AHP BASED STARTUP BUSINESS SELECTION OF B2C TYPE E-BUSINESS

A CASE STUDY

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Abstract:
B2C, or business-to-consumer, is the type of commerce transaction in which businesses sell products or services to consumers. Small businesses are the most suitable for part-time or entrepreneurial experiences. E-Business has become very popular in this era of high-speed internet & fast-growing demands of the customers. It can be run at a very low cost & manpower. There are so many risks in a startup e-commerce business which can be minimized by proper selection or decision makings. Proper planning can ensure preventive maintenance of the business & enables the entrepreneur to do the right thing the first time. The analytic hierarchy process (AHP) is a structured technique for organizing and analyzing complex decisions, based on mathematics and psychology. It is one of the world-wide popular methods of decision making. This research is based on business selection by applying AHP. The E-Business decision was taken based on a deep analysis using AHP.

Keywords: AHP, MCDM, E-Business, OCW, Decision Making, Sensitivity Analysis etc.

1. Introduction

The main aim of any business organizations is to add value and for private sector this involves to make profit. With the development of internet facility, internet has become a huge platform for trading, distributing, buying and selling goods and services between organizations, among organizations and consumers and even between customers. E-commerce is a process whereby organization/business share and exchange information, maintain relationships and conduct business transactions

using technologies. According to Sulaiman (2000), these types of activities are done by businesses that are involved in five different business processes or activities like advertising, marketing, order and delivery, payment and customer support and services. E-commerce is classified in five types, which is described later in this paper. Among these five types, business-2-consumer (B2C) is more suitable for startup business because consumers deal directly with the organization, avoiding any intermediaries and the initial investment and the probability of loss is less than other ones. There are many alternatives in B2C e-commerce business, so choosing the appropriate business plan is vital. Decision making is a process of choosing the best alternative by assessing many alternatives. If decision making fails to give the best decision, optimum profit gaining will not be possible. For taking appropriate decision, the problem can be divided into some criteria and sub-criteria. By analyzing criteria, sub-criteria and their interrelation can be described as Multi Criteria Decision Making (MCDM). Some of the multi criteria decision making are Analytical hierarchy Process (AHP), Analytic Network Process, Multi-Attribute Utility Theory, Fuzzy Set Theory, Weight Sum Model, Weight Product Model Goal Programming, ELECTRE, PROMETHEE etc. Among them Analytical Hierarchy Process (AHP) is one of the popular methods of Multi Criteria Decision Making (MCDM) method that was originally developed by Prof. Thomas L. Saaty. It is an effective tool for dealing with complex decision-making, and may aid the decision maker to set priorities and make the best decision. For startup e-commerce business, there are many alternatives so that we have to choose the best alternative. In our problem, we chose three alternatives for startup e-commerce, that's why we use AHP method for finding the best one. In a business all criteria evaluation is very important because once business is started up then further problems analysis will be easier so that all criteria have been used earlier in the selection stage as AHP has been used. The impact of single criteria on business can be analyzed in AHP method to measure the weight of the criteria & alternatives. In conflict resolution among tangible factors according to their weight is easily possible in AHP. In this paper we had individual criteria and these criteria had individual weights but in decision making they had overall impact. For this analysis AHP is most widely used tool. This is the new implementation of AHP in this regard, so we can say that it will bring a revolution in this research field.

