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Using the Hierarchical Decision Model (HDM) to Select a Sustainable Voice Over Internet Protocol (VOIP) Provider

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Abstract—The continued technological progression has instituted a modification in communication facets. Consequently, the use of the Voice over Internet Protocol (VoIP) has enhanced and technical researchers believe that this innovation will be at the center stage for future phone engagements. VoIP services are offered by different providers depending on the customer's unique personal or corporate requirement. Therefore, firms should undertake extensive researches to determine the most appropriate service providers that would optimize operations and improve productivity. In most cases, the choice of VoIP in a hierarchical organization is influenced by factors such as the number of users within various protocols, the total devices needed to reach a far-reaching link, and the sustainability of the selected broadband technology. Aspects like the cost of acquiring a VoIP and output should also be considered to facilitate a timely return on investment.

Getting accustomed to interior networking schemes and current technologies is vital in the quest to establish a useful internet set-up design. While the presence of several inhibiting factors may affect the effectiveness of VoIP, the hierarchical decision model (HDM) provides a decision-making criterion that can be applied to improve its functioning. The approach considers several VoIP options that are drawn and approved by network specialists. Therefore, the HDM is used as software to make a balanced contrast of different tangible factors before they are ranked according to their importance.

Finally, an analytical model established to make VoIP coherent consisted of different stages that included the objective, criteria, sub-criteria, and alternatives as the main decision aspects. Groups of telecommunication experts from diverse organizations were invited to help in making a proper judgment regarding the best VoIP option. Google voice emerged as the most viable alternative from the study due to its effectiveness. Therefore, it is evident that embracing accurate inquiry outlooks and standards is essential for attaining successful research outcomes. The research question is: what is the best-chosen service provider through multiple alternatives?

I. INTRODUCTION

VOIP refers to Voice over Internet Protocol, and is a methodology and group of systematic technology of transferring voice communication or multimedia messages over Internet Protocol (IP) networks. In other words, it is a phone service over the Internet. Since the invention of World Wide Web and revolutionary research in the field of internet connectivity, human beings have searched for better communication methods where VOIP is also a part of that advancement. VOIP technology provides services in lower

rates than traditional phone services. All you need is fast and secure internet connection and it works in the following three ways:

1. Using ATA (Analog Telephone Adapter)

The ATA is attached to a traditional telephone and is tasked with converting the voice signals generated by the caller to digital packets that are then sent over the internet through IP [1]. ATA adapters are even being connected to fax machines and other analog devices capable of VoIP Fig1.

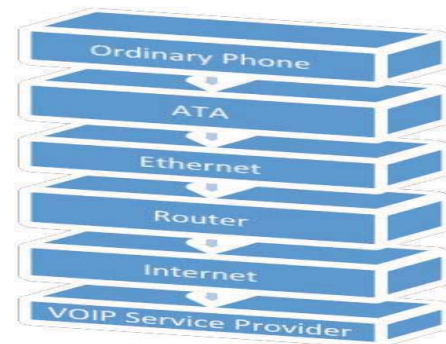


Fig.1. Analog Telephone Adapter

2. Using IP Phones.

VoIP phones use a host internet protocols to implement VoIP calls. Unlike legacy phones they convert analog voice calls to a digital format and incoming digital phone signals from the internet to standard telephone audio. IP addresses through the Dynamic Host Configuration Protocol (DHCP) automatically configure the VoIP parameters. Domain Name System tracks the IP addresses to connect the IP phones. IP phones include hardware-based IP phones and software-based IP phones.

3. Computer to Computer

Using a computer and Skype a VoIP call can be made over the internet. A VoIP provider software needs to be installed on the computer and caller must know the IP address of the called party to make connection as shown in Fig2.

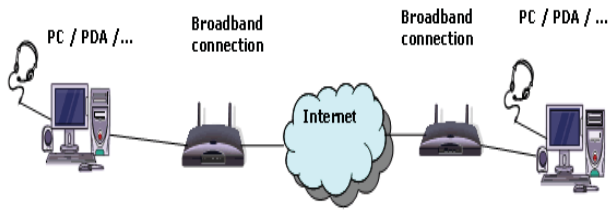


Fig.2. Computer to computer procedures

II. RESEARCH OBJECTIVES

- To employ Hierarchical Decision Model in an attempt to evaluate and select the most suitable VoIP alternative for international tourists among a variety of services through the analysis of a myriad of criteria and perspectives that need to be put into consideration while selecting the VoIP alternative.
- To ascertain the most preferred alternative among a majority of the users of VoIP services.
- To address the most important criteria for selecting VoIP services.

