Estimate People's Willingness to Pay for the Use of Information and Communication Technology in Tackling the Social Consequences of the Corona Pandemic

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ABSTRACT

Aims The spread of the Corona pandemic has affected the status of companies involved in information and communication technology. This study aimed to investigate individuals' subjective perspectives on the use of ICT (online businesses, virtual meetings, e-learning, and generally the role and impact of cyberspace) and finally evaluate people's willingness to pay.
Materials & Methods In this study, a conditional logit model was used. The required information was collected through a field survey by completing a questionnaire from 384 respondents of Tehran citizens in 2021.
Findings Based on the information from the questionnaires filled, more than 75% of the respondents rated the use of cyberspace capabilities for encountering Corona disease as moderate and high. The result of estimating people's willingness to pay for the feature of "use of information and communication technology" in the present study was 5600000 Rials.
Conclusion Considering the capabilities of this technology and its position among the people, it is necessary to put on the agenda ICT penetration expansion and planning to make maximum use of its capabilities in similar pandemics and crises.

Keywords COVID-19; Technology; Economic Valuation; Public Health

CITATION LINKS

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Introduction

In recent years, economic assessment of the social consequences of economic activities, environmental issues, and even health-related projects and issues has become an integral part of cost-benefit analysis [1]. Social impact assessment experts believe that all issues that affect people directly or indirectly can be assessed. In other words, social impact assessment includes the process of analyzing, monitoring, and managing the desirable and undesirable social consequences, as well as the positive and negative aspects of any program interventions under policies, programs, plans, projects, and generally any social changes that have occurred as a result of interventions [2]. As for social consequences, they encompass a wide range of aspects of human life that form the basis of interaction with society. Cases such as lifestyle, culture, social and political interactions, health and fitness, citizens' interactions in the business environment, personal rights and property, wishes and worries, etc. [3].

As can be seen, social consequences shape a variety of aspects of individuals' lives in society. Among them, information and communication technology (ICT) is one of the contexts that can play an important role in shaping individuals' relationships and interactions and in managing social consequences. This is because this technology can provide a platform for communication and interaction with society, participation in social and political activities, entry into the business world (internet jobs), the realization of electronic health, and so on. It is obvious that under these circumstances, ICT can manifest itself as an economic incentive in the form of facilitating interactions and improving the efficiency and productivity of activities, creating value and becoming economically valuable so that citizens are willing to pay for the use of its capabilities.

On the other hand, the world has been struggling with the outbreak of the Corona pandemic for more than two years. The disease has taken a toll on the economy and has led to numerous social consequences, and these non-economic consequences, or in other words, the social consequences have in turn led to much greater and more drastic costs being imposed on the economic and social dimensions of society. The critical conditions resulting from the outbreak of this disease in the country and the quarantine naturally have many psychological and physical consequences at the individual and social levels—conditions that almost none of the Iranians in today's society have ever experienced living under quarantine or have not had the opportunity to practice how to behave under these conditions. Some studies show that more than 77% [4] to 90% of people [5] have experienced these conditions [6].

The Corona crisis severely limited the ability to talk with family, friends, and colleagues, attend family and friendship gatherings, go to cafes, and join various groups and clubs. Studies show that 63% of people had consciously reduced their interactions with others and 20% of participants reported that they had reduced these interactions to zero [7]. Fazeli [5] showed that about 75% of families experienced interactions and conversations in the family at high and very high levels. Also, the results of a study conducted by the Institute of Culture and Arts of Iran [4] indicated that 19% of the respondents had introduced family conversations as their leisure activity. In this situation where face-to-face contact with others is decreasing, cyberspace comes with the aid of real space. Contacting others through video calls is an activity that more than 65% of the population engaged in more frequently than average during the quarantine period [5].

This level of interaction and conversation with family members, which many families have not experienced before, could be a good opportunity to review many interactions and, of course, improve intergenerational relationships, but it has also brought dangers, as studies show. More than 16% [4, 8] to 28% [5] of people reported tensions in family relationships. 58% of said people reported tensions in the relationship between couples and 42% reported an increase in tensions in the relationship between parents and children [6, 8]. Based on a survey conducted by Tehran Municipality between April 6 and 7, 2020 with a sample size of 1,023 people, it was found that people are more concerned about Covid-19 compared to the first wave of the survey in March 2019. 51% said they were seriously concerned, 20% somewhat concerned, and 29% slightly concerned [8, 9]. In these conditions, prolonged stay at home can lead to depression, lethargy, and exacerbation of underlying conditions such as hypertension, stress, and anger, which have led to respiratory injuries in many people. Another social consequence of the Corona pandemic has been people's increased reaction to each other or, in other words, increased sensitivity in interpersonal relationships. In short, the negative points can be summarized as the creation of a social divide and an increase in individualism and social isolation, particularly controlled, purposeful, accountable, and largely non-emotional encounters, contacts, and communications; a decrease in face-to-face interpersonal communication practices; and an increase in virtual communication and meanwhile decreased social capital, especially social trust and consideration of the possibility of risk in any domain, decreased social health, the creation, and amplification of psychosocial consequences such as fear, anxiety, stress, obsessive-compulsive disorder [10-13].

