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Highlights

An Evaluation of Islami Human Computer Interaction

Parallel Signed Multipliers

Test Methods of Interfaces

Discovering Thoughts, Inventing Future

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Investigating the VLSI Characterization of Parallel Signed Multipliers for RNS Applications using FPGAs

By Mr. Pradeep. N, Mr. S. Elango, Dr. P. Sampath & Ms. Gayathri
Bannari Amman Institute of Technology, India

Abstract- Signed multiplication is a complex arithmetic operation, which is reflected in its relatively high signal propagation delay, high power dissipation, and large area requirement. High reliability applications such as Cryptography, Residue Number System (RNS) and Digital Signal Processing (DSP)'s effective performance is mainly depend on its arithmetic circuit's performance. Trend of using Residue Number System (RNS) instead of Constrain over-whelming Binary representation is promising technique in VLSI Systems and Multiplier is the basic building block of such systems. In this paper we have considered signed Modified Baugh Wooley Multiplier and Modified Booth Encoding (MBE) Multiplier logic for analysis and synthesized on best suited application platform. Analysis has taken account of Delay, Number of Logic Element requirements; Number of Signal Transition for particular sample input and its Power Consumption were analyzed for both Modified Baugh Wooley Multiplier and Modified Booth Encoding Multiplier.

Keywords: baugh wooley multiplier, modified booth encoding (mbe), computer arithmetic, signed multiplier, verilog hdl, xilinx ise, altera quartus.

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Mr. Pradeep. N [α], Mr. S. Elango [σ], Dr. P. Sampath [ρ] & Ms. Gayathri [ω]

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Keywords: baugh wooley multiplier, modified booth encoding (mbe), computer arithmetic, signed multiplier, verilog hdl, xilinx ise, altera quartus.

I. Introduction

Multiplication is a most generally used operation in wide computing systems. In fact multiplication is nothing but addition since, multiplicand adds to itself multiplier number of times, gives the multiplication value between multiplier and multiplicand. But considering the fact that this kind of implementation really takes huge hardware resources and the circuit operates at utterly low speed. In order to address this so many ideas have been presented so far for the last three decades. Each one is aimed at improvement according to the requirement. One may be aimed at high clock speeds and another may be aimed for low power or less area occupation. Either way ultimate job is to come up with an efficient architecture which can address three constraints of VLSI speed, area, and power. Among three constrains, speed is the vital one which requires more attention. If we observe closely multiplication operation involves two steps one is producing partial products and adding these partial products [3].

Thus, the speed of a multiplier hardly depends on how fast generate the partial products and how fast we can add them together.Since the multipliers have a significant impact on the performance of the entire system, many high performance algorithms and architectures have been proposed [1-12]. The very high speed and dedicated multipliers are used in pipeline and vector computers.

Residue Number System (RNS) reduces the delay of carry propagation, thus offering significant speed up over the conventional binary system. This characteristic is advantageous when repetitive arithmetic operations on long operands have to be performed. RNS has been adopted in the design of Digital Signal Processors (DSP) .The low power consumption of RNS compared to conventional arithmetic circuits for the implementation of Finite Impulse Response (FIR) filters inspired lot of work against it. Therefore, RNS may be an interesting candidate for building processing circuits in deep submicron technologies.

The rest of the paper is organized as: Section-II describes Baugh-Wooley Multiplication Section-III provides deep understanding about Modified Booth Encoding techniques, Comparative results and its analysis are exploited in Section-IV and Finally Conclusion of the paper illustrated in Section –V.

II. Baugh Wooley Multiplier

The Baugh-Wooley multiplication is one of the efficient methods to handle the sign bits and this approach has been developed in order to design regular multipliers[2], suited for 2's complement numbers.