III. HIERARCHICAL MODEL

A Hierarchical Database Model is a type of data model, which organizes the data into a tree-like structure. The data is stored in the forms of records, which are inter connected to each other. A record is a collection of any field containing only one value. The records in the hierarchical database shows the relationship between the corresponding rows. This model resembles a family tree. A family tree in such a way that a parent can have many children but a child can be related to a single parent.

A hierarchical model can be helpful in finding the benefits of VoIP such as the relationship between VoIP marketing and customer needs. It is also can help us in calculating and predicting the right VOIP service provide. It shows the various parameters and constraints upon which the right VOIP provide can be forecasted. A Hierarchical Model has the following advantages.

- Clear Chain of Command
- Clear Paths of Advancement
- Specialization

IV. RESEARCH OBJECTIVES

In this study, the basic aim is to analyze the VOIP by using qualitative and qualitative research methodology. The VOIP will be analyzed with the aid of Hierarchical decision model. The future prospects in this field would also be discussed in the form of sensitivity analysis by keeping different kind of benefits under consideration. When choosing the most appropriate VoIP there are many variables to consider which makes the entire process a fiddly work for someone without the satisfactory knowledge in the field. Problems that are associated with technology selection are because of multiple objective variable problem, which bring about many qualitative and quantitative factors to consider.

V. METHODOLOGY

In this highly competitive Voice over IP protocol services and quick technology innovations and improvement, there are many methods to test the decisions for best selecting the right company to get adapted. In this research and for getting deep decisions, I applied multi-criteria decision analysis for instance:

VI. HIERARCHICAL DECISION MODEL: HDM

The first methodology for selecting the best VoIP provider is HDM-hierarchical decision mode. Methodology employed in this research is hierarchical decision modeling (HDM), which is one of the widely used multi-variable decision-making methodologies Ibrahim[2][3]. Such methodologies have also acted to help point out the most recurrent issues that are a challenge to the organization and the best way to act upon adopting resolving measures. In this research three phases of the methodology have been applied. The HDM model consist of four levels including objective level, Technology level, Strategy level, and Resource level.

VII. DATA REQUIREMENT

Two instruments were utilized in this phase so as to give accurate data. The first phase involves a detailed interview process that seeks to find out from a direct source. Each of the respondents have to express their professional opinion on a face-to-face, E. mail, or call basis as stipulated in the model. The responses that they gave were printed out and they were given a chance to reevaluate their given answers in case of any reconsideration [4]. The data is used to generate the preference weights of expert validated criteria. Such criteria are often tangible or intangible in nature and are used to tank the preference weights of the experts' suggestions on VoIP. This HDM technique proved to be very useful in establishing objectives and ranking policy options. In addition, it was very resourceful in checking for inconsistencies on any of the stake holder's accounts. The practical application of this approach is very complex because of its dynamic data elicitation processes. The following is The Final of a Hierarchical Decision Model

VIII. THE FINAL OF A HIERARCHICAL DECISION MODEL

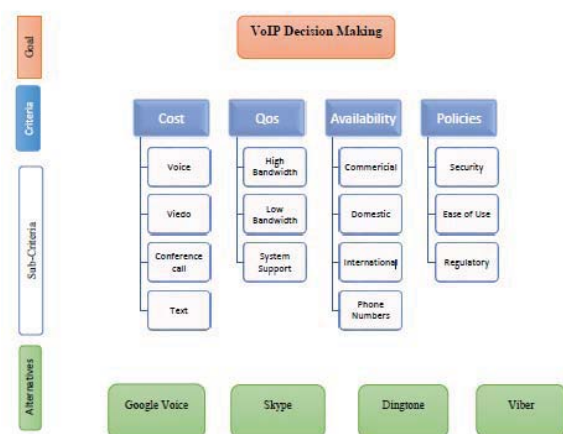


Fig.3. Final Model for selecting sustainable VOIP

The best VoIP technology is judged by experts with respect to be the best decision making selection matching the most criteria chosen in this research.

