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Research Article

Ranking the Value prepositions in business models of IOT mobile application in health using Shannon Entropy approach

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Abstract

Background Objective: The significant growth of the IOT market in various fields leads to ask a question whether conventional business model frameworks can continue to Design business models for IOT applications. To answer the question, the aim of this paper is to identify the importance and ranking of "value proposition" in business models of IOT applications in healthcare.

Method: In this paper, the application of design factors of value proposition of 30 IOT mobile application in healthcare is determined based on Canvas Business Model Framework and expert opinions. First, we
Identify 30 successful and widely used IoT application based on the data available in the Appstore and Google play platform, and determine selectable factors in designing the value preposition section Business Model of IOT health application. To examine which of the selected factors were used in each of 30 IOT health applications, 15 experts are selected. Seven experts were academic researchers who had research papers or reports in this fields. other experts have been involved in the development of IoT applications in health for at least 5 years. Finally, we use Shanon Entropy approach to determine weight and rank of design factors of value preposition in the business model of IOT applications in health.

Results: An analysis of the number of factors used in the top thirty IOT applications shows that the most commonly used design factors in the value proposition were acknowledged, Newness, Customization. The identification of these three factors illustrates the importance of the IOT in health Innovation. Due to all three factors are related to the concept of innovation, and unlike most business models, the price is ranked 21st out of 31 design factors in the value proposition.

Conclusion: The results of this study can be used as a starting point for IOT developers to focus on the most commonly used design factors for business models, reducing trial and error costs and software development timely.

Keywords: Internet of Things (IOT), Health care, Business Model, Ranking, Shannon Entropy

Background and Objective

IOT is a transformative innovation that can affect different aspects of the daily life of individuals or businesses. IOT describes the interconnection of entities or objects with various purposes, including identifying, communicating, sensing or collecting data[1]. Specifically, the Internet of Things includes an infrastructure capable of measuring, identifying, tracking, and monitoring entities to connect objects, sensors, drivers, and other intelligent technologies that make life easier for people by automating activities[2]. IOT as a pervasive phenomenon with numerous applications in smart cities, smart transport systems, health industry, etc., has been the focus of many researchers and practitioners[3,4]. According to forecasts by research institutes such as Gartner, the number of interconnected devices will increase from 5 billion devices in 2014 to 20 billion in 2020[5]. Experts in IOT have predicted that by 2021, the total global IOT investment will be around 1.4 trillion dollars[6]. The health industry is one of the most well-known and attractive fields in IOT applications that is forecasted to reach 2.5 trillion dollars value in 2025[7, 8]. Innovations arose from the use of IOT in health are still infanct, and the interconnection of three factors, including humans, the Internet, and computers, will be the solution to many issues in the health industry[9].

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Reducing costs, increasing reliability and safety are the most important benefits of using the IOT in the healthcare industry, which can be achieved by monitoring and remotely monitoring patients, or replacing smart devices and sensors with humans to monitor patients' vital and timely symptoms online[4]. The significant growth of the IOT market in various fields on the one hand and the transformative nature of the innovations of this technology on the other hand have led researchers to question whether conventional business model frameworks can continue to Design business models for IOT applications. To this end, numerous studies have been conducted in this area[4-6, 10-14]. The result of the paper leads to new structures, in addition to the main structures of conventional business models such as those presented by Canvas. New stream of the research is to identify the factors of the business model that are appropriate to the various application areas of IOT such as health, transportation, and so on. Because the specific circumstances of each field can lead to new business model that are not relevant to other areas. As Wnuk and Murari[15] emphasize, the impact of IOT technology on changing existing business models and emerging business opportunities created by new products or services and processes has not yet been seriously considered[5]. The same research gap has been emphasized by other researchers[16]. So, the issue addressed in this article is what the key factors are in prioritizing value proposition in business models of IOT applications in the field of health. To answer the question, it is assumed that the model governing each of the business models of successful IOT applications was the result of management choices designed to gain market advantage[17].

In the present paper, according to the business model of IOT introduced by Dijkman[12], we customized the selected factors in the value preposition of Business Model using analysis of them in thirty applications in the field of IOT in health. Despite numerous researches to specialize business models tailored to the characteristics of technology of IOT and IOT in health, the importance of designing a business model for internet applications have not been discussed in health yet. So, we determine the weigh and importance of the business model factors of internet applications in health.