2. Literature Review

Selection of business for startup often creates complexities for the entrepreneurs. Multiple fields and strategies create confusion for getting optimality from the purpose. Hereby, a proper decision-making framework is essential for analyzing present situation, obstacles and take decision from multiple alternatives. Durmusuglo (2018) expressed his opinion about MCDM that by a logical approach and structured way MCDM can provide an optimum decision. So AHP is nowadays one of the most widely used tool to give best solution regarding several alternatives and considering multiple criteria and sub criteria. In the analysis from Li,Ni,F & Zhu,2017 we see AHP can be applied in aircraft selection and AHP can be applied in facility location selection (Mahmud, Rayhan & Ahamed, 2016). In addition, there are numerous papers on decision making by using AHP in different fields. In the field of e-commerce, for decision-making, Analytic Network Process (ANP) was applied for strategy selection (Raisinghani, Meade, Schkade, 2007). However, there specific business of service or product was not specified for B2C e-business rather overall strategy was highlighted. Again, for entrepreneurship decision, Mohiuddin (2014)

used AHP. By combining the concepts of the studies, AHP is applied in this study to select specific product or service in a region to start up in B2C e-business and a further sensitivity analysis is done for decision variability. Similar type of study is not frequent in this field to select product or service. So, this study can be preferable for optimal business and supplier selection.

2.1 B2c e-commerce

E-commerce can be described as processing of transactions like buying or selling products even services through computer network and furthermore it is broadened in use of mobile or smart devices. Nisara & Prabhakar (2017) classified E-commerce in five types: business-to-business (B2B), business-to-consumer (B2C), business-to-government (B2G), consumer-to-consumer (C2C) and mobile commerce (m-commerce). Among them we selected B2C type business.

Business to consumer type e-commerce delineates about the consumption of goods or services to end customer from the business organization without any intermediaries. B2C is one of the emerging sector of e-commerce as it deals directly with the consumer with the flourish of internet people are acquainted with it and buy physical or information goods or services from businessman through an electronic network. As number of customers is higher in this type, it is easier to reach people through marketing and advertisement. So, with a lower initial investment, high profit is gain able through retail and wholesale business. Though Bangladesh has several problems in payment gateway, trust issue and other critical factors, B2C e-commerce sector is going through a revolutionary time. Easy access of internet and in the era of smart phone, people from different age and professions can buy their required goods and service in e-commerce sector by saving time and energy. Because of high demand and flexibility of low tax, B2C e-commerce can be chosen as profitable start up sector. Some sectors which are being dealt with B2C e-business are given below:

- Readymade Garments (RMG)
- Online Banking
- Web-hosting, Domain
- Website and Software development
- Electronic goods
- Online Transportation
- Hotel management and tourism
- Food catering etc.

2.2 Analytic Hierarchy Process

The Analytic Hierarchy Process (AHP) is a Multi-Criteria Decision-Making approach and was introduced by T. L. Saaty (1977). The AHP has attracted the interest of many researchers mainly due to the nice mathematical properties of the method and the fact that the required input data are rather easy to obtain.). AHP method can be applied in decision making, in Government issue, Location selection, Business selection, Asset purchase, Comparative model analysis, Competition, Planning, Resolving Conflict, Optimization, Forecasting, Medicine and Research Field, Political, Social, Sports Management, Quality Control, Supply Chain Management etc. (Vaidya & Kumar, 2006). It uses a multi-level hierarchical structure of objectives, criteria, sub-criteria, and alternatives. The AHP method is based on three principles: 1) Structure of the model; 2) Comparative judgment of the

alternatives and criteria, sub-criteria; 3) Synthesis of the priorities. Successful analysis from AHP depends on proper development of hierarchy of criteria, pair wise comparison with criteria, sub-criteria, alternatives and priorities. For comparison, Saaty (1980) developed a scale rating on 1-9 where 1 represents equal importance and 9 represents absolute importance of one element over another. Saaty's scale of relative importance is given in Table 1.

