.044 | -0.066 | Supported |

Table 7: RMSE values for MLP models with different numbers of neurons in the hidden layer.

| Model | Neurons | Training | Testing |
|---|---|---|---|
| *Perceived value* | 2 | 0.3009 | 0.2806 |
| Perceived value | 3 | 0.3021 | 0.2984 |
| Perceived value | 4 | 0.3015 | 0.2973 |
| *Perceived cost* | 2 | 0.3 | 0.2945 |
| Perceived cost | 3 | 0.3019 | 0.2987 |
| Perceived cost | 4 | 0.3075 | 0.2967 |
| *Institutional and technological support* | 2 | 0.3028 | 0.2814 |
| Institutional and technological support | 3 | 0.3098 | 0.2919 |
| Institutional and technological support | 4 | 0.3153 | 0.2963 |
| *Perceived limited communication* | 2 | 0.3048 | 0.2719 |
| Perceived limited communication | 3 | 0.3082 | 0.2977 |
| Perceived limited communication | 4 | 0.3076 | 0.2947 |

Table 8: The importance of variables in determining the changes in independent variable.

| Factors | Normalized importance |
|---|---|
| Perceived value | 1,000 |
| Institutional and technological support | 0.832 |
| Perceived limited communication | 0.494 |
| Perceived cost | 0.371 |

## 6. Conclusion and Implications

Smart working is not a new phenomenon, and there were businesses that already used this model. However, the lockdown resulting from the COVID-19 pandemic created a situation where most businesses are forced to work from home. Albeit, technological advances, both in the fields of hardware and software, also provide the necessary conditions for remote work and the acceptance of SW. The expansion of 5G, the increase in the penetration rate and access rate to the Internet among people in the society, the existence of the necessary software to manage work processes, etc. gave business managers the assurance that they can either fully or partially transform to SW. However, for the successful implementation of this transformation to the SW, the employees of the organization, who are at the center of this transition, should welcome it. And the acceptance of SW and adopting to remote work will result in the organizational performance [5, 10]. Therefore, the present study is aimed at firstly determining what factors are effective in the behavioral intention of employees in the SW adoption and, secondly, using the neural network method, providing a model for predicting the behavior of employees in SW adoption. By studying the literature, the variables of this model were initially composed of perceived value, perceived cost, ICT skills, institutional and technological support, and perceived limited communication, but after testing the model using SEM, it was disclosed that only perceived value, perceived cost, institutional and technological support, and perceived limited communication are effective in the decision of employees to adopt SW. In the next step, using an innovative methodology, the outputs of the SEM model were entered into the MLP model, and the importance of each of the variables in predicting employee behavior was examined. Since this study is one of the first studies to provide a conceptual model for employee SW adoption, this model contributes to the literature of SW as well as the behavioral intention theory. The findings not only provide a basis for future research but also provide guidance for managers of knowledge-based organizations to manage remote work, which are referred to below.

*6.1. Theoretical Implications.* This study identifies antecedents of employee SW adoption using a quantitative empirical study. Findings of this study revealed that employee's perceived value not only influences employees' decision-making in adopting SW but also has the greatest impact on their behavioral intentions compared to other variables. This finding is consistent with other findings in the behavioral intention theory literature, where, for example, Davis [22], Wei et al. [18], and Wu and Wang [25] argue that perceived value is also an influential variable in the technology acceptance model. This study also provides evidence of the effectiveness of institutional and technological support on employee SW adoption, which is in line with the findings of Eom et al. [19]. Eom et al. [19] also show that institutional and technological support is one of the factors influencing SW adoption by the South Korean government. Confirmation of the effect of perceived limited communication on employees' behavioral intentions in the present study is also consistent with the studies of Mokhtarian and Salomon [29] and Pérez et al. [30]. However, it was found that this variable

has a negative relationship with the behavioral intentions of employees. In other words, if employees expect that SW will lower the chances of their social interactions, they will be less willing to adopt SW. This can be seen in another finding of this study, where it is found that perceived costs have a negative impact on employee behavioral intentions. This finding is also consistent with other findings in the behavioral intention literature, especially technology acceptance models (e.g., [24]). However, the present study failed to provide evidence to support the impact of employees' ICT skills on their decision to adopt SW, and the hypothesis corresponding to this variable (i.e., the third hypothesis) was also rejected. This hypothesis is rejected because, on the one hand, this study has been conducted among knowledge-based companies that one of the characteristics of these companies is moving across the frontiers of knowledge [45], and it is expected that the employees of such companies have a minimum of digital literacy and ICT skills. On the other hand, a look at the demographic characteristics of the participants in this study reveals that they all have a university education, and almost 75% of them are under 45 years old, so it is expected that having such skills is not the main challenge for these groups of people, and this variable will not affect their decision to adopt SW.

*6.2. Managerial Implications.* Remote and smart works are not a new issue, but COVID-9 pandemic forced most organizations to switch to remote work, and it is expected that many businesses will somehow maintain the remote work procedure [15]. Therefore, identifying the motivating and inhibiting forces of employees in accepting SW can provide guidance to managers to better manage this transition. This study provides quantitative empirical evidence that perceived value is one of the antecedents to employee SW adoption. This finding indicates that the value that employees expect from accepting SW is one of the driving forces of their behavioral intention. If employees expect that with the SW, they can spend more time with their family, this gives them more flexibility, and they will be encouraged to adopt SW. Hypothesis H2 of this study confirms that perceived cost has a negative effect on employee SW adoption. Smart work and remote work are expected to reduce staff travel costs to work as well as their business trip costs. The results of this study show that this reduction in costs has led to their adoption of SW. The results of testing the fourth hypothesis of the present study illustrated that "institutional and technological support" is another factor affecting the employee's intention to adopt SW. In SW, when there is ambiguity in the work, the chances of meeting supervisors and managers up close are much lower. Therefore, the importance of this institutional and technological support in SW seems necessary. Finally, this study outlined that perceived limited communication is an important predictor of employee intent to adopt SW. Remote work reduces employees' chances of communicating with coworkers and their social interactions in general, and if they cannot find a suitable alternative to meet their social needs (for example, with family and friends), they feel lonely and isolated that affect their decision to adopt SW.

## Data Availability

All data will be available upon request.

## Conflicts of Interest

The authors declare that they have no conflicts of interest.

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