Let us consider two n-bit signed numbers, X (Multiplicand) and Y (Multiplier), to be multiplied

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$$X = -x_{n-1}2^{n-1} + \sum_{i=0}^{n-2} x_i 2^i \quad [1]$$

$$Y = -y_{n-1}2^{n-1} + \sum_{i=0}^{n-2} y_i 2^i \quad [2]$$

where the xi's and yi's are the bits in X and Y, respectively, and x_{n-1} and y_{n-1} are the sign bits.

The product, P= X * Y, is then given by the following equation:

P = X * Y

$$= \left(-x_{n-1}2^{n-1} + \sum_{i=0}^{n-2} x_i 2^i\right) * \left(-y_{n-1}2^{n-1} + \sum_{j=0}^{n-2} y_j 2^j\right)$$

$$= x_{n-1}y_{n-1}2^{2n-2} + \sum_{i=0}^{n-2}\sum_{j=0}^{n-2} x_i y_j 2^{i+j}$$

$$-2^{n-1}\sum_{i=0}^{n-2} x_i y_{n-1}2^i - 2^{n-1}\sum_{j=0}^{n-2} x_{n-1}y_j 2^j \quad [3]$$

The final product can be obtained by subtracting the last two positive terms from the first two terms.

Instead of pursuing subtraction operation, it is possible to obtain the 2's complement of the last two terms and add all terms to get the final product.

The final product (3), P=X * Y becomes:

P = X * Y

$$= x_{n-1}y_{n-1}2^{2n-2} + \sum_{i=0}^{n-2} x_i 2^i \sum_{j=0}^{n-2} y_j 2^j$$

$$+2^{2n-1}\sum_{i=0}^{n-2} \overline{x_i y_{n-1}}\,2^i + 2^{n-1}\sum_{j=0}^{n-2} \overline{x_{n-1}y_j}\,2^j \quad [4]$$

$$-2^{2n-1} + 2^n$$

Simple 4x4 Baugh-wooley multiplication is exhibited in figure 1.

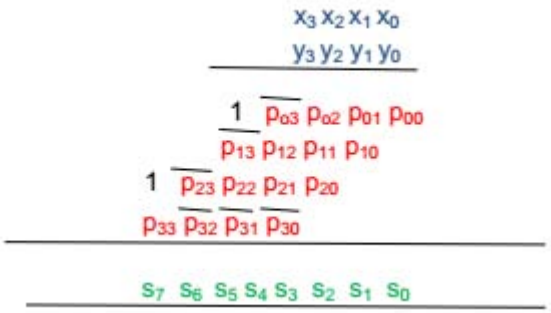


Figure 1

The same multiplication logic can be extended for different multiplier strength such as 4,8,16,32,64 bit-length and the efficiency is analyzed with simulation and synthesis tool .Baugh-wooley implementation require n2 AND gates and n(n-1) ADDERS as shown in figure 2.