IX. MODEL DEFINITION:

The cost perspective which is in the first node at the second level is evaluated by the features the technology offers in terms of voice, video, call conferencing, and messaging. These features will form the criteria under cost perspective. For quality of services ‘QoS’ in the second node in the second level perspective where it is used looked at high bandwidth, low bandwidth and system support. Onwards, the Availability perspective took into account commercial, domestic, and international and phone numbers criteria. Finally, the policy perspective was marked by security and privacy, regulatory and ease of use criteria. Frankly, these are the main criteria based on the main decision factors. The alternatives expected to be/are in the market with a high level of usage according to customers’ satisfaction with the general criteria based on the real information.

X. MODEL ALTERNATIVES DEFINITION:

A. Google voice

Google Voice is a web-based service that makes it possible for the user to have a fixed phone number even if they change service providers, go on vacation or switch jobs. VoIP call is the latest addition by Google Voice. It is one of the important selected alternatives. Google Voice added VoIP call as a main feature for Gmail giving. They provide voicemail, email, free US long distance call, allow international calls, and many features like transcripts, call blocking, call screening, conference calling, SMS, and more [5]. Known as a free user-to-user chat functions,

B. Skype

Skype is one of the oldest VoIP users and was among the very first service providers to facilitate international to international calls since the onset of the new century. Skype is a VoIP software application. Skype is an IP telephone service provide. It also one of the fewest providers that allowed international to international calls from the beginning of the new century [6][7].

C. Dingtone

Dingtone is popular for its superior sound quality as compared to the regular phone call. Further, Dingtone is capable of turning the user’s phone into a real Walkie Talkie. Additionally, Dingtone can assign real phone numbers to its users thus making it possible for the user to receive phone text messages and phone calls from anyone. Dingtone refers to a software mobile application for iPhone and Android with a free download. By using the app, allow customers to make free phone calls, send free text messages, and instantly share pictures, videos, and your location [8].

D. Viber:

Viber is a freeware for Android, Linux, Microsoft Windows, iOS, and macOS that facilitates VoIP communication as well as cross-platform instant messaging. Additionally, its users can share media messages, images, video and audio files.

Viber is a quick messaging and Voice over IP (VoIP) mobile application app for smartphones developed by Viber Media. In addition to instant messaging, users can exchange images, video and audio media messages [9].

Based on the personal experiences of experts and the data collected during the research process, the following comparison table 1 was arrived at in an attempt to select the best VoIP service provider [10] [11] [12].

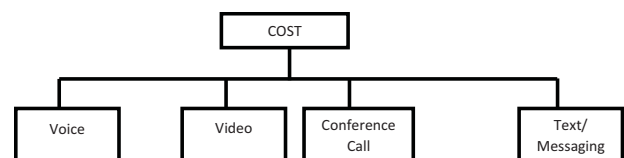
TABLE1. VOIP SEVICES FEATURES COMPARASION

Category or Feature	Google Voice	Dingtone	Skype	Viber	Description
Founded	2009	2012	2002	2010	
Voice	√	√	√	√	
Video	√	√	√	√	
Conference Call	√	√	√		
Text	√	√	√	√	
Cost	From 1 Cent*	From 0.91 Cent*	From 2.3 Cents*	*	Free from app to app
Phone Numbers	√	√			They charge for getting a VoIP number
Phone Plans	No	No	No	No	
Desktop	√		√		
Phone Applications	√	√	√	√	Free download with no cost
System Support	√	√	√	√	

XI. THE DEFINITION OF THE SELECTED CRITERIA ARE AS FOLLOWS;

A. Cost

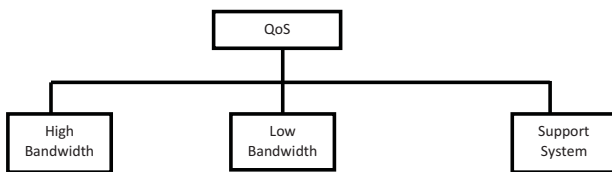
Occupies the first node at the second level and is evaluated on the basis of the features that the technology offers clients in terms of video, voice, messaging and, call conferencing.



