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Modelling Willingness-to-Adopt an Intelligent Oven: Capturing the Seniors Perspective

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Abstract: Introduction: The senior population is projected to continue to increase dramatically for the foreseeable future and cognitive issues associated with aging have become a major concern as they affect people's ability to carry on activities of daily living. One area of daily living, which has often been cited as a key problem area for seniors is the detection of risks in the home, especially in the kitchen. The kitchen is the place where most domestic accidents occur and the oven is the main source. **Methods:** We propose a safety kitchen solution, InOvUS, which focuses on safety and reducing the risk of fire, burn and intoxication. We present the evaluation of the soundness of the method we designed to evaluate the adoption intention and interest of a safety kitchen system from a senior user's perspective. **Results:** We develop a conceptual model utilizing several existing scales such as the CAI (consumer adoption intention), CI (consumer innovativeness), TAM (technology acceptance model), PEOU (perceived ease of use) and PU (perceived usefulness) scales, but specific to the senior 65+ segment. **Conclusion:** The evaluation results of InOvUS through the application of our model show a clear buying intention toward InOvUS and also a clear intent to use it.

Key words: Willingness-to-adopt, intelligent oven, safety, cognitive decline, seniors.

1. Introduction

Among seniors 65+, burns and fires are found to be the 5th leading cause of accidental death, with 43% of cases resulting from fire/flame, 34% from scald injuries and 9% from contact with a hot object [1]. Respectively, in a leading study on elderly patients discharged from the emergency department, it was shown that 68% of all burns among seniors were reported to be cooking-related, with most of those originating in the kitchen [2]. Considering 82.6% of all burn injuries reported occurred in the home [3], the kitchen thus represents a very high majority of all burn occurrences.

Indeed, the aging process is said to trigger physical, sensorial and cognitive declines, which have severe impacts on ADL (activities of daily living). This is an important concern as there are approximately 90% of Canadian and American seniors who plan to age in their current homes [4, 5]. In fact, some cognitive declines in aging, like attention- and memory-related problems, limit people in performing their cooking related tasks and lead seniors to become strongly concerned with cooking-associated risks (e.g., fire, burn or intoxication) [6], not to mention the concerns of their family members.

The safety management of cooking risk is, thus, a vital concern, especially when considering that there are 5.8 million 65+ Canadians and the number of 80+ is expected to more than double to as 3.3 million by 2036 according to a medium growth scenario [7]. Additionally, in the United States, by 2060, the number of 65+ (47.8 million) is expected to double (98.2 million) and 19.7 million will be 85+ [8]. Given that the vast majority of seniors living independently wish to remain in their environment as long as possible [4] and with a more general move towards long-term in-home care provision [9], these statistics are critical elements to consider as a point of

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intervention.

In fact, the projected growth pattern of the senior population places a real burden on caregivers, healthcare facilities and social services as ensuring safety of activities of daily life becomes a vital element in helping seniors to remain independent. This is especially true when seniors are engaged in what can become a high-risk activity such as cooking. Consequently, the aims of this paper are: (1) to survey the literature to identify the risks and solutions posed for seniors when cooking; (2) to perform a qualitative analysis to identify the interest in an intelligent oven, such as InOvUS, a safety kitchen solution which focuses on safety and reducing the risk of fire, burn and intoxication, designed to better manage such risks; and (3) to propose a research instrument as an evaluation tool to test and model seniors' willingness-to-adopt InOvUS.

2. Literature Review

There are 3 major risks while cooking in the kitchen: fire, burn and intoxication [6, 10]. Despite this, existing research often addresses only fire as a risk in cooking and no global solution for kitchen safety has been reported. Undoubtedly, fires are well documented in the literatures [11-14]. Most scholars, however, have concentrated on identifying the causes of home fires and their consequences without focusing on specific populations that may have higher risks than others. For instance, a review of studies from 1990 to 1998 on factors triggering domestic fires revealed that domestic fire sources and the type of people living in the housing unit are correlated [12]. Additionally, unattended cooking is found as the leading main factor responsible for fire in the kitchen [15, 16] and, according to the literature, the three main causes of fires while cooking are: (1) fires related to the usage of the oven, (2) the use of unattended stove burners and (3) the use of portable devices such as toasters [17].