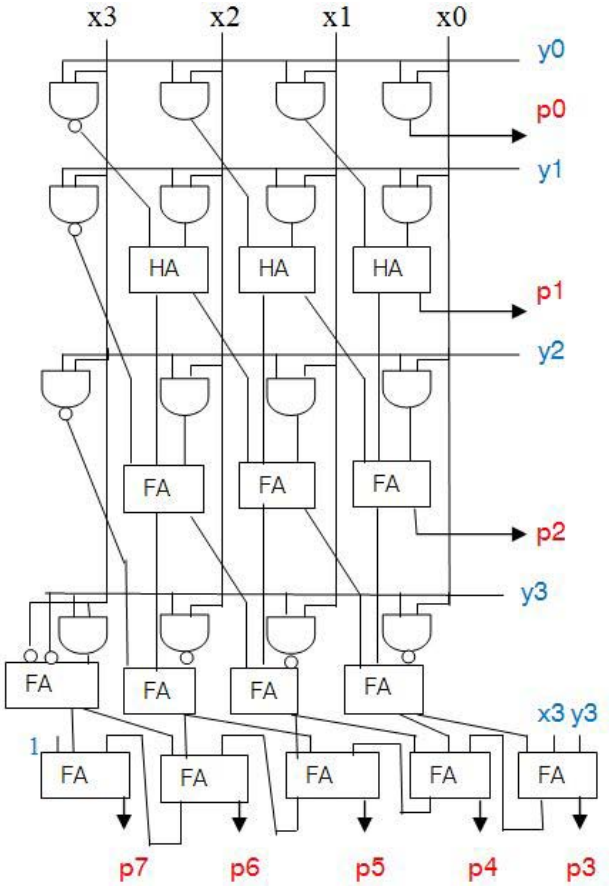


Figure 2

III. Booth Multiplier

The modified-Booth algorithm [1] is more preferred and extensively used for high-speed multiplier circuits. Modified Booth Multiplier is one of the different techniques for signed multiplication This multiplier architecture is based on Radix 4(2^2) Booth multiplier. In order to improve the architecture, we have made 2 enhancements as in [14]. The first is to use efficient Wen-Chang's Modified Booth Encoder (MBE) since it is proved as the fastest scheme to generate a partial product.

a) Algorithm of the Modified Booth Multiplier

Booth Multiplication consists of three[10-14] steps:

1. The first step to generate the partial products;
2. The second step to add the generated partial products until the last two rows are remained;
3. The third step to compute the final multiplication results by adding the last two rows.

The modified Booth algorithm reduces the number of partial products by half in the first step. We

used the modified Booth encoding (MBE) scheme proposed in [1], It is known as the most efficient Booth encoding and decoding scheme. To multiply M by N using the modified Booth algorithm starts from grouping N by three bits and encoding into one of {-2, -1, 0, 1, 2}.Figure 3 exhibit the general architecture of MBE.

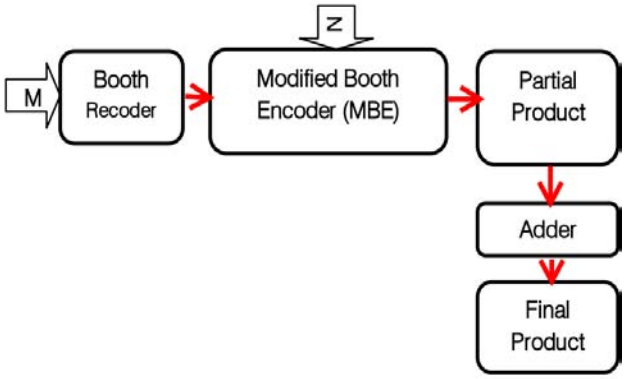


Figure 3

Table 1 : Modified Booth Encoder Logic [1]

b_3	b_2	b_1	Operation	Explanation
0	0	0	0	Add 0
0	0	1	A	Add Multiplicand
0	1	0	A	Add Multiplicand
0	1	1	2A	Two times Add Multiplicand
1	0	0	-2A	2's Complement of Multiplicand and Add 2 times.
1	0	1	-A	2's Complement of multiplicand and Add
1	1	0	-A	2's Complement of multiplicand and Add
1	1	1	0	Add 0

In this case, the multiplicand is offset one bit to the left to enter into the adder while for the low-order multiplicand position a 0 is added. Each time the partial product is shifted two bit positions to the right and the sign is extended to the left.

During each add-shift cycle, different versions of the multiplicand are added to the new partial product depends on the equation derived from the bit-pair recoding table above.

Here are some examples for understanding:

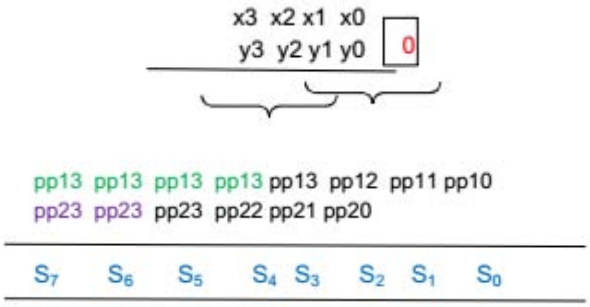


Figure 4

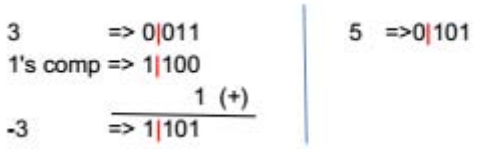
The new MBE recorder [14] is designed in accordance to the area efficient wen-chang's Modified Booth Encoder (MBE) since it is proved to be the efficient architecture on trend, and Table (1) presents the truth table of the new encoding scheme. The way of application and calculation procedure is expressed in the following examples.