Table 1

Scale of relative importance (Saaty, 1980; Triantaphyllou & Mann, 1995)

Intensity of importance	Definition	Explanation
1	Equal importance	Two activities contribute equally to the objective.
3	Weak importance	Experience and judgment slightly favor one activity over another.
5	Strong importance	Experience and judgment slightly strongly one activity over another.
7	Very strong importance	An activity strongly favored and its dominance demonstrated in tactics.
9	Extreme importance	Importance of one over another affirmed on the highest possible order.
2,4,6,8	Intermediate values	When compromise is needed between the priorities.
Reciprocals of above nonzero	If activity i has one of the above nonzero numbers assigned to it when compared with activity j, then j has the reciprocal value when compared with i	

The process of AHP is described step by step according to Mu & Pereyra-Rojas, (2017). At first, a hierarchy chart is built where objective, criteria, sub-criteria and alternatives are defined. Then by using Saaty's 1-9 rule from Table 1, the weights of the criteria are developed by a single pair wise matrix. Then column of the matrix is normalized and priority or weights of criteria is calculated. The next stage is to check the consistency. In AHP, Consistency Ratio is defined as CR, where CR = CI/RI (Here, CI = Consistency Index, RI = Random Consistency Index). Saaty (2012) showed the value of CR should be less than 0.10 to continue AHP analysis. If CR is greater than 0.10, it is inconsistent and the cause should be reconsidered.

Now,

$$CI = \frac{\text{Eigen Value} - \text{n}}{\text{n} - 1}$$

Where, n is number of criteria, Eigen value = λ_{max}.

Random Consistency Index can be found from the Table 2.

Table 2

Value of Random Consistency Index (RI)

N	1	2	3	4	5	6	7	8	9	10
RI	0	0	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49

The next step is deriving the relative priorities of the alternatives with respect to each criterion. For this comparison matrix is constructed among the alternatives. Like previous comparison and normalizing of criteria here, similar process is done for the alternatives and priority is determined with respect to all the criteria and sub-criteria. Now the next task is deriving overall priorities. For this, priorities of alternatives with respect to criteria (local priorities) are multiplied with the derived priorities of the criteria. Then total weight score of alternatives is summed and the highest score is chosen.

3. Research objectives

3.1 Methodology of research

For selection of Business-2-consumer (B2C) e-business, we had a survey on this field to get the present condition of such business conducting in different areas of Bangladesh. 30 business organizations helped us by giving their opinions according to survey questionnaires. Analyzing those surveys, we came to decision that 6 criteria influence for selection of the business. These six criteria can be split in nine sub-criteria in total, which is described in Figure 1. the hierarchy chart. There are many businesses taking part in this field and according to survey, we classified them into three main alternatives. They were electronic goods, garments, IT service. Electronic goods actually include all type of electronic product, garments include all type of textile related products and IT service includes all type of IT related service like web development, software & apps development, online marketing, home services etc. deals directly with customers. Those criteria are 1) Investment, 2) Delivery 3) Internet Facility 4) Inventory Management, 5) Marketing, 6) Demand. By constructing hierarchy chart and computing comparison matrix of criteria and sub-criteria and deriving priorities, a decision was selected for business startup.