Moreover, a three-decade review of senior burn patients uncovered more serious consequences and "diminished senses, impaired mentation, slower reaction time, reduced mobility and bedridden states" lead to greater inability to identify severity of burn-related threats and escape from them [18]. The same research showed that for any given type of burn, among the 75+ age category, more serious consequences were reported including higher mortality rates. On the other hand, the literature has relatively few studies on intoxication by inhalation but many studies are found on injuries caused by carbon monoxide [19] and so we can extrapolate that intoxication by inhalation is also higher in the senior population.

The consequences of fire risks can be fatal and according to the literature there are two main categories for reducing the consequences of cooking-related risks affecting seniors: "human" and "technology" [20]. From a technological perspective, the literature covers specific solutions that are designed to reduce risks in the kitchen. For instance, Ref. [21] established a system for assisting seniors in the kitchen through video and audio. To potentially avoid cooking hazards, the system reminds seniors to follow the correct steps when performing a cooking task but the system does not react in the advent of a dangerous situation.

In terms of the human perspective, Ref. [22] worked on a system that assists people in the kitchen and reacts when a potential dangerous situation is detected. The mechanism of this system is based on the detection of rapid variations in temperature and smoke in the kitchen. The system sends notifications to the fire department and caregivers with camera shots, activates exhaust fans and a fire-extinguishing suppression system. Nevertheless, systems with camera surveillance are generally not well perceived and acceptable by users due to the intrusion into the user's private life [23] and thus bring an important disadvantage. There are also a number of studies mentioning oven monitoring as a part of larger

systems to track ADL. For instance, Ref. [24] measures oven usage and Ref. [25] proposes detecting unsafe usage of the oven. Both systems use embedded temperature sensors to measure the burner status, ultrasonic sensors to detect the presence of a pot and electric current sensors to detect the usage of the oven and levels of abnormality in the kitchen [25]. Yet, these systems may be considered intrusive, as they either require modifications to the oven to install sensors or use visible-light cameras. Other research focused on an automated top oven-monitoring system based on thermal cameras to detect dangerous situations [26]. The system alerts users or caregivers when a dangerous situation occurs and since it is based on thermal imaging instead of visible-light cameras, it respects user privacy. Indeed, the thermal camera does not process regular images but is confined to important limitations: it is sensitive to cooking heat and smoke.

In all related work, it is clear that the systems designed to manage or reduce the risks posed when cooking carries important limitations that can impact senior's willingness to use and adopt such systems. Paradoxically then, while the risks associated with cognitive decline in aging may positively influence seniors to acquire such systems, the invasion of privacy from the systems' cameras can severely attenuate seniors' interest and willingness-to-adopt them. It is clear that with the rise of an ageing population, the extensive statistics associated with fires, burns and intoxication risks and consequences, as well as the constrained technologies available in the market all come together to trigger the urgent need to develop solutions to support seniors in improving their quality-of-life. To the best of our knowledge, only a small number of assistive technologies have been developed to assist seniors as part of assistive kitchens and they focus more strongly on the technology side, rather than on building safety and knowledge from the user's perspective and thereby reducing the risk of fire, burn and inhaling. Specifically, almost all related work is more focussed on evaluating the technical mechanisms and algorithms validation than evaluating the end-user perspective of such systems. Above all, none of the studies seen in the literature addresses the interest and/or adoption intention from the end-user perspective. To this end, we propose an intelligent oven, or a sensor-based cooking safe system, called "InOvUS". InOvUS aims at discerning hazardous situations by monitoring and measuring pertinent parameters around the oven to reduce the risks of fire, smoke inhalation and burn. Fire parameters include concentrations of VOC (volatile organic compound) and alcohol gases found in the cooking environment. Relative humidity, utensil temperatures, burner temperature and presence of utensils on the burner for burn by splash and contact constitute the burn parameter. For intoxication by gas/smoke, InOvUS observes the concentration of CO (carbone monoxide) gas. These parameters are extracted based on extensive risk analysis.