Now in such circumstances, as mentioned previously it seems that ICT can play an important role in shaping individuals' relationships and interactions and in managing social consequences. In this context the opportunities for ICT to address the spread of the Covid-19 virus have been reported into three groups: Identification and control of disease carriers, combating the spread of misinformation on social media, and reduction of physical contact (telework, e-learning, e-banking, etc.) [14]. That is why with the Corona pandemic, the process of digitalization has accelerated around the world. While countries face frequent shutdowns, school closures, and industry closures, digital skills - whether for distance learning, e-commerce, or working from home - have become more necessary than ever [13]. Studies show that teleworkers perform 13% better than their counterparts and 97% of teleworkers feel that their performance is better or no worse than non-teleworkers. Telework has also been identified as a factor in retaining the corporate workforce, such that retention rates increase by 10% and 54% of employees would quit their current job if offered a new job with the option of telework [15]. Based on the Tehran citizens' response to the questionnaires distributed in the present study in 2021, the ability of cyberspace encounter (efficiency and effectiveness) with corona disease was rated moderate and high.

In this study, we try to take a look at the main social impact of the disease to analyze the impact of the use of ICT based on economic principles, and finally, make an economic evaluation to achieve the harm to the economy and society using the choice experiment (CE) method as a new approach in the economic evaluation of social consequences. The "Choice Experiment" technique has also been expressed as a subset of choice modeling, one of the methods for evaluating stated preferences [12].

This study aimed to investigate individuals' subjective perspectives on the use of ICT (online businesses, virtual meetings, e-learning, and generally the role and impact of cyberspace) and finally evaluate people's willingness to pay.

Materials and Methods

The scope of the CE method in various scientific fields such as health economics, transportation economics, natural resource economics, and microeconomics has expanded in recent years due to scientific advances in these fields [16]. The CE method is one of the choice modeling approaches from the family of expressed preferences and the hypothetical market that has expanded in recent decades. Among the advantages of the choice test method is the possibility of calculating and valuing non-market functions and the ability to include socio-economic variables in it. As regards that we are also faced with the aforementioned variables in health fields, and in the present research, to estimate

the willingness of people to pay for using information and communication technology, it is necessary to examine the preferences and tendencies of different people in society. The subject will be possible only through taking a questionnaire, so a questionnaire was designed based on the principles of the CE method, which will be explained below.

The CE method was first developed by Louviere & Hensher [17] and Louviere & Woodworth [18] at the beginning of the 1980s. The CE is one of the commonly used methods to evaluate market and non-market goods. The CE is based on the Lancaster microeconomic approach and random utility model (RUM), which states that a commodity is used based on its characteristics and attributes. The basis of the CE is RUM. The indirect utility function for each respondent (U) is divided into two parts: a specific part (V), which is usually chosen as a linear index of the attributes of j different alternatives in the choice set, and a random part (e), which shows the unseen effects on individual choice.

Equation 1 shows the indirect utility function:

$$(1) \quad U_{ij} = V_{ij}(X_{ij}) + e_{ij} = bX_{ij} + e_{ij}$$

The possibility that each person prefers alternative g in the C_i choice set over other alternatives such as *h* depends on how much its utility to the person *i* exceeds the utility of the other alternatives in the choice set [17]; as shown in Equation 2:

$$(2) \quad P(U_{ig} > U_{ih}, \forall h \neq g) = P[(V_{ig} - V_{ih}) > (e_{ih} + e_{ig})]$$

Normally, the distribution of error terms (*eij*) assumes that the random terms or disturbances of the indirect utility function are uniformly and independently distributed by the extreme value distribution (Weibull distribution). In Equation 3, the random terms of the indirect utility function are Weibull distributed. That is the probability of choosing any preferred alternative such as *g* from C_i choice set can be expressed as a logistic distribution. This equation is estimated by different logit models such as conditional logit, multinomial logit, mixed logit, and nested logit [19].