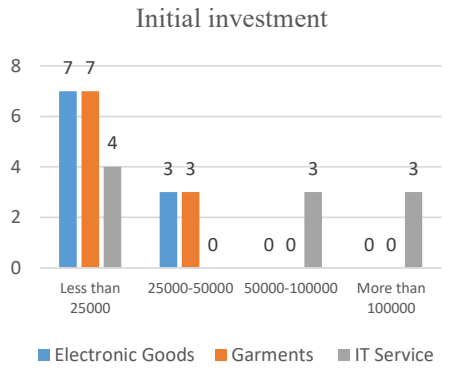

Figure 1. Initial investment

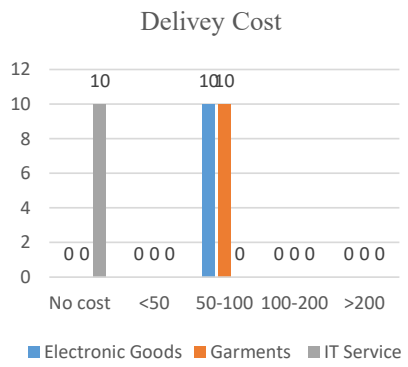

Figure 2. Delivery Cost

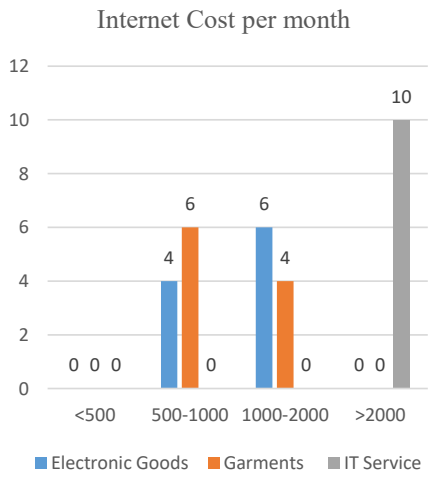

Figure 3. Internet cost per month

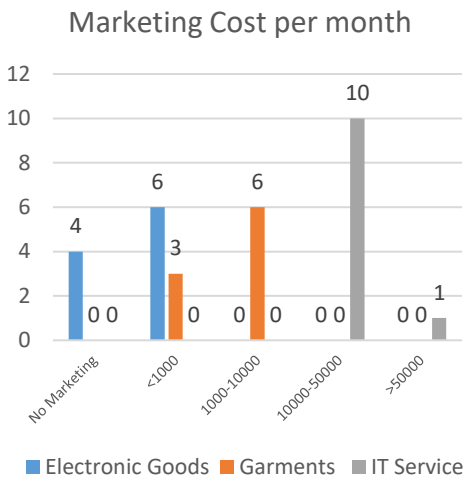

Figure 4. Marketing Cost per month

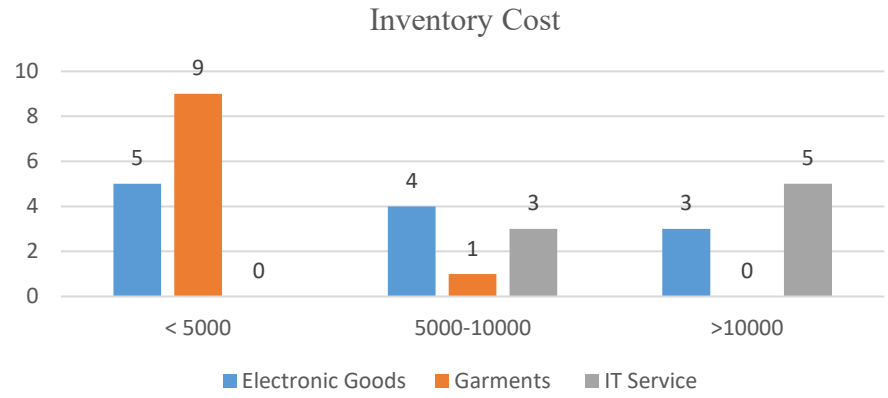

Figure 5. Inventory Cost

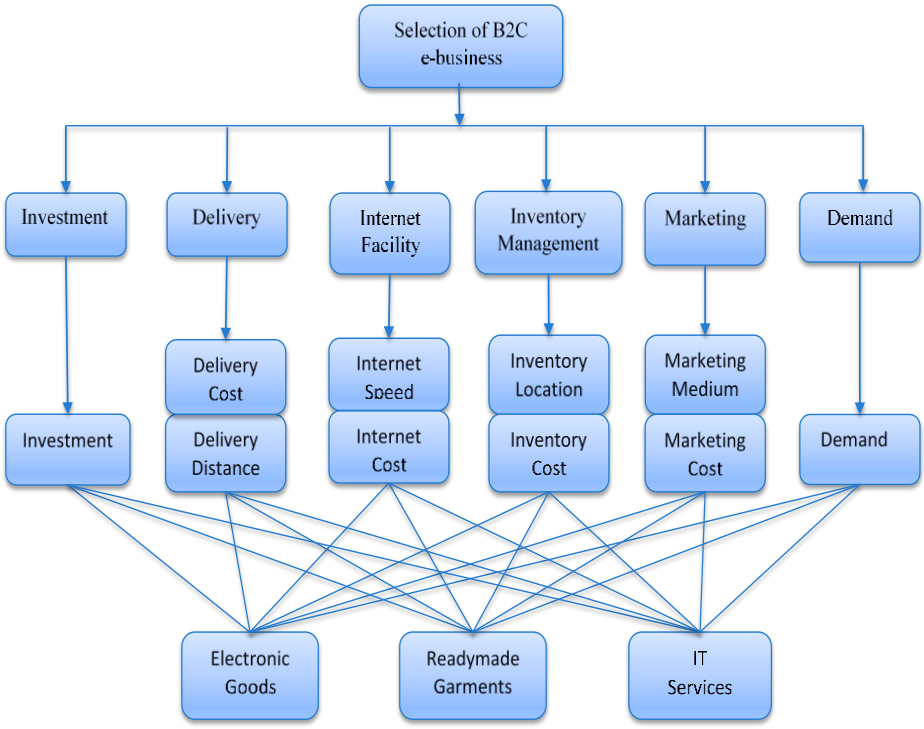

Figure 6. Hierarchical Structure for business selection

Table 3

Pairwise Comparison matrix with intensity judgments of Criteria for business selection

	Investment	Delivery	Internet facility	Inventory management	Marketing	Demand
Investment	1	2	7	5	7	5
Delivery	1/2	1	3	3	3	1/2
Internet facility	1/7	1/3	1	2	1	1/3
Inventory management	1/5	1/3	1/2	1	2	1/3
Marketing	1/7	1/3	1	1/2	1	1
Demand	1/5	2	3	3	1	1

Table 4

Normalized weights of matrix of pair wise comparisons of criteria with priority

	Investment	Delivery	Internet facility	Inventory management	Marketing	Demand	Weighted sum	Priority
Investment	0.458	0.333	0.452	0.345	0.467	0.612	0.974	0.444
Delivery	0.229	0.167	0.194	0.207	0.200	0.061	0.114	0.176
Internet facility	0.065	0.056	0.065	0.138	0.067	0.041	0.459	0.072
Inventory management	0.092	0.056	0.032	0.069	0.133	0.041	0.447	0.070
Marketing	0.065	0.056	0.065	0.034	0.067	0.122	0.466	0.068
Demand	0.092	0.333	0.194	0.207	0.067	0.122	0.105	0.169