In second section of the paper, background of the research is reviewed. The third section describes the research steps and results of each step. The fourth section also presents the analysis of the results and suggestions for developing this research.

Background research

Over the past twenty years, many researchers focus on business model[18]. The most important function introduced for the business model is to explain the approach and framework that firm has chosen to do for its business and creating money[19]. Numerous factors and sections have been provided for the framework of business models either publicly or privately. The most widely accepted model in the literature addresses business model components in nine segments including customers, values preposition, channels, customer relationships, revenue streams, key resources, key activities, key partners and the cost structures[19]. The numerous business opportunities available in IOT technology on the one hand and the innovative and transformative nature of this technology that creates value in a collaborative environment between different businesses[6], on the other hand, in recent years make to gain attention of researchers to designing business models tailored to the characteristics of IOT technology. Because in this technology contextual issues such as interdependencies, interactions and partnerships increase the complexities of the business environment for digital technologies[20] and help to explain these transformative complexities and innovations that accompanied by innovations in conventional business models. This field leads to numerous

research into the fitting of conventional business models into IOT features. Metallo et al[5]. conducted an exploratory study to understand how to innovate and change the business model of industries performing their operations based on IOT. In this study, using the multiple case study approach, the business model framework of Canvas is based and the most important factors enabled IOT oriented organization are determined[5]. Chan (2015), based on the Archetypal Business Model presented by Jasman et al [21]., explains the business model framework for IOT using a case study of top companies in the IOT Award 2014 and 2015 in Hong Kong, has been validated[11]. In this model, the main parts of the business answer four questions such as who? what? How? And why? respectively seeking the target customer, the value preposition, the value chain of the proposed value delivery to the target customer, and the economic model of value. Sun et al. (2012) have also identified a similar model as the DNA model in three parts: design, needs and aspirations for business model components of the IOT. Design to response how, identifies different business components including key partners, resources and activities. Needs in response to what, it refers to customer segments and relationships with them and aspirations to answer the question of why, it deals with earnings[22]. In another study, Rang et al. (2015) developed the integrated 6C framework to better and systematically understand IOT-based business systems. In the framework, six main issues are considered: "context" to describe the business environment, "collaboration" to describe mechanisms for collaborating with partners, "components" based on core structures and ecosystem support, "Configuration" to explain the identification of the relationship between partners and "capacity" to explain the resources used and "change" to explain the changes that each of the other five elements are facing[11]. IOT capabilities such as tracking customer behavior, linking products together, allowing for more accurate analysis and forecasting, process optimization and also has provided an understanding of product user experience for sellers[23]. Therefore, the service-oriented logic proposed by Torber et al. In 2014 for Internet-based business models of objects. According to this logic, it is envisaged IOT oriented organization focus on as a platform that creates value for customers and competitors rather than selling products to customers. In this logic, the enterprise-centric approach to business model design shifts to a network-centric approach[24]. Westerlund et al. In 2014 propose three key levers including drivers, value nodes, and value exchanges to design the IOT business models in an ecosystem and platform. The drivers refer to the monetization incentives of each partner in the ecosystem and include the value nodes of the types of actors and activities that are linked together to generate value. Value exchanges also deal with the exchange of resources, knowledge and information between different nodes of value[25]. Although there have been numerous research and models on the specification of business models tailored to the capabilities and innovations of the IOT, but on the business models of the use of IOT on research health, there are limited research in IOT functions in the field of health. However, one of the most widely used areas of the Internet of Things is health. In 2015, Jag et al identified five groups of technology of IOT by examining active equipment in India, and then introduced components of the model based on the Canvas Business Model Framework[26]. In 2016, Gomez and Moghadirad presented a conceptual model for IOT business models to facilitate the Causal Layered Analysis of future IOT businesses[9]. In this study, options for changing the nature of business model components of the IOT in the short-, medium- and long-term are explained by conducting interview with a group of experts. In a similar study by Gomez et al. (2017)[35], conceptual maps of value-added services across four layers of sensors, networks, services, and interfaces for the IOT business ecosystem are introduced. In this study, 16 workshops and 12 interviews with patients' families were conducted to identify future needs and identify

the expected values of IOT use[27]. A review of research in the literature indicates that the basis of explaining the components of IOT business models in health has largely been based on interviews with experts or users. However, many technologies are currently being developed that are operating as successful businesses in the field of IOT Health. In a comprehensive study, Islam et al[7]. have explained the various dimensions of IOT applications in health. This research presents the framework of services and applications that IOT in health can be considered as a value in the business model. The business model paradigm of these applications can explain the successful pattern of designing a business model of IOT.