3. Methodology

In this exploratory phase of our research the focus is to identify the interest in InOvUS and propose a research instrument, as an evaluation tool to test senior's willingness-to-adopt. The findings will aid in the long-term development of technological support to help the safety of seniors in cooking activities. As this is an exploratory study and our goal is to assess the appropriateness of the structure of our constructs and test their reliability, we are not proposing hypotheses for testing at this stage.

To elicit expert opinion from researchers we posted an open-ended question to an online community of researchers: "What are the best measures of 'Willingness-to-Adopt' and/or 'Consumer Innovativeness' for use with electronic devices?" Out of the fifteen answers that we received, the most popular response was the one, which seemed to best respond to our needs, citing a 2008 JMR paper [27], which measured the adoption intention of 22 telecom

and electronic products (e.g. mobile phone, TIVO). The final scales were adapted from Ref. [28] "Characterization of Really New Products". Participants were asked to rate their agreement with each of the following 4 statements on a 5-point scale anchored by "strongly disagree" and "strongly agree": 1—"I feel quite certain of the benefits I could expect to get if I bought (adopted) this product/service." (Reverse coded); 2—"I'm quite sure of what the relevant trade-offs are among the costs and benefits of buying and using this product/service." (Reverse coded); 3—"I'll have to change my behaviour significantly to attain the potential benefits of this new product/service"; 4—"Using this new product/service would allow me to do things that I can not easily do now." Based on the experts' feedback, it seemed to be the best metric to use to measure "Willingness-to-Adopt".

Also of interest to our work is the positive directional (antecedent) relationship from CI (consumer innovativeness), captured on a single item: "I am always the first in my circle of friends to adopt a new product or service" to CAI (consumer adoption intention) that was postulated by Ref. [27]. Moreover, we examined other suggested metrics related to CAI like Ref. [29] TAM (technology acceptance model), which is highly predictive of technology adoption use. And since TAM is related to CAI, "ease of use" and "usefulness", and given that in Ref. [29] TAM3 model the output variable is "buying intention" (BI), it insinuates that CAI and BI are potentially related and that PEOU (perceived ease of use), PU (perceived usefulness) and CI (consumer innovativeness) would be potential precursors to these intention constructs. We therefore included a set of questions on ease of use and usefulness adapted in the current study from TAM, as well as CAI, BI and the single measure of CI, considered by Ref. [27] to be a precursor as well to CAI.

Also a meta-analysis on the drivers of consumer intentions to adopt innovations and the criteria consumers use in the stages of the adoption process has demonstrated that "opinion leadership" is a key driver in the decision to adopt an innovation [30]. According to that work, opinion leaders diffuse a positive main effect on consumer innovation adoption. Similarly Ref. [31] demonstrated that group decisions moderate the motivation to adopt new technologies and their perceived usefulness. As such, we included key questions on the IOCAI (impact on consumer adoption intention) by family members and caregivers and UFI (usefulness for family influencers) as moderators. As the purpose of this study is to develop a sound instrument to measure seniors' adoption intention and interest on innovativeness on an intelligent oven like InOvUS, we consider family members and caregivers to act as the opinion leaders influencing seniors' decisions. Fig. 1 shows our research model and Table 1 shows our questionnaire.