Sum							0.566	0.000

Check for consistency:

$$\lambda max = \frac{(6.693+6.323+6.397+6.343+6.842+6.537)}{6} = 6.523$$

CI = $\frac{6.523-6}{6-1}$ = 0.1046, RI = 1.24 (For n=6), CR= CI / RI = 0.0844 = 8.44% < 10%

Since the value of CR is less than 0.1, the system is consistent. We can proceed our decision-making using AHP. By using this similar process, comparison between sub-criteria was done and sub-criteria weights were determined. Now multiplying criteria weight with sub-criteria weight, Overall criteria weight was found which is shown in Table 5.

Table 5

Computation of Overall criteria weight (OCW) of each criterion

Criteria	Criteria weight	Sub-Criteria	Sub-criteria weight	OCW
Investment	0.444	---		0.444
Delivery	0.176	Delivery cost	.167	0.029
		Distance	.833	0.147
Internet Facility	0.072	speed	.875	0.063
		Cost	.125	0.009
Inventory Management	0.070	Cost	.167	0.012
		Location	.833	0.058
Marketing	0.068	Medium	.875	0.060
		cost	.125	0.009
Demand	0.169	---		0.169

Then the next step was deriving local priorities for the alternatives. Priorities of the alternatives were measured according to the criteria and sub-criteria by using the same procedure. Then the task was deriving overall priorities. Multiplying them with the OCW, total weight score of alternatives was calculated. Highest score denotes the best decision. This is shown in Table 6.