1. Voice: This criterion establishes that the voice cost between the lines is to standards and can match the requirements of the business. It is important to note that despite the fact that dedicated broadband offers high internet connectivity, leased lines are the best when considering voice quality [13].
2. Video: Under the cost perspective, quality video transmission is an essential criterion that should be considered for the best VoIP technology. In the modern world, there are multitude tools to choose from, but the best should be the one that allows them to make and access video conference calls anytime and anywhere. That said, a mobile integrated VoIP system can help workers make direct and access video calls even when they are not in their offices.
3. Conference Calls: It is clear that conference calls are not for big corporations alone. The best VoIP technology for a business should be one that offers free conferencing calls between just a few people to thousands. The criterion subjects the various VoIP applications to scrutiny on the basis of their ability to support free pc to pc calls and very inexpensive calls to cell phones and to landlines.
4. Messaging: There is nothing annoying like realizing that the VoIP system installed in your business does not offer texting services. However, there are some VoIP providers that offer messaging services at an affordable fee using the client's mobile devices.

B. Quality of Service

Occupies the second node at the second level and it encompasses system support, high bandwidth as well as low band width. Quality of Service is simply known as QoS, and is based on VoIP communication quality which is an imperative criterion. Delay and latency cause issues to the users. QoS is varies between services. This is a key issue when analyzing the quality worthiness of a VoIP [13] [14].

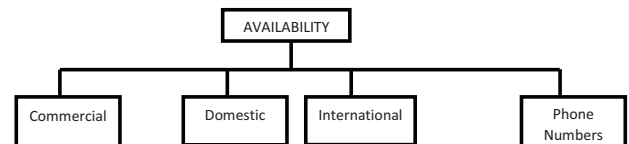


1. High Bandwidth: Factors to consider here are as such as the quality of bandwidth the most preferential being the one with the highest bandwidth. This is because voice and video connections improve as the bandwidth increases [15].
2. Low Bandwidth: In evaluating cost a low bandwidth VoIP will be cheaper than the latter. The key issue here is how to guarantee that the packet traffic for the media connection will not be interfered with from other priority traffic.
3. System support [16]: In this category, also the system support for the VoIP is a determining factor for the overall cost. A preferable one will include a functional

system support according to the opinion of the given experts.

C. Availability

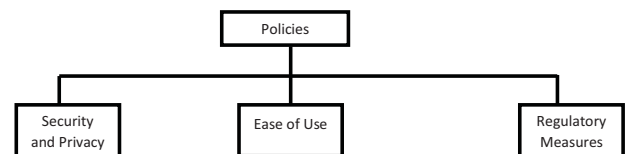
Occupies the third node at the second level and takes into account the following criteria: domestic, commercial, and international and, phone numbers. This perspective outlines that the scope of the VoIP should not be limiting in terms of where it can be used [17].



1. Commercial: The commercial availability of a VoIP system is a necessary consideration while selecting the VoIP system
2. Domestic: If local calls are a preference, then the availability of domestic calls is an important criterion while selecting the VoIP technology.
3. International: The best VoIP system that should be selected ought to have international coverage in order to make it usable for business travelers. Additionally, the best VoIP should have a provision for availability status notifications for users who are online for communication. Consequently, users can avoid scheduling their communication by advertising their availability on their mobile phones or desktops. From all interviews conducted, the respondents credited the cost consequence of such a VoIP [18].
4. Phone numbers: Availability of phone numbers in a VoIP should be a necessary consideration while selecting the VoIP as the numbers aid in the expansion of calls from one service to another.

D. Policies

Occupies the forth node at the second level and puts into account privacy, security, ease of use and, regulatory criteria. A set of ways and rules that made by VoIP services such as ease of use and Security and privacy and their regulations. Criteria to consider here is the VoIP's ease of use while utilizing improved technology [19].



1. Security and Privacy [21] [22]: Another criterion is the security and privacy of the VoIP. This takes into consideration the privacy of connections from third parties who may want to hack into it in addition to keeping customers information secure and private. For this reason, experts guide to a VoIP with an elaborate encryption system that will secure itself from any intrusion.

2. Ease of use [20]: This has the implication that since they are replacing the analog phones they should be easier to use in terms of their call control and navigation software.
3. Regulatory [23]: The last criteria are the regulatory measures that can be exercised on the VoIP on preference. Experts advise on a legal VoIP that is malleable to control measures. The decision making team took four VoIP technologies for the decisions alternatives and placed them at the bottom level of the hierarchy in addition to important regulatory issues and emerging technology which is Voice over Internet Protocol (VoIP)

At the end of explanation these criteria, the decision will be based on the alternative four big services in the country such as Google Voice, Skype, Dingtone, and Viber. These are the most VoIP the customers like.