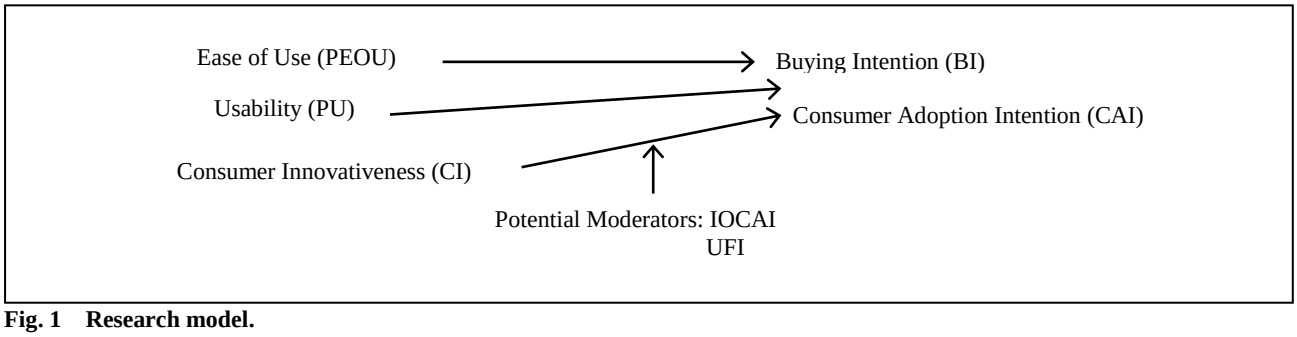

Fig. 1 Research model.

Model Used: CAI: consumer adoption Intention; PEOU: perceived ease of use; PU: perceived usefulness; CI: consumer innovativeness; IOCAI: impact on consumer adoption intention (by family members, caregivers); UFI: usefulness for family influencers; BI: buying intention.

Table 1 Research instrument and descriptive results.

#	Items
CAI 4101	I feel quite certain of the benefits I could expect to get if I bought (adopted) this product.
CAI 4102	I'm quite sure of what the relevant trade-offs are among the costs and benefits of buying and using this product.
CAI 4103	I'll have to change my behavior significantly to attain the potential benefits of this new product.
CAI 4104	Using this new product would allow me to do things that I can't easily do now.
PEOU 4105	Use of such a product is clear and understandable.
PEOU 4106	Using such a product would not require a lot of my mental effort.
PEOU 4107	I would find the product to be easy to use.
PEOU 4108	I would find it easy to get the product to do what I want it to do.
PU 4109	Using such a product would improve my cooking performance.
PU 4110	Using such a product would enhance my cooking effectiveness.
PU 4111	Using such a product would increase my cooking productivity.
CI 4112	I am always the first in my circle of friends to adopt a new product or service.
IOCAI 4113	My family members/caregivers would understand the benefits of buying such a product.
IOCAI 4114	My family members/caregivers would understand the costs of buying such a product.
IOCAI 4115	My family members/caregivers could facilitate collecting information about such a product.
IOCAI 4116	My family members/caregivers could facilitate buying such a product.
UFI 4117	Such a product would give my family members/caregivers peace of mind.
UFI 4118	Such a product would make things easier for my family members/caregivers.
UFI 4119	Such a product would enable me to continue cooking on my own.
BI 4120	If I had access to such a product, my intention would be to use it.
BI 4121	If I had access to such a product, I predict that I would use it.
B1 4122	I would use such a product.

4. Results

We pre-tested the wording and level of understanding of our questionnaire in a focus group with 8 seniors 65+. Based on the focus group outcome, minimal changes were made to the questionnaire. In that preliminary focus group session, we asked participants what the challenges were that they feel they face or other seniors face when using a stove. The reported problems were all related to the risk of fires and safety issues (4/8), design of the stove (4/8), lack of attention risks (1/8) and maintenance or ease of use (1/8). We next examine the key evaluation results of InOvUS and of our research instrument.

In total, 57 seniors (65+) aged from 65 to 95 participated in this study to test our model on senior's adoption intention and interest in InOvUS as an innovativeness safety kitchen system. Table 2 shows the key demographics of our sample and the descriptive statistics of our evaluation model are presented in Table 3.