Research Method and Results

The business model shapes and defines the fundamentals of how a firm's value-for-money clients are formed. In other words, the business model is a summary of the entrepreneurial activity of a firm, simplifying the complexities of the relationships within a firm to create value and explaining the key components and factors selected in each component. So that the roots of the success of a business can be traced to the components of the business model and the factors selected in those components. In the field studied in this research, IOT applications in health are associated with the business model that developers have created to gain value. Therefore, in the paper, by adopting a comparative exploratory study, a set of IOT applications in health is examined, and considering the frequent factors in their respective business models, the most important value preposition factors considered in IOTs has been identified in health. A comparative exploratory study approach is appropriate for areas that have been relatively under-explored, such as IOT business models in health where many empirical studies are lacking[28].

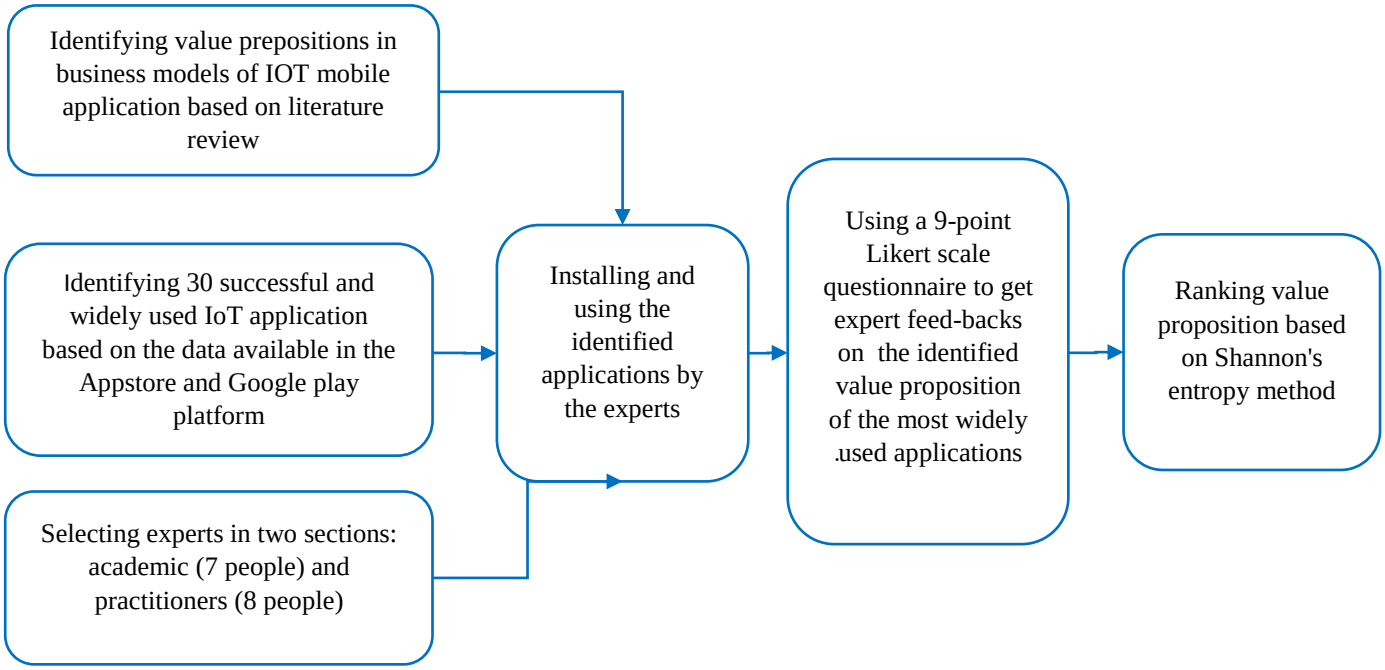

Figure 1: Schematic diagram of research steps

Step 1 – Identifying Successful IOT Applications in Health

Thirty-one health-related IOT applications were selected with the highest score from the available software platforms and selected as samples to analyze their business model. To choose any application, different health areas are considered and among the applications available in that field, the most favored and popular applications are selected. The top rated applications were in Apple Store, Bazar, and Google Play. Applications have been selected to have sufficient diversity in different areas of health. One of the most important criteria in selecting a software is its availability, possibility for install, and use. Because to identify the business model factors embedded in each application, the capabilities of the applications will be evaluated in practice. A brief description of the investigated application is presented in Table 1.