XII. SPECIFIC OBJECTIVES

- To employ Hierarchical Decision Model in an attempt to evaluate and select the most suitable VoIP alternative for international tourists among a variety of services through the analysis of a myriad of criteria and perspectives that need to be put into consideration while selecting the VoIP alternative.
- To ascertain the most preferred alternative among a majority of the users of VoIP services.
- To address the most important criteria for selecting VoIP services.

XIII. DATA AND DATA SOURCE(S)

This was applied in the choice phase of the research as recommended by the model. With a well-developed list of VoIP solutions the quantitative method of AHP was developed which entails a couple of pairwise comparisons between alternatives [24]. The instruments put into application here are such as the in depth interviews. Using the HDM model the in depth interviews were applied in different phases of multi criteria decisions such as pairwise comparison and data analysis with the old literature review evaluating. The main criteria that are involved in the evaluation of the VoIP system need to be assessed with a lot of care. These factors are taken into consideration with great regard of the organizational need that evoked the need for research in the first place [25]. First the researcher presented the different criteria proposed by the

The criteria that are put into consideration while deciding on the best VoIP service vary in accordance with the organizational and individual needs. Therefore, the selection process needs to be done with utmost care. As part of the research process, the researcher presented a variety of criteria that were in line with the AHP model to a group of experts and discussions pertaining the criteria were conducted. The researcher also presented open ended questions to the experts. The questions revolved around these issues:

- a) The most used features of the VoIP system adopted by the company.

- b) The VoIP features that the experts would recommend for adoption by the company.
- c) The various VoIP technologies available in the market and their rate of advancement.
- d) The merits of adoption of VoIP technologies in any given company.
- e) The demerits of use of VoIP technologies in any given company.
- f) The main criteria put into consideration while evaluating and deciding on the most efficient and appropriate VoIP technology that a company should make use of.

From the questions, pairwise comparisons were able to be made. Conclusively, the main sources of data for the research were the results of the HDM model in conjunction with the pairwise comparisons made by the experts. Additionally, evaluation of existing literature beefed up the data.

XIV. EXPERT PANEL

The panel of experts that facilitated the research process comprised members with diverse academic and professional backgrounds but with common knowledge of the HDM model. All the experts contributed in the results and findings of the research. The expert panel consisted of six professionals whose details are in the table below:

TABLE2. DISTRIBUTION AND BACKGROUND OF EXPERT PANEL [26].

<i>EXPERTS</i>	<i>BACKGROUND</i>	<i>CONSULTING ENGINEERING COMPANY</i>	<i>ACADEMIA</i>
EXPERT 1	AT&T Telecommunication store	√	
EXPERT 2	ETM Graduate Student at Portland State University		√
EXPERT 3	ETM Graduate Student at Portland State University		√
EXPERT 4	PMI: PMP	√	
EXPERT 5	Computer Science and Electrical Engineering Professional		√
EXPERT 6	Ph.D. Scholar in Information Technology		√

XV. MODEL VALIDATION

The initial feedback from the experts was a recommendation to make additions to the decision making options. The recommendations included addition of availability and policies for the perspective level as well as shifting customer service to the third tier. To attain clarity and to facilitate reasonable decision making, eight more criteria were added to the third level. Consequently, the initially suggested model was modified as per the experts' recommendations (Appendix A).

XVI. ANALYSIS AND KEY FINDINGS

The HDM model provided a platform to analyze different products in a competitive environment for best decision making process. A systemic combinational relationship of elements in level 1, level 2, level 3, and level 4 was created thus providing a perspective based on the importance of different elements compared to each other at adjacent levels. Due to different schedules of the expert weighting for the final result, the questionnaires alongside the possible pairwise comparison combinations proposed by the group were distributed among the decision makers [27]. The hierarchical pairwise factor weight is obtained by using the pairwise comparison matrix of criteria and sub-criteria elements. From this, it is possible to compute the Eigen vector using the provided equations [28]. Pairwise comparison matrices were used for comparisons of combinations and possible combinations distributed among expert group members. To come up with precise preferences pairwise combinations were used to compare different entities for best decision making. To calculate the Eigen factors weights of pairwise elements were obtained using criteria matrices. Geometric mean aggregation was compounded by comparison of all decision makers sub criteria combinations and provide Eigen equations. Results compiled were dissected by researcher comparing sub criterions from level 3, level 4 with main criteria considering priorities by local experts benchmarking with global standards. Perspectives calculations were graphically represented as shown in the Appendix A.