Overall, seniors' consumer adoption intention of InOvUS is good (Q# CAI mean scores: 4101 = 4.91 & 4104 = 4.89) and it has a clear perceived ease of use (Q# PEOU mean scores: 4107 = 5.33, 4108 = 5.11 & 4106 = 5.05). Nevertheless, its perceived usefulness is less evident to seniors (Q# PU mean scores: 4109 = 2.95, 4110 = 3.44 & 4111 = 3.23). On average seniors believe that their family members/caregivers would have a positive perception of a system such as InOvUS (Q# IOCAI mean scores: 4113 = 4.38, 4114 = 4.20, 4115 = 4.49 & 4116 = 4.16). In addition, results confirm that seniors would continue with their cooking activities if they used InOvUS (Q# UFI mean score: 4119 = 4.39) and it would bring peace of mind to their family members (Q# UFI mean scores: 4117 = 4.39 & 4118 = 4.07). The maximum score of these descriptive statistics is 7.

Moreover, the validity and reliability of our evaluation model on seniors' adoption intention and interest in InOvUS was tested by using an exploratory factor analysis and reliability analysis. Table 1 shows

Table 2 Demographics of the sample.

Gender	Male	44	Female	13

Driver's licence	Yes	50	No	7

Age	65- < 70	70- < 75	75- < 80	80- < 85	85- < 90	90- < 95	95+
	20 (35.1%)	18 (31.6%)	12 (21.1%)	3 (5.3%)	3 (5.3%)	1 (1.8%)	0 (0%)

General health	Excellent	Very good	Good	Fair	Poor
	17	22	16	1	

Physical health or emotional problems interference with social activities	None of the time	A little bit of the time	Some of the time	Most of the time	All of the time
	42	12	1	1	

Marital status	Single	In couple	Married	Divorced	Separated	Widow
	4	9	22	9	1	12

Income	0-10,000	10,001-15,000	15,001-20,000	20,001-25,000	25,001-40,000	> 40,001	Not disclose
	1 (1.8%)		13 (22.8%)	3 (5.3%)	9 (15.8%)	30 (52.6%)	1

Table 3 Final research instrument.

	#	Items				
Factor 1—BI	BI 4120	If I had access to such a product, my intention would be to use it				
	BI 4121	If I had access to such a product, I predict that I would use it				
	BI 4122	I would use such a product				
		Total variance	Cronbach's α	Mean	Range	Variance
		32.703%	α = 0.974	5.099	5.019-5.185	0.007
Factor 2—PU	PU 4110	Using such a product would enhance my cooking effectiveness				
	PU 4109	Using such a product would improve my cooking performance				
	PU 4111	Using such a product would increase my cooking productivity				
		Total variance	Cronbach's α	Mean	Range	Variance
		17.295%	α = 0.835	3.256	3.036-3.500	0.054
Factor 3—PEOU	PEOU 4108	I would find it easy to get the product to do what I want it to do				
	PEOU 4107	I would find the product to be easy to use				
	PEOU 4105	Use of such a product is clear and understandable				
	PEOU 4106	Using such a product would not require a lot of my mental effort				
		Total variance	Cronbach's α	Mean	Range	Variance
		10.328%	α = 0.830	4.717	4.400-5.067	0.077
Factor 4—CAI	CAI 4102	I am quite sure of what the relevant trade-offs are among the costs and benefits of buying and using this product.				
	CAI 4101	I feel quite certain of the benefits I could expect to get if I bought (adopted) this product				
	CAI 4103	I'll have to change my behavior significantly to attain the potential benefits of this new product.				
		Total variance	Cronbach's α	Mean	Range	Variance
		8.838%	α = 0.750	4.139	3.450 - 4.583	0.366
Factor 5—CI	CI 4112	I am always the first in my circle of friends to adopt a new product or service				
		Total variance	Cronbach's α	Mean	Range	Variance
		7.242%	-	-	-	-