Table 1. IOT Health Applications Study

No.	Application Title	Context	Function
1	On Track Diabetes	Diabetes control	Continuous monitoring of glucose, hemoglobin, weight, heart rate, blood pressure, blood lipids and related indicators in weekly, monthly and yearly charts
2	Diabetes	Diabetes control	Diagnosis of type 2 diabetes, recording of medications used by patients, recording history of insulin use, setting alarm range, measuring glucose and alerting
3	Cooey	Health Risk Alert	Measuring glucose, blood pressure, weight and activity recordings, quality of sleep, obtaining information on disease and allergy records, and reporting health risks
4	Fever Watch	Control of body temperature	To permanently check body temperature, alert if body temperature is within a specified range
5	Body Temperature	Control of body temperature	To view daily, weekly, monthly, or customized body temperature trends on a chart, measuring multiple body temperatures simultaneously
6	Molekule	Air pollution control	Controlling the amount of air pollution, air purification if the level of air pollution increases from a certain level
7	Asthma trucker and log	Respiratory Disease	Record information on shortness of breath and patient smoking, alert for shortness of breath
8	Neuroon	Sleep	Useful sleeping rates based on the number of blinkers during sleep, alerting for proper sleep time based on the patient's recorded information such as age, gender, weight, occupational status, use of specific medications, etc.
9	Sleep Aids fan	Sleep	Providing the right music to stimulate deep sleep to fit one's profile
10	:Relax Melodies	Sleep	Providing the right music to stimulate deep sleep to fit one's profile
11	BP	blood pressure	Record fixed information such as height, weight and daily information such as food and exercise, record pressure range and measurement information, and alert you if pressure rises or drops from desired range
12	Blood Pressure Rate	blood pressure	Control and alert blood pressure
13	Fast Hearing Check	Hearing	Audible frequency measurement by ear
14	Mimi Hearing test	Hearing	Perform a hearing test for 6 minutes and share the results with physician
15	Uhear	Hearing	Perform a hearing test by recording user beats on the screen
16	Tinnitus Aid	Hearing	Hearing test by filtering out extra sounds
17	Tinnitus balance	Hearing	Hearing test by adding music by the user
18	Instant Heart Rate	heart beat	Measure heart rate by placing a finger on the camera of a smartphone or device and changing the color of blood

No.	Application Title	Context	Function
19	Runstatic Herat Rate	heart beat	Measuring heart rate by placing a finger on the camera, measuring reminder, charging for more than three measurements
20	Herat Rate Monitor	heart beat	Age record and normal range for heart rate, heart rate measurement, and charge for measurement after 29 times measurement
21	Ioximeter	heart beat	Connect a device to the user and record the heart rate continuously
22	Karafs	Calorie expenditure	Record basic information such as height, weight, date of birth, level of activity and calorie expenditure by body movement, giving recipes
23	Calories	Calorie expenditure	Record food intake and calculate calorie expenditure
24	13.1	Fitness	Announcing an alert to a sedentary person, offering a fitness program
25	Healthypal	Fitness	Providing a database of sports coaches, physicians and nutrition consultants, providing the right exercise schedule, reminding the right time for exercise activities, communicating with the consultant user.
26	Fall Safety Pro	Accidents	Finding a personal place where someone has landed. That way, enter the personal information of the person we want to be notified after the crash, and the location of your phone or smartphone should also be clear. After 10 seconds, the application gives the opportunity to warn others if it is okay to warn otherwise.
27	My Water	Nutrition	Register water consumption, alert for water consumption tailored to user needs
28	Eye Care	Sight	Evaluation of visual power
29	Icare	Medicine expenditure	Announcing a drug alert at the designated time
30	MBIoT- Utility	Control of critical indicators	Record vital information such as temperature, hearing, heartbeat, blood pressure and control

Step 2- Determining Selectable Factors in Designing the Value preposition section Business Model of IOT Health Application