For the ease of understanding, the main two different categories of signed multiplication are taken into consideration that is multiplication of a negative multiplicand and positive multiplier in example-1 and both negative multiplicand and multiplier in case of example-2 are clearly described for understanding.

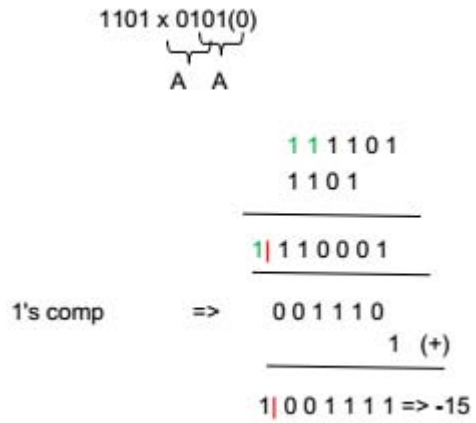
Example 1: For One negative and One positive number.

Consider -3 x 5

Step-1: binary conversion and 2's complement



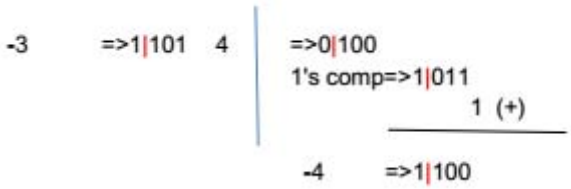
Step-2: Multiplication by Modified booth recoding



Example 2: For Both Negative Numbers.

Consider -3 x -4

Step-1: Binary conversion and 2's complement



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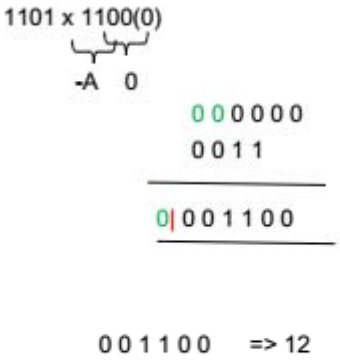


Once the partial products are generated then the addition process is very similar to the array multiplier.

IV. Results and Analysis

The Multiplier were taken for analysis was described using structural Verilog HDL and synthesized to produce a gate level net list using two different synthesizer namely Xilinx ISE Design Suite 14.3, Altera Quartus II 12.0 with reference to Virtex7 XCV2000T-2FLG1925 and Cyclone II EP2C35F672C6 FPGA respectively. The multipliers were simulated and analyzed at different strengths such as 4 x 4, 8 x 8, 16 x16, 32 x 32 and 64 x 64 as shown below in table [2-4] .

a) Area Analysis

In FPGA based design, Area requirement of the design is proportional to logic utilization i.e in Xilinx - Number of Slice LUTs Required and in Altera its Number of Logic Elements Required. For 16 x 16 bit strength Booth Consume 20.5% lesser area than Baugh-Wooley Multiplier.

b) Delay Analysis

In FPGA based Design, EDA tools having inbuilt capability to predict the Delay of the design. In Xilinx - Timing Analyzer Tool and in Altera Time Quest Timing Analyzer Tool were used for delay analyze. Various Delay analysis shows Modified Booth has about 43% performance efficient over Baugh-Wooley.

c) Power Analysis

Power Evaluation of the design done at various levels such as Total Thermal power Dissipation (mW-milli Watt's), Core Dynamic Thermal power Dissipation (mW), core static Thermal power Dissipation (mW), I/O Thermal Power Dissipation(mW). Among the various power levels dynamic power varies with design to design it decides the efficient architecture.