the twenty-two items (questions) utilized in the questionnaire to define our 7 constructs (i.e., CIA, PEOU, PU, CI, IOCAI, UFI and BI). These were measured on a 7-point Likert scale from 1 (never/strongly disagree) to 7 (always/strongly agree) with 4 being neutral. However, as IOCAI and UFI are treated as moderators they have been excluded from the factorial analysis, but they will be treated in a separate paper as moderators. Results produced a KMO value of 0.63 pointing to a mediocre factorability and sampling adequacy of our data. However, the Bartlett's test of sphericity result demonstrates we have sufficiently large correlations between items to conduct the exploratory factor analysis (χ^2 = 476.100, df = 105, p = 0.000). Thus, a principal factorial analysis with varimax rotation was applied on the 15 items. After reading the rotated component matrix and matrix correlation, 1 item was removed from our instrument (i.e., CAI—4104) to preserve the closest outcome capturing our 5 constructs and thus reducing our research instrument to 14 items.

Next, a factor analysis with oblimin rotation was done with the 14-item solution and generated a total variance of 76.406%. This solution produced 5 factors: Buying Intention (BI, 3 items), Perceived Usefulness (PU, 3 items), Perceived Ease of Use (PEOU, 4 items), Consumer Adoption Intention (CAI, 3 items) and Consumer Innovativeness (CI, 1 item). The model and the key statistics per construct are presented in Table 3. The reliability for each construct was obtained using Cronbach's α and results show that our scales hold satisfactory internal consistency (BI: α = 0.974; PU: α = 0.835; PEOU: α = 0.830 and CAI: α = 0.750). The reliability for CI cannot be assessed being that it is a single-item scale. Moreover, seniors' (n = 57) mean scores on each of the construct scales were mostly positive on the different dimensions relating to Factor 1 BI (mean = 5.099, variance = 0.007), followed by Factor 3 PEOU (mean = 4.717, variance = 0.77), and by the Factor 4 CAI (mean = 4.139, variance = 0.366). Perceptions were also positive, but less so towards Factor 2 PU (mean = 3.256, variance = 0.054).

Next a linear regression was applied on the outcome factors BI then CAI with each predictor at a time. For this aim factor analysis scores in linear regression models were used. No significant results were found for the PU/BI (p-val. = 0.873) and CI/BI (p-val. = 0.530) relationships. However, results demonstrate that there is a moderate relationship (r = 0.388) between PEOU and BI and that PEOU statistically impacts BI (sig. = 0.003). In fact, 15.1% of the variation in senior's buying intention of InOvUS is explained by its ease of use. Moreover, there is a small relationship (r = 0.277) between PU/CAI with PU explaining 5.1% of the variation in CAI. PU statistically impacts CAI but at a 90% confidence level (p-val = 0.090). PEOU (p-val = 0.214) and CI (p-val = 0.962) were not statistically significant predictors of CAI.

5. Discussion

It was evidenced from the focus group that the problems related to risks of fire, safety, user-friendly design, lack of attention or cognitive decline and ease of use needed to serve as the foundation of our work to ensure InOvUS corresponds to the needs and requirements of seniors. Therefore, in order to meet the requirements of InOvUS conceptual guidelines, we developed our instrument based on the willingness-to-adopt metric. Our results of our study show that there is a good predisposition in seniors' adoption intention of InOvUS primarily because of the benefits they would be getting if they bought InOvUS. Seniors find InOvUS easy to use and easy for them to get it to do what they want. Additionally, InOvUS does not require a lot of mental effort to use. However, how InOvUS could help seniors improve their cooking performance, effectiveness and productivity is less evident to them. They also think their family members/caregivers would not only understand the benefits and costs of InOvUS but that it would be easier

for them to collect the product's information. Very interestingly, seniors believe InOvUS would enable them to continue cooking on their own and make things much easier for their family members as it would bring them peace of mind.