Numerous models have been proposed in the research literature to explain the key components and factors of business models[31-34]. The CBM business model presented by Osterwalder (2004) and Osterwalder and Pigneur (2010) is the most widely cited and used among all the models presented[5]. Generally, the Canvas model divides the core components of a business model into nine groups, including key partners, key activities, value propositions, customer segments, customer relationship types, distribution channels, cost structures, and revenue structures. Since the main issue in this article is determining the importance of leading factors for designing a business model's proposed value in line with the context of IOT, first of all the factors that can be put forward in the proposed value segment by the business model designer. A review of the literature has been devised to identify key factors relevant to the IOT of health in the next section.

Selectable factors in the value proposition section of the main business model that are based on the literature review are: Newness, Performance, Customization, Getting the job done, Design, Brand/Status, Price, Cost Reduction, Risk Reduction, Accessibility, Convenience / Usability, Comfort, Trust, easy to understanding, Communication with person, To be Acknowledge, Cooperation with others, Sales

idea, Increase improvement, Deficit, Deficit time[12, 29-31].

- Newness: new set of needs that customers previously didn't perceive because there was no similar offering.
- Performance: Better performance has been the hallmark of many product offerings over the years to thrive for decades on improved performance versions of the same products.
- Customization: Providing the option to tailor the product to the consumer's preferences adds value for the customer.
- Getting the job done: Value can be created simply by helping a customer get jobs done.
- Design: This element of value creation is hard to quantify, but is becoming increasingly important.
- Brand/Status: Design and brand/status can be clustered together because their appeal is quite similar, Customers may find value in the simple act of using or displaying a specific brand.
- Price: Offering similar value at a lower price is a common way to satisfy customer.
- Cost Reduction: a great role in helping consumers reduce cost will make values.
- Risk Reduction: The less risk associated with purchasing a product or service, the more value a customer derives from it.
- Accessibility: making a previously inaccessible product or service available to a consumer segment.
- Convenience / Usability: Making things more convenient or easier to use can create substantial value.
- Comfort: The easier the task, its value.
- Trust: It is important for a product to solve a problem in a trust way.
- Easy to understanding: Making easy to understanding can create substantial value for all people.
- Communication with person: Offering similar value with better communication is a common way to satisfy the customer.
- To be Acknowledge: To be Acknowledge will help the customer look and feel in control, important and part of the in-crowd.
- Cooperation with others: using services with cooperation make value.
- Sales idea: sales idea be a very effective part of the value proposition
- Increase Improvement: show improvement in product or services create value.
- Deficit: Customers may find value in high efficiency with low cost.
- Deficit time Customers may find value in high efficiency with short time.

Step 3 - Identifying Selected Factors in Designing Business Model Components of Top IOT application by Experts Group

To examine which of the factors mentioned in the second step were used in each of the applications of Table 1, 15 experts were selected. Seven experts were academic researchers who had research papers or reports in this fields. Other experts have been involved in the development of IoT applications in health for at least 5 years.

After declaring their readiness to participate in this study, the team members were asked to rate their perceptions of each of the following factors after installing and using the studied applications with 9-point degree that one means the least and nine is the most. Frequency of comments is considered as the final result for analysis. For example, a score of 9 for the "Price" factor in the Diabetes software means that most experts in the group believed that this factor was most relevant to the Diabetes applications of value preposition. Table 3 shows the frequency of expert opinions on the design factors of the proposed value section for each of the application studied.

Table 3. Amount of Design Factors Used in the Value Preposition of the Business Model IOT in health Applications