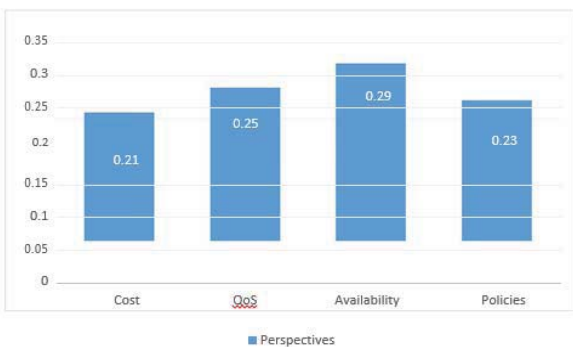


Fig.4. Total Perspectives Weight Chart.

Experts considered cost, availability, quality of service and policies to decide on a selected perspective. The professional experts' weighing with respectively are availability, quality of service, policies, and cost as 0.29, 0.25, 0.23, and 0.21. It was expected that one of the factor to be more preferable to experts

opinion but not as the cost perspectives which has the lowest rank with 0.21. It is really surprised that the cost is not one of the first majority for the four upcoming alternatives because users as people to people or business to business consider prices at the first moment to select their VoIP service provider. For, quality of services and policies with the rank 0.25 and 0.23 are acceptable to the expert's preference due to the significant of availability factor. As a result. Availability at all times of the VoIP services with limited downtime was the significant factor considered in the hierarchy of the decision making process. Prioritizing availability was attributed to the fact that people needing such services prefer time and cost effective services.

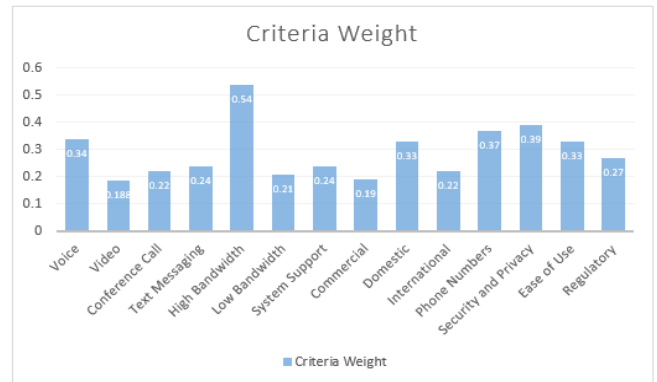


Fig.5. The Criteria weight after experts' judgments evaluations.

After analysis and weighing different combinations of the criteria, high bandwidth was the highly valued criteria among experts and users to use for decision making while choosing a VoIP services provider. To support high quality calls over the internet high bandwidth is the most preferred. Voice calls edged out text messaging, video calls and conferencing. Bandwidth rate determines the number of concurrent calls that can made over the IP internet. Considered high bandwidth is under availability. The analysis found that the factors ranked as follows; high bandwidth, text messaging, conference call, international, low bandwidth, commercial and video calls.

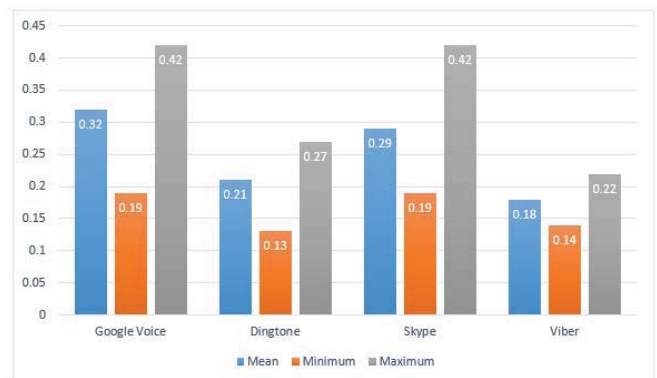


Fig.7. Alternatives Weight Figure

Skype despite being the earliest product development for VoIP services came behind the recent invention in Google Voice with 0.3 difference. Google Voice features that gave it an edge over the competition include unlimited domestic calls including mobile and landline, free short messaging services, free call forwarding, voicemail transcription, free call recording, free individual phone number, needs phone plan, and free group video chat. Expert alternatives varied as below;