Table 6

Synthesized table for the optimal alternative selection

	OCW	Local priorities of alternatives			Weight Score of Alternatives = OCW* Alternative		
		Elec-tronic Goods	Garments	IT Service	Electronic Goods	Garments	IT Service
Investment	0.444	0.429	0.429	0.142	0.190	0.190	0.063

Delivery cost	0.029	0.143	0.143	0.714	0.004	0.004	0.021
Distance	0.147	0.200	0.200	0.600	0.029	0.029	0.088
Speed	0.063	0.429	0.429	0.142	0.027	0.027	0.009
Cost	0.009	0.429	0.429	0.142	0.004	0.004	0.001
Cost	0.012	0.286	0.574	0.140	0.003	0.007	0.002
Location	0.058	0.143	0.143	0.714	0.008	0.008	0.041
Medium	0.060	0.200	0.200	0.600	0.012	0.012	0.036
Cost	0.009	0.633	0.261	0.106	0.006	0.002	0.001
Demand	0.169	0.261	0.106	0.633	0.044	0.018	0.107
Total					0.328	0.302	0.369
Decision					**2nd**	**3rd**	**1st**

4. Results and discussion

The main objective of this paper is to select the optimum B2C e-business for startup. For selecting the business, we used one of the most commonly used and efficient Multi Criteria Decision Making (MCDM) tool, Analytic Hierarchy Process (AHP). By pairwise comparison and priorities, we determined Overall Criteria Weight (OCW). By deriving local and overall criteria, we got total weight score of the alternatives. A comparative study of the weight score of the criteria and sub-criteria among the alternatives is shown in the following bar chart.

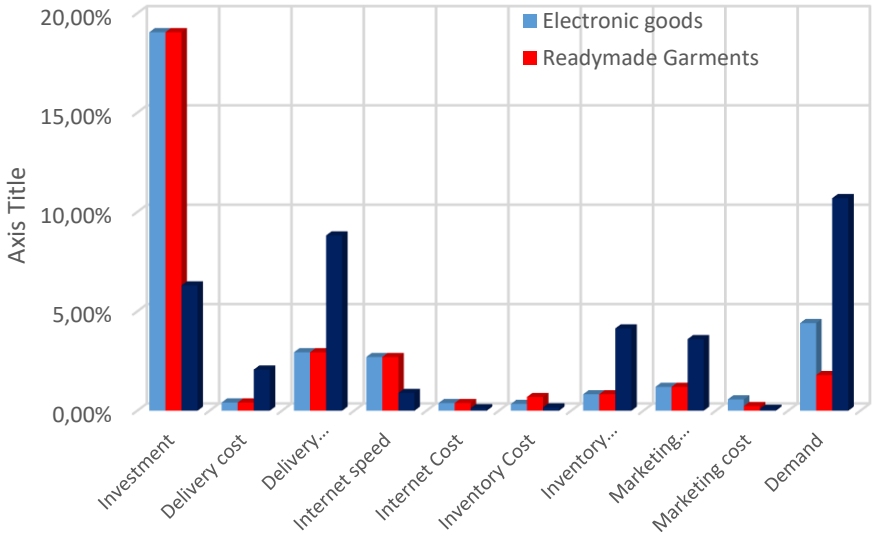

Figure 7. Comparative study of the weight score of the criteria and sub-criteria among the alternatives

From figure 7 we can see that; the weight of electronic goods and Readymade Garments is higher than IT service for investment criterion. But in case of delivery, delivery distance, inventory location, marketing medium, demand IT service consists higher priority. So, in overall, IT service is better than electronic goods and Readymade Garments. Total weight score of Electronic goods, Readymade Garments, IT Service are eventually 0.328 (32.8%), 0.302 (30.2%), 0.369 (36.9%). It is seen that IT Service consists highest score among them. The results' summary is shown in Table 7 and bar chart below.