Dynamic Power Requirement of the design is decided based on number of signal transition (or) activity during simulation time. Here analysis has been made using Power Play Power Analyzer from Altera. Power Analyzer required an input file of Signal Activities and Value Changed Dump (VCD) File to evaluate the power of the design. Here we have measure the signal activities count for 20 different Samples for 100ns simulation and the same sample is forced for other design also in order to evaluate the exact power difference between the design. power Analysis with powerplay analyzer tool for 4 x 4 bit shows 46.90% Modified Booth consume less than Baugh-wooley Multiplier and found consistence for all strength.

Table 2 : Area analysis using Altera Quartus-II

Multipliers Strength	Multiplier Name	No. of IOBs	Altera Cyclone II EP2C35F672C6	
			No. of Logic Elements Required	Delay (ns)
4x4	BAUGH	16	30	15.650
	BOOTH	16	28	10.173
8x8	BAUGH	32	164	36.994
	BOOTH	32	150	25.082
16x16	BAUGH	64	698	99.377
	BOOTH	64	538	42.826
32x32	BAUGH	128	2,874	325.172
	BOOTH	128	2,284	87.473
64x64	BAUGH	256	10,122	956.214
	BOOTH	256	9,542	189.886

Table 3 : Area and Delay analysis using Xilinx ISE

Multipliers Strength	Multiplier Name	No. of IOBs	Xilinx Virtex7 XCV2000T-2FLG1925	
			No. of Slice LUTs Required	Delay (ns)
4x4	BAUGH	16	20	15.91
	BOOTH	16	18	10.14
8x8	BAUGH	32	104	55.93
	BOOTH	32	96	22.15
16x16	BAUGH	64	452	191.84
	BOOTH	64	354	40.87
32x32	BAUGH	128	1851	670.46
	BOOTH	128	1595	81.19
64x64	BAUGH	256	7392	1838.32
	BOOTH	256	6480	159.28

Table 4 : Power Analysis (Time interval of 100ns with 20 different samples)

Multipliers Strength	Multiplier Name	Altera Cyclone II EP2C35F672C6				
		Number Signal Transition during simulation for 100ns	Power estimation			
			Total Thermal Power Dissipation (mW)	Core Dynamic Thermal Dissipation (mW)	Core Static Thermal power Dissipation (mW)	I/O Thermal power Dissipation (mW)
4x4	BAUGH	1857	169.92	1.13	80.12	86.67
	BOOTH	986	166.13	1.01	80.01	86.59
8x8	BAUGH	20911	223.47	4.81	80.30	138.36
	BOOTH	10291	223.39	5.28	80.30	138.30
16x16	BAUGH	498261	351.24	27.12	80.74	243.39
	BOOTH	51942	345.25	19.86	80.72	244.67
32x32	BAUGH	9606019	642.20	115.05	81.75	445.40
	BOOTH	469336	601.67	82.31	81.61	437.74
64x64	BAUGH	19212038	1302.34	331.53	83.13	887.68
	BOOTH	1877344	1278.88	360.30	83.24	836.34