No.	Applications	Newness	Performance	Customization	Getting the job done	Design	Brand/States	Price	Cost reduction	Risk reduction	Accessibility	Convenience/usability	Comfort	Trust	Easy to understanding	communication with	To be acknowledged	cooperation with others	sales idea	Increase improvement	Deficit	Deficit time
1	Diabetes	2	5	8	5	5	2	9	8	8	8	8	5	7	4	5	2	2	4	6	8	8
2	Cooey	7	9	5	9	9	2	6	8	8	8	5	9	9	8	5	2	5	8	6	9	8
3	On Track Diabetes	9	3	3	4	8	2	9	8	8	8	8	5	5	4	5	2	5	4	6	8	8
4	98.6 Fever Watch	8	9	8	8	9	6	7	8	9	9	9	9	5	7	8	8	9	9	9	5	8
5	Body Temperature	5	4	6	4	4	5	4	3	5	5	5	5	5	5	4	4	5	4	2	8	5
6	Molekule	8	9	7	9	9	5	9	4	9	5	9	9	9	8	8	4	7	8	9	6	9
7	Asthma Trucker & log	5	5	8	5	5	5	4	9	4	7	4	4	5	4	4	4	3	3	4	6	5
8	Neuroon	8	9	8	9	9	7	4	4	7	2	7	7	9	9	9	9	9	9	9	7	9
9	Sleep Aids Fan	4	3	2	4	5	5	7	7	4	8	9	9	3	5	5	3	3	2	3	9	7
10	Relax Melodies	4	6	5	6	7	5	8	8	5	9	9	9	5	5	5	3	3	2	3	9	8
11	BP	2	7	7	8	3	2	5	3	4	5	5	6	7	7	5	2	3	3	6	5	5
12	Blood pressure rate	8	2	2	5	2	2	5	3	3	5	5	5	3	5	5	2	3	3	2	5	5
13	Fast Hearing Check	2	2	2	8	2	2	3	7	5	8	8	8	6	8	9	2	5	5	5	6	8
14	Mimi Hearing Test	2	5	2	8	2	2	3	7	8	5	5	5	7	8	9	2	5	5	5	7	8
15	Uhear	2	7	2	8	2	2	3	7	8	5	5	5	8	9	9	2	5	5	5	8	8
16	Tinnitus Aid	8	9	9	8	8	6	3	7	8	9	8	8	9	9	9	3	8	9	9	5	7
17	Tinnitus Balance	5	4	7	6	8	4	3	7	8	9	8	8	8	8	9	2	8	9	9	5	7
18	Instant Heart Rate	2	7	2	3	2	1	8	5	5	5	8	9	7	9	9	1	5	2	6	7	6
19	Runstatic Heart Rate	2	5	2	3	2	1	8	5	5	5	8	9	7	9	9	1	5	2	6	7	6
20	Heart Rate Monitor	2	6	2	3	2	1	8	5	5	5	7	9	7	9	9	1	5	2	6	7	6
21	Ioximeter	9	8	3	8	7	5	5	5	8	3	9	9	9	9	9	5	5	6	9	8	9
22	Karafs	7	8	5	8	5	5	4	8	7	8	8	8	8	9	9	7	8	8	9	9	9
23	Calories	5	7	5	8	3	5	4	8	6	8	7	7	6	9	9	7	8	8	8	9	9
24	13.1	8	5	5	8	4	5	4	8	5	8	7	7	6	9	9	7	8	8	7	9	9
25	Healthypal	9	8	8	9	8	5	7	8	8	8	9	9	9	9	9	8	8	8	9	9	9
26	Fall Safety Pro	9	9	8	6	6	5	8	8	8	9	8	8	8	8	8	5	9	8	9	9	9
27	My Water	9	8	7	8	8	5	8	8	8	8	7	7	7	8	9	5	8	8	8	8	8
28	Eye Care	9	8	8	9	7	5	6	8	9	9	6	6	8	7	9	5	8	8	9	9	9
29	I Care	9	8	8	9	7	5	7	7	9	9	8	8	9	9	9	5	9	9	9	9	9
30	MBIOT-utility App	4	5	6	5	5	5	7	8	7	8	5	6	5	6	9	5	7	7	8	7	7

Step 4 - Determining the Weight and Rank of Design Factors value preposition in the Business Model of IOT Applications in Health

In this study, to weight the business model design factors of IOT applications in health and rank them based on these weights, we use Shannon entropy method which according to Meng[35] as one of the most popular methods of index weights calculation is used. The steps for using this method are as follows:

Decision Making Matrix: Summarizing the experts' opinions on the business model design factors in the three sections of value proposition, customer segment, and revenue model for each of the application studied, is considered as the decision matrix in this study.

x_{ij} in the decision matrix $X = [x_{ij}]_{m\times n}$, the design factor j is used in application i. In each of the three components of the business model namely value proposition, customer segment and revenue model, the three decision matrices were $X1 = [x_{ij}]_{30\times 21}$ ، $X2 = [x_{ij}]_{30\times 5}$ and $X3 = [x_{ij}]_{30\times 9}$ respectively and have been analyzed using the expert opinions presented in Tables 1, 2 and 3 in subsequent steps.