$$(3) \quad Pr_i(g|C_i) = P(U_{ig} > U_{ih}, \forall h \neq g) = \frac{\exp(\mu V_{ig})}{\sum_{h \in C_i} \exp(\mu V_{ih})}$$

The main purpose of the CE model is to estimate the structure of respondents' preferences. To achieve this goal, the respondent selects one of the alternatives included in the choice set. The CE approach evaluates the goods based on their attributes. If price is one of these attributes, the final estimate of utility becomes the estimate of WTP to change the level of attributes. The main advantage of the CE method is its ability to combine data in terms of qualitative and quantitative attributes [20]. To

achieve the objectives of the study, a questionnaire was presented that conformed to the design principles of the CE. The first step in designing the CE is to assign the characteristics and expressions of each attribute. The desired characteristics were selected based on library studies, articles written by social scientists, economists, and pathology reports prepared by them.

The characteristics considered in the present study include mental illness, unemployment, use of information and communication technology, family problems, concern about social discrimination (all in three levels of low, medium, and high), and price based on field research (numerous financial documents of patients and the tariffs of the medical system) in 2021 were defined in three levels (10,000,000, 40,000,000 and 80,000,000 Iranian Rials). Table 1 shows an example of a selected card in the current study.

Table 1) sample selection card

Attributes	Choice 1	Choice 2	Choice 3
Mental illness	low	high	Whether or not these conditions are different to me and I do not want to pay any fees for it.
Unemployment	low	high	
Use of information and communication technology	high	low	
Family problems	high	low	
Concern about social discrimination	medium	low	
Willingness to pay (Iranian Rial)	80,000,000	10,000,000	0
Which of the above scenarios do you prefer?	-	-	-

According to the defined characteristics and their associated levels, the number of possible modes for the 36 selection test is 729 options. Since it is not possible to test this number of options, 22 options were selected using the statistical method of optimal D and orthogonal main effects with SAS software.

The 22 options considered were included in 11 duplicate choice sets. Then, a null option was added to each selection (I do not care if these conditions exist or not, and I do not want to pay for them) to avoid the negative effects of forced selection.

The Cochran-Orcutt formula was used to select the sample size, which required 384 individuals according to the appropriate calculations. Therefore, the required information was collected through a field survey by completing a questionnaire from 384 respondents of Tehran citizens in 2021.

Findings

Based on the CE method and conditional logit model, information and communication technology use and willingness to pay were considered independent variables for the conditional logit model. a constant is used in the model to affect the current state

(corona), which is also used in this study. The results of the estimation of the conditional logit model are reported in Table 2.

Table 2) Conditional logit results

Variable	r	S.E.
Constant	4.49	0.09
Use of information and communication technology	0.18	0.03
Willingness to pay (price)	0.32	0.008

All was significance

The sign of the constant rate was positive and significant. The sign of the coefficients of the constant rate and the significance interval indicate that the majority of the respondents prefer the hypothetical option (improving conditions) to the current conditions option. The sign of the WTP coefficient is negative according to the theory and significant at the 1% level.

The coefficient on the price variable is negative because increasing the price reduces people's desirability and makes them less likely to accept the desired option. Except for the willingness to pay attribute, the sign of the use of information and communication technology was positive and significant. This shows that people's willingness to pay is positive due to Corona disease. As we know, econometric analyzes were based on signs and numerical values of variables, and the statistics that were the criteria and basis for the accuracy of model estimation are presented in Table 3.

Table 3) Goodness of fit for the conditional logit

Statistics	Amounts
LR(7)	5543.679
R^2 McFadden's	0.38
R^2 Count	0.90

Since the coefficients in logit models cannot be interpreted directly, this type of model uses implied prices or willingness-to-pay for characteristics to interpret the coefficients of characteristics and compare them with each other. The relationship between the coefficient of each characteristic and the coefficient of the monetary variable can be estimated. Based on the results of the present study, the willingness to pay for the use of information and communication technology for each sample person in Tehran city was 5,600,000 Rials on average.

Discussion

What has been discussed in different studies [21, 22] and seen in the governmental support and allocated budget for Corona is that the focus has been on evaluating the economic damages and consequences of Corona disease to society and the numerous and serious social consequences and costs imposed on the society have been neglected; in this study, people's willingness to pay for using information and communication technology has been estimated

and analyzed as one of the most important social consequences of Corona pandemic.