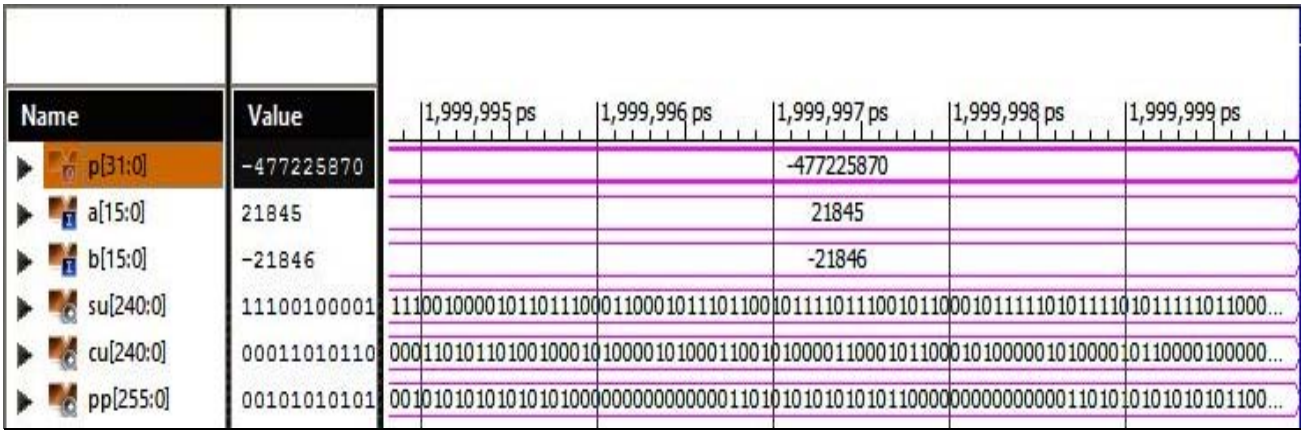


Figure 5

The Xilinx Simulation result for booth-32 x 32 bit is exhibited below in the Figure 5, and then the structure level port-map model is synthesized as Gate-level Netlist for signal Transition calculation. Modified Booth's 64 x 64 bit simulation result on Altera Quartus-II is illustrated in the Figure 6, and then synthesis summary is depicted inFigure7-11.

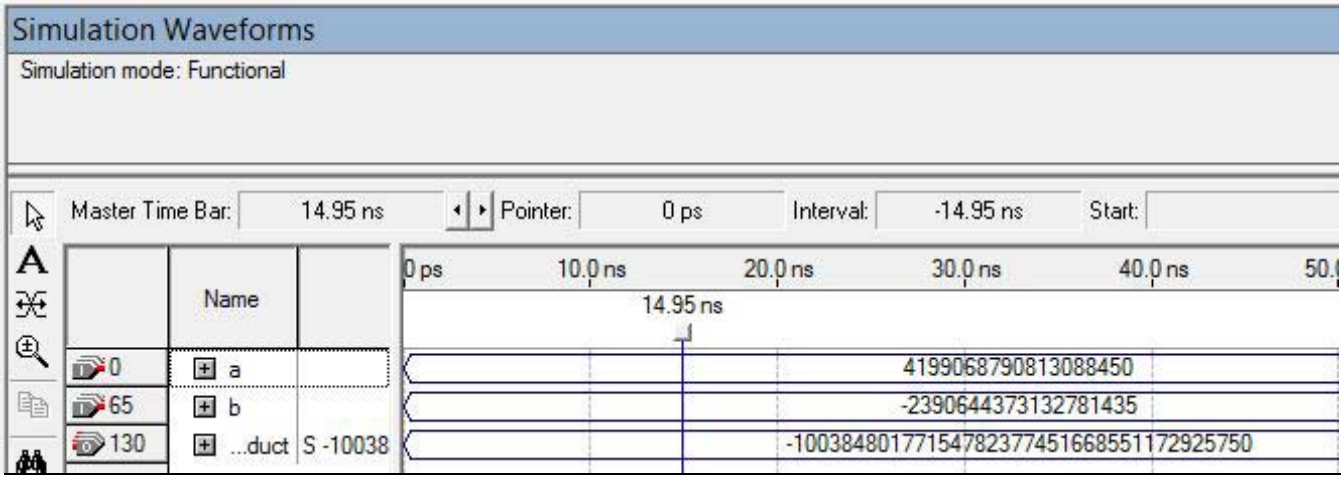


Figure 6

The Figure 7-plot graph Xilinx Area-Multiplier strength versus No. of LUT's, figure 8- Graph plot for Xilinx Delay-Multiplier strength versus delay time (ns). Figure 9-plot for Altera Area-Multiplier strength versus No. of LUT's figure and 10-Altera Delay-Multiplier strength versus delay time (ns).and finally figure 11 Graph plot for Altera Powerplay power-strength versus power dissipation (mW).