Table 7

Comparison between decisions

Alternatives	Total Weight Score	Decision
Electronic Goods	0.328	3rd Best
Readymade Garments	0.302	2nd Best
IT Service	0.369	1st Best

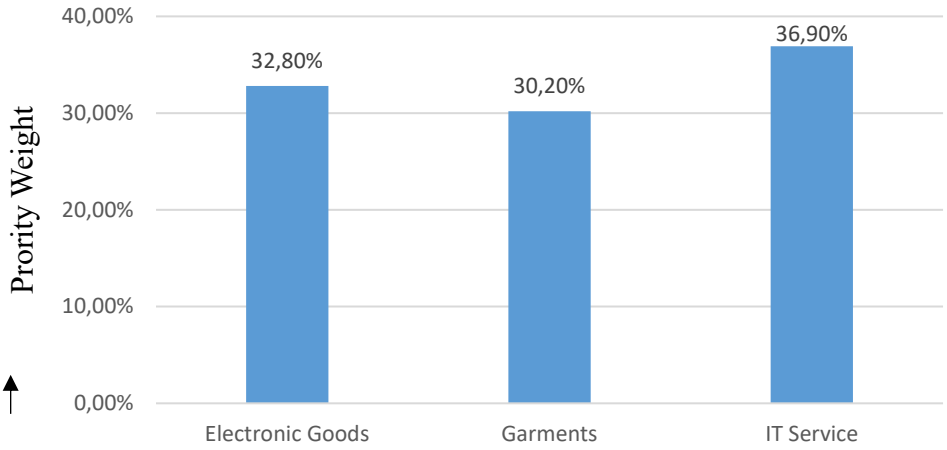

Figure 8. Comparison between decisions

5. Sensitivity Analysis

A sensitivity analysis is a tool that shows how different values of an independent variable affect a particular dependent variable under a given set of assumptions. It is the study of relative importance of several inputs influencing the total output. In AHP, if the weight of a certain criteria is changed then the final decision will also change. For this, a "what if" analysis is needed for understanding of a least change. This is vital factor for decision making in AHP (Mu & Pereyra-Rojas,2017).

In prior calculation, the weight of investment criterion was much higher than the other ones. So, the change of this weight may affect much for the final decision. From table 6, we can see that the investment weight is 44.4% which is much higher than others. From table 7, overall priority for electronic goods, Readymade Garments, IT service results 32.8%, 30.2%, 36.9%.

Assuming all the categories having same weight, overall priority was calculated from table 6, overall priorities for the alternatives are 31.5%, 29.1% and 39.3%. In both two case, IT service is the final decision. If weight of investment is assumed as half of the total weight and others are equally divided, then overall priorities for alternatives vary to 36.6%, 35.3%, 28.2% eventually (From table 7). Here electronic goods is optimum business, which differs from the previous results. If priority of investment is considered as 75%, and others are equally divided, then the overall priority of the first two alternatives having slight difference. From table 7, Both electronic goods and IT service are to be selected.

6. Conclusions

In this study, Analytic Hierarchy Process (AHP) is used for selection on optimum B2C e-business in a particular region. The major 6 criteria used in this research are most important in any B2C E-business selection based on conducted survey. All major & their subcategories helped to choose the suitable startup among the 3 alternatives. In brief, if we consider overall criteria having different weights for decision making, IT service is the best decision for starting up B2C e-business. Also, if all the criteria are equally important, IT service is preferable. If a particular area is considered for special purpose (investment is more important, showed in sensitivity

analysis) then electronic goods are optimum. If more surveys could have been done, then more criteria, sub- criteria and alternatives could occur. This may affect result in selection of the best alternative. There is a limitation for collecting profit-based data, as data provider didn't share their business profit, if this type data is got then further approach of AHP like cost benefit analysis can de applicable. In this study, uncertainty was not considered and fuzzy logic concept can be applicable by considering uncertainty.

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