According to the latest information published by the Iranian Statistics Center [23] about the average total cost of an urban household, the total net cost in 2020 is 621,392 thousand Rials and the average estimate of the willingness to pay in the current research is 5,600 thousand Rials, which is 0.9% of household total expenses in 2020. This number (0.9% of total household expenses) indicates the relatively high willingness to pay Iranians to use ICT capabilities in the Corona era. Especially when we compare this digit with the 2.2% share of the communication sector (including post, courier, landline & mobile phone, etc.) from the annual budget of Iranian households. It seems that during the outbreak of Corona, Iranians are well aware of the capabilities of this technology and have placed a high value on it. It is also necessary to mention that this condition is observed in other areas as well. McKinsey global digital sentiment insights survey [24] reported a considerable rate of growth in the use of digital technologies in the corona pandemic by consumers in some selected industries such as facilities and insurance (46%), public sector (45%), travel (38%), telecommunications (36%) and banking (28%). According to this report, nearly half of these growth rates (about 45%) have been due to the intense use of digital technologies during the Corona pandemic.

Although the results of the present study regarding the willingness of Iranians to pay for the use of ICT (as the present study innovation), are not observed in the literature on the subject. But it is consistent with the results of the studies conducted in the field of using this technology in the field of health. For instance, Wang _et al._ [25] discussed how the pandemic influences the practices of e-health from the perspective of users in China's Hubei province (i.e. the first epicenter of COVID-19). They found that e-health has played a crucial role in fighting the COVID-19 pandemic which is mostly rooted in factors such as the high risk of infection outdoors, the shutting down of transport systems, and dysfunctional healthcare facilities that neglect non-COVID-19 patients' clinical demands. They concluded that digital health acts as a functional equivalent to traditional medical treatment meanwhile the respondents expressed their willingness to continue the use of e-health in the post-COVID-19 phase. However, the authors assert that despite the increasing use of e-health, it cannot fully substitute traditional offline treatment. On the other hand, Bui _et al._ [26] discussed despite the rapid deployment of digital health applications since the beginning of COVID-19 in Vietnam (including telemedicine and artificial intelligence and related applications) which has brought great benefits in the diagnosis, and treatment of COVID-19 for them,

numerous constraints such as lack of strong governance of digital health development and deployment; insufficient infrastructure and staff capacity for digital health application had been among the main drawbacks of proper utilization of e-health. In this regard, we can also refer to the study of Eslami _et al._ [27] which, by a comprehensive literature review, focused on e-health potentials in COVID-19 pandemic control and found that most of the COVID-19 e-health interventions designed or suggested for improving prevention (48%) and diagnosis (48%). They finally concluded that e-health solutions have the great potential to provide useful services to help in the COVID-19 pandemic in terms of prevention, diagnosis, treatment, screening, surveillance, resource allocation, education, management, and control.

It is also necessary to mention that the capabilities of ICT in the field of health are not limited to the period of Corona. In this regard, Hosseinzadeh & Mozayani [28] by using provincial data in Iran (before the outbreak of Corona) showed that the increase in the penetration rate of Internet in Iranian households has had a significant effect on reducing household spending on health services.

According to what was raised, it seems necessary to pay attention to two issues. First, it is necessary to develop the digital economy in Iran, which has significant potential compared to the situation in other countries. The statistics indicate that, while the share of the digital economy in the national economy in Iran is 3.2%, this number for the United States of America, China, and the global average is 21.6, 30, and 15.5%, respectively [29]. The second point is the necessity of maximum use of ICT in the field of health in the form of various examples of E-Health such as Health Knowledge Management, Electronic Health Records, Smart E-Home, Telemedicine, Informatics Health Consumer, Virtual Mobile Health, Healthcare Information Systems, etc.

In summary, the findings of the present study indicate the high subjective value of using ICT capabilities among Iranians to manage the transition period from corona disease and their relatively significant willingness to pay in return. This finding is consistent with the results of studies and practices in other countries. Therefore, the following recommendations can be suggested to strengthen the opportunities for using this technology as much as possible.

1- Expansion of ICT penetration from the infrastructures perspectives and at the same time development of platforms for using the capabilities of this technology such as E-Health, E-learning, E-commerce, etc.

2- Separate planning to make maximum use of ICT capabilities in similar crises and pandemics, for instance in areas such as online counseling, online notifications, online training, online monitoring, etc.

Conclusion

In the last two years, despite the spread of Corona, the process of digitalization in the world has accelerated and significant investments have been made in the field of digital economy development, especially in areas related to the provision of medical services. Given the experience of the Corona pandemic, the development of digital capabilities is now more than ever essential to ensure the economic growth and resilience of countries, and each country must properly assess its position among the various obstacles in the development chain of digital services. The results of the present study implied Iranians have a considerable willingness to pay for the use of information and communication technology capabilities in the Corona era.

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