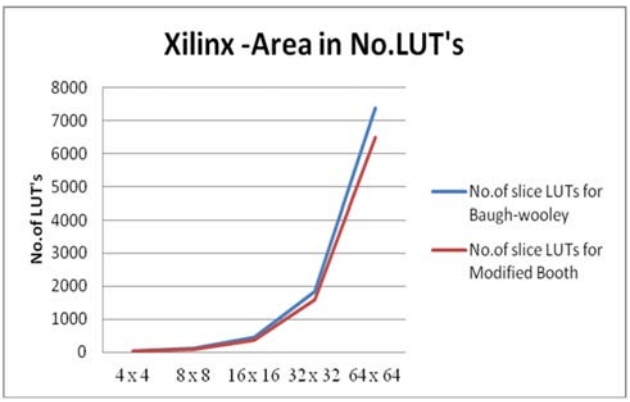


Figure 7

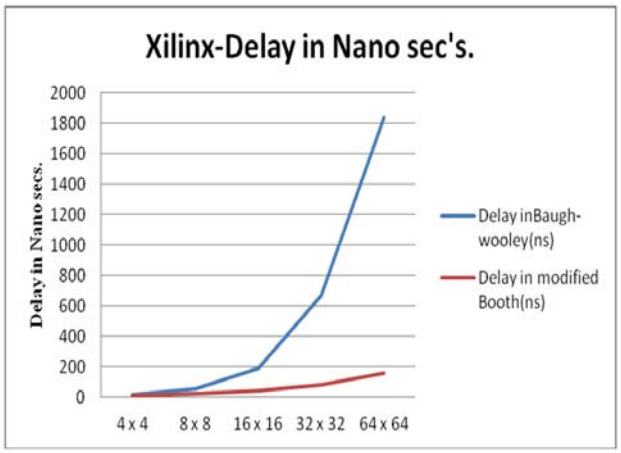
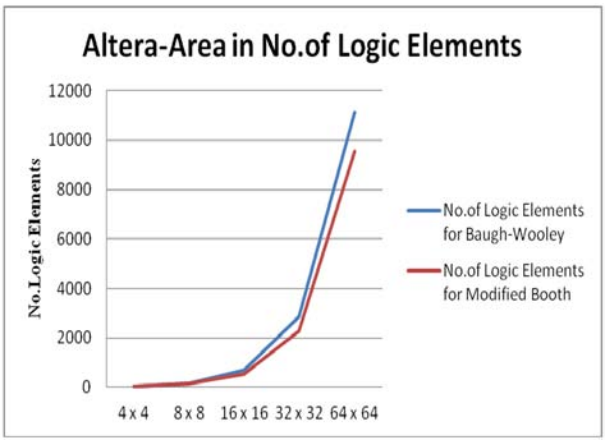


Figure 8



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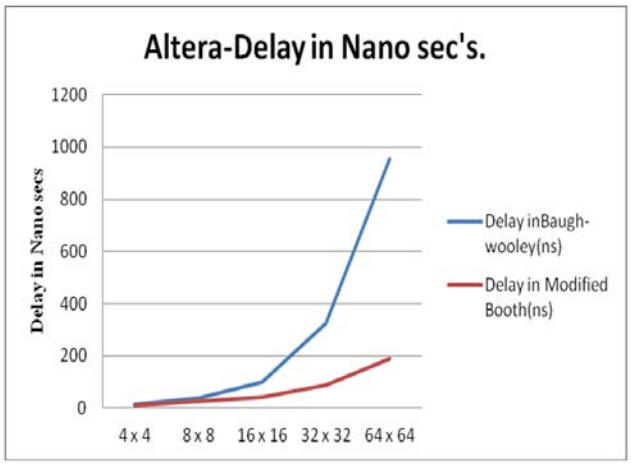