TABLE3. RELATIVE VALUE OF EACH PLAN BASED ON THE RESULTS OF THE MODEL

BEST VOIP SERVICE	GOOGLE VOICE	DINGTONE	SKYPE	VIBER	INCONSISTENCY
EXPERT 1	0.37	0.27	0.21	0.15	0.04
EXPERT 2	0.42	0.2	0.19	0.19	0.02
EXPERT 3	0.31	0.21	0.3	0.18	0.04
EXPERT 4	0.19	0.19	0.42	0.19	0.02
EXPERT 5	0.38	0.13	0.35	0.14	0.05
EXPERT 6	0.25	0.24	0.29	0.22	0.02
MEAN	0.32	0.21	0.29	0.18	
DISAGREEMENT					0.056

XVII. SENSITIVE ANALYSIS

Overall, based on table 3 and Fig 3.1.2.3.4.5.6, the overall mean for all criteria weighting is 22.143 and experts for 0.25 where that all values appears just one. By taking off one of the experts expert number 6, the over all of alternative will be completely change to 0.24 for the highest ranked alternatives selection from Google Voice, Skype, Dingtone, and Viber to Google voice, Dingtone, Viber, and then Skype. This change made Skype to have a lower rank instead of being the second highest rank. That's big change is related to the new innovative technology.

XVIII. INCONSISTENCY AND DISAGREEMENT

To validate the results inconsistency measurements and disagreements were carried out bring about robustness in rankings and potential. For validation purposes inconsistency measurements of all experts and correlation coefficients are tested for reliability and potential changes can be made [29].

A validation of the HDM model is depends on the level and range of inconsistencies of experts in their decision making based on the availed criteria. Experts' inconsistencies vary from 0.02 to 0.05 and this being below the range of acceptability makes the findings valid and reliable.

XIX. FUTURE RESEARCH

Advanced features and lowered cost of communication over IP is the future of VoIP. From the research conducted the more user friendly and cheaper features a VoIP service provider has the more interested users subscribe to the platform. Future research should also focus on the integration of communication to provide business solutions globally. Extensive research has to be conducted and collected data used to improve the quality of services for VoIP sessions. Other

resources for the research should be considered in demonstrating the methodology [30] [31] [32].

As global technology standards entailing IP and connectivity aim to be tailored to fit business needs, so should the HDM decision making process aim to precisely find the best VoIP service providers based on more refined criteria. For instance VoIP services unlike phone services do not provide emergency dial options in case of tragedies and emergencies.

With 5G internet upon us VoIP providers should highly consider going mobile for fast connections and improved quality. Security should also be an area to invest in. Security entails security audits, firewalls. VoIP research should futuristically be based on finding ways of decision making that will ensure better communication unification on cloud based platforms to benefit from scalability, unified messaging and autonomy to make changes remotely.

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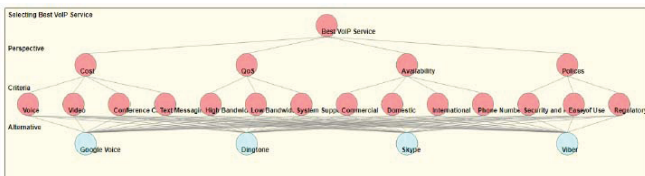
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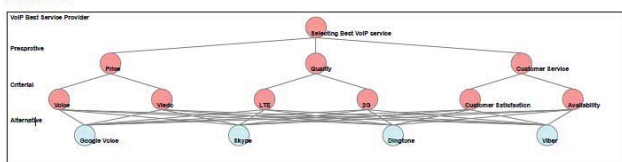
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APPENDIX A – QUANTIFIED MODEL



Final Screenshot of running the final model in the HDM online software at ETM

HDM (Hierarchical Decision Model)