Normalization of Decision Matrices: Each of the three decision matrix referred to in step 1 is then normalized using relation 1.

$$P_{ij} = \frac{x_{ij}}{\sum_{i=1}^{m} x_{ij}} \ , (i = 1,2, \dots , m), (j = 1,2, \dots , n) \qquad (1)$$

The entropy calculation of each design factor in each decision matrix:

The value of $E_j$is the entropy of each of the design factors in each of the three decision matrix based on the relation 2.

$$E_j = -k \sum_{i=1}^{m} [P_{ij}. lnP_{ij}] \ , (j = 1,2, \dots , n), k = \frac{1}{\ln m} \qquad (2)$$

Calculate the degree of deviation of each design factor in each of the decision matrix:

In the fourth step, the uncertainty or degree of d_j deviation from the information generated for the design factor j is calculated using the relation 3. The degree of deviation indicates how much useful information is available to the decision maker.

$$d_j = 1 - E_j \ , (j = 1,2, \dots , n) \qquad (3)$$

Calculate the weight of design factors in each decision matrix:

Using the calculated degree of deviation, the weight of each design factor is calculated relative to the other factors in each decision matrix, w_j, taking into account the relation 4.

$$w_j = \frac{d_j}{\sum_{j=1}^{n} d_j} \ , (j = 1,2, \dots , n) \qquad (4)$$

The results of data analysis during the Shannon entropy step 3 to 5 using the data contained in the decision matrix $X1$ are shown in Table 3.

Table 3 . Entropy, Degree of Deviation, Weight and Rank of Design Options in Value Preposition Section

	To be acknowledged	Newness	Customization	Design	Brand/Status	sales idea	cooperation with others	Performance	Increase improvement	Price	Getting the job done	Accessibility	Cost reduction	Risk reduction	Trust	communication with person	Easy to understanding	Comfort	Convenience/usability	Deficit	Deficit time
E_j	0.95118	0.962129	0.965219	0.965278	0.96675	0.967978	0.979771	0.980687	0.980934	0.981217	0.984962	0.986734	0.988145	0.988819	0.989748	0.989948	0.990961	0.992218	0.992752	0.994137	0.99487
d_j	0.04882	0.037871	0.034781	0.034722	0.03325	0.032022	0.020229	0.019313	0.019066	0.018783	0.015038	0.013266	0.011855	0.011181	0.010252	0.010052	0.009039	0.007782	0.007248	0.005863	0.00513
w_j	0.120376	0.093378	0.08576	0.085614	0.081985	0.078956	0.049878	0.04762	0.047012	0.046313	0.03708	0.032711	0.02923	0.027569	0.025278	0.024786	0.022287	0.019188	0.017872	0.014457	0.012649
Rank	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21

Conclusion

IOT is one of the most widely used technologies along with transformative innovations. Therefore, it is necessary to identify the design factors facing business model designers and their importance in the context of the application of this technology. In this study, due to the great use of IOT in health, the importance and ranking of design factors in the value preposition of the business model was identified by analyzing successful applications in this field. An analysis of the number of factors used in the top thirty IOT applications shows that the most commonly used design factors in the value proposition were acknowledged, Newness, Customization. The identification of these three factors illustrates the importance of the IOT in health Innovation. Due to all three factors are related to the concept of innovation, and unlike most business models, the price is ranked 21st out of 31 design factors in the value proposition.

By studying the literature, rating and identifying the importance of the factors facing business model designers, especially in the field of IOT in health was identified as a research gap. Therefore, determining the importance and weight of design factors in the value proposition and ranking them based on the performance of successful IOT applications in health is one of the innovations of this article. The results of this research help designers of business models in IOT to consider factors that have been used in other applications and have had successful performance rather than trial and error. Conducting this research with a wider range of applications can obtain more valid results. Ranking design factors in other components of a business model can also help designers to choose the factors which create more value for customer.

Conflict of Interest:

Authors of the paper certify that there is no actual or potential conflict of interest in relation to this article.

Authors' Contributions

Ehsan Malihi, develop the framework of the research and contributions, Aida Rezaei conduct the questionnaire. To analyze the questionnaire Aida Rezaei and Yasaman Asadi are contributed.

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