Our model result showed that the oblimin rotation generated a clearer and more contextually coherent structure while producing 5 factors solution: Buying Intention (BI, 3 items), Perceived Usefulness (PU, 3 items), Perceived Ease of Use (PEOU, 4 items), Consumer Adoption Intention (CAI, 3 items) and Consumer Innovativeness (CI, 1 item). The reliability for CI was not measured as it is a single-item scale. However, in our confirmatory factor analysis the reliability of CI will be measured as part of the structural equation modeling using the Coefficient H as many times the Coefficient alpha can be underreported. Further, our factorial model showed that seniors have generally positive attitudes regarding the adoption intention and innovativeness of a product such as InOvUS. The most important results were seen through their high buying intention, their strong perceived ease of use of InOvUS and their adoption intention in such a product. These results go in line with the fact that almost all senior Canadians (90%) live independently in their community and wish to remain this way for as long as possible [32]. Therefore, enabling kitchen safety is a major factor for these seniors.

Moreover, it was found that perceived ease of use statistically impacts senior's buying intention. This leads to say that the perceived ease of use of InOvUS is a driving force influencing seniors' buying intention for such a product. Another interesting finding is the trend showing that the usability (PU) of InOvUS influences seniors' adoption intention, which shows that clear benefits must be perceived in using such a product to increase seniors' willingness to adopt it.

To summarize, during the first phase of this instrument development process, we assessed the reliability and validity of our scales. The preliminary description analysis confirmed that our data were appropriate to conduct an exploratory factor analysis. With the exploratory factor analysis we obtained a five-factor structure defining our instrument and explaining 76.406% of the total variance. This was obtained after deleting the 4 items that cross-loaded on more than one factor and/or had a rather lower correlation level, 18 items remained to form part of the final instrument. Four factors produced high reliabilities (all factors have Cronbach's $\alpha > 0.750$). As such, BI, PU, PEOU and CAI have been confirmed as reliable through this study. Based on these exploratory results seniors' adoption intention and interest on innovativeness for a new technological product, such as InOvUS, can be measured by examining the CAI (consumer adoption intention) and BI (buying intention) constructs and the factors that likely have an impact on these forms of willingness-to-adopt: PU (perceived usefulness), PEOU (perceived ease of use) and CI (consumer innovativeness). Our results have demonstrated that PEOU (perceived ease of use) is the key criteria when seniors are considering buying a product such as InOvUS and perceived usefulness will influence their actual CAI (consumer adoption intention).

There are some limitations with regards to this study. The first one comes from the analysis method itself. By definition, an exploratory factor analysis is a method used to evaluate the validity of constructs and the psychometric properties of the scales. This type of method is not sufficient to test the theoretical foundations of the instrument [33]. In fact, a confirmatory factor analysis must be conducted to further validate the theoretical soundness of the research instrument. The second limitation pertains to a response bias. Participants completed the questionnaire on a paper format with a section containing all of the 22 original items divided in two pages. This type of survey formatting might have caused an acquiescence response bias. Meaning that it is probable that a similar response pattern could have emerged in this section.

6. Conclusion

The long-term goal of our research work is to introduce solutions for seniors, such as InOvUS, compensating for declines associated with aging. Our research instrument has been conceived to collect important user perspectives to the development of the next generation of technology aimed at improving safety and reducing risk in the home environment for the elderly. Involving end-users at an early stage of development is often not incorporated early enough in the technology development or design process. This practice has the immediate impact, when utilized, of alleviating unnecessary costs and time from the overall development process. As such, this methodology provides a unique opportunity to develop user needs studies and concept development for technological products while increasing the odds of seniors' willingness-to-adopt and use such products.

Moreover, we recommend that this study be repeated with seniors 65+ living in residence with full autonomy, partial autonomy, living at home, seniors' associations, and seniors' groups. Further, we will continue to evaluate the model and metrics developed in this study with other technologies aimed at senior in-home safety assistance to reach a sound confirmatory factor analysis.

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