First model build before experts validation

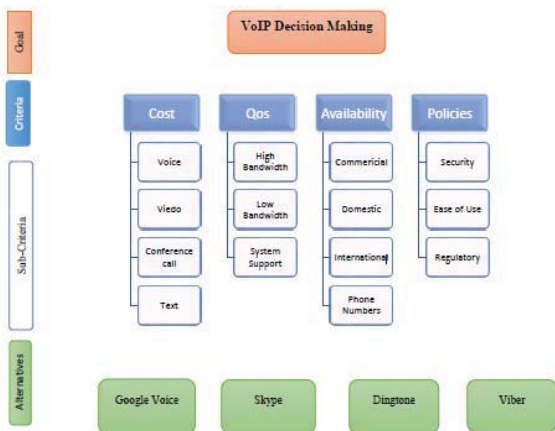


Fig.1. The Final of a Hierarchical Decision Model

APPENDIX B – AHP/HDM PCM DATA TABLES

Best VoIP Service	Google Voice	Dingtone	Skype	Viber	Inconsistency
Durham Vincent	0.37	0.27	0.21	0.15	0.04
Fayez Nasser	0.42	0.2	0.19	0.19	0.02
Joseph A	0.31	0.21	0.3	0.18	0.04
Liliana Fitzpatrick	0.19	0.19	0.42	0.19	0.02
Nathalie Marquez	0.38	0.13	0.35	0.14	0.05
Shuying Li	0.25	0.24	0.29	0.22	0.02
Mean	0.32	0.21	0.29	0.18	
Minimum	0.19	0.13	0.19	0.14	
Maximum	0.42	0.27	0.42	0.22	
Std. Deviation	0.08	0.04	0.08	0.03	
Disagreement					0.056

The statistical F-test for evaluating the null hypothesis (Ho: ric = 0) is obtained by dividing between-subjects variability with residual variability.

Source of Variation	Sum of Square	Deg. of freedom	Mean Square	F-test value
Between Subjects	0.08	3	0.28	4.57
Between Conditions	0.00	5	0.000	
Residual	0.09	15	0.006	
Total	0.17	23		
Critical F-value with degrees of freedom 3 & 15 at 0.01 level:				5.42
Critical F-value with degrees of freedom 3 & 15 at 0.025 level:				4.15
Critical F-value with degrees of freedom 3 & 15 at 0.05 level:				3.29
Critical F-value with degrees of freedom 3 & 15 at 0.1 level:				2.49

Fig.2.1. Screenshot of the final results of the model

Individual Analysis Results:

Level-1	Best VoIP Services
Cost	0.17
QoS	0.34
Availability	0.27
Policies	0.22
Inconsistency	0.02

Level-2	Cost	QoS	Availability	Policies
Viber	0.27	0.02	0.00	0.00
Voice	0.27	0.00	0.00	0.00
Conference Call	0.17	0.00	0.00	0.00
Text Messaging	0.18	0.00	0.00	0.00
High Bandwidth	0.00	0.23	0.00	0.00
Low Bandwidth	0.00	0.41	0.00	0.00
System Support	0.00	0.32	0.00	0.00
Commercial	0.00	0.22	0.00	0.00
Domestic	0.00	0.00	0.28	0.00
International	0.00	0.00	0.18	0.00
Phone Numbers	0.00	0.00	0.21	0.00
Security and Privacy	0.00	0.00	0.44	0.00
Ease of Use	0.00	0.00	0.00	0.33
Regulatory	0.00	0.00	0.00	0.22
Inconsistency	0.01	0.01	0.01	0.00

Level-3	Voice	Video	Conference Call	Text Messaging	High Bandwidth	Low Bandwidth	System Support	Commercial	Domestic	International	Phone Numbers	Security and Privacy	Ease of Use	Regulatory
Google Voice	0.24	0.41	0.30	0.41	0.41	0.23	0.47	0.38	0.37	0.34	0.38	0.45	0.30	0.33
Dingtone	0.27	0.32	0.34	0.28	0.28	0.18	0.29	0.33	0.27	0.30	0.31	0.29	0.29	0.30
Skype	0.28	0.18	0.18	0.18	0.28	0.28	0.17	0.24	0.23	0.20	0.17	0.18	0.28	0.18
Viber	0.18	0.11	0.10	0.11	0.11	0.33	0.10	0.11	0.14	0.18	0.13	0.03	0.11	0.18
Inconsistency	0.10	0.05	0.09	0.02	0.04	0.01	0.02	0.07	0.02	0.07	0.04	0.00	0.10	0.04

Level-1	Best VoIP Services
Google Voice	0.37
Dingtone	0.27
Skype	0.21
Viber	0.15
Inconsistency	0.04

Fig.3.1 Expert-1 analysis results