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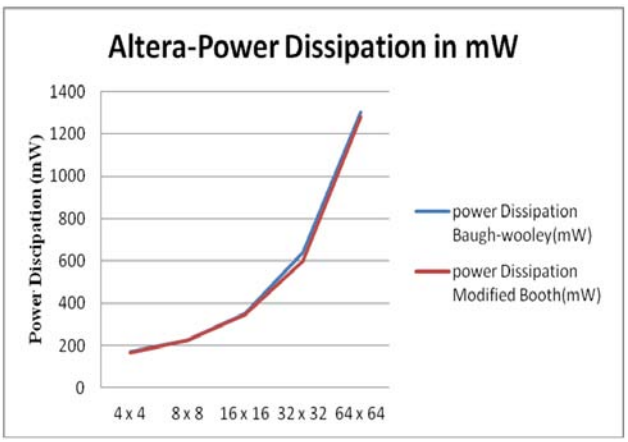

Figure 11

V. Conclusion

Our work has covered analysis of advanced signed multiplier architecture such as Baugh Wooley Multiplier and Modified Booth Encoder (MBE) Multiplier at various strength such as 4 x 4, 8 x 8, 16 x 16, 32 x 32 & 64 x 64 and the Result analysis with various VLSI Parameters like (Delay, Number of Logic Element requirements, Number of Signal Transition for particular sample input and its Power Consumption). As the Multiplier strength grows Area Curve shows a moderate difference while the delay performance of booth compared to that of Baugh wooley is approximately 4 times better(i.e,, for 32 x 32 Baugh wooley needs ~325 ns while booth complete it with ~90 ns). Modified Booth proves great result in all forms of VLSI constraints and works effectively with desired specification needed for highly reliable RNS application and for further optimization Multi-Modulo Residue architecture are advisably wise choice. Thus Signed Booth multiplier performs superior than state of art multiplier and its efficiency can be utilized for further optimization of Multi-Modulo Residue architecture for all modulus in special moduli set.

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Achievement of Maqasid-al-Shari`ah in Islamic Banking: An Evaluation of Islami Bank Bangladesh Limited

By Mohammad Abu Hurayra

Abstract- Shari`ah is the foundation of Islamic banking and also any other form of Islamic organization. The ultimate goal of the Islamic organization is to achieve the Shari`ah objectives, that is, Maqasid-al-Shari'ah. A comprehensive and careful examination of the Shari`ah rulings entails an understanding that Shari`ah aims at protecting and preserving public interests (i. e., Maslahah) in all aspects and segments of life. This study is a noble effort of evaluating the products of Islami Bank Bangladesh Limited (IBBL) to justify how far these products are achieving the Maqasid-al-Shari'ah. The study found that the bank has been achieving the main and upmost (macro) Maqasid-al-Shari`ah, that is, public interest and the prohibition of riba over the last two decades. These two objectives have been achieving from the inception of the bank. However, the minor Maqasid-al-Shari`ah such as freeing from any kinds of debt and other benefits that related to macro-economics of the country is yet to be achieved in Islami Bank Bangladesh Limited.

Keywords: *maqasid-al-shari`ah, islamic banking, IBBL, bangladesh.*

GJCST-A Classification : *D.2.9, J.1*

Strictly as per the compliance and regulations of:

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I. Introduction

Maqasid is the plural form of maqsad, literally it means objective, goal and purpose. Shariah refers to Islamic law. So, maqasid al shariah means the purpose of Islamic ruling or the wisdom behind shariah's command. In general, Maqasid al shariah is the public interest, to achieve justice (Ibn Taimia), to bring benefits of man on earth (al Ghazali), to achieve happiness. ***Mashhad al allaf (2003)***

It is very important to understand maqasid al shariah in every single command of almighty Allah swt. Without realizing the wisdom behind the ruling, no one can apply the shariah verdict with full of satisfaction. ***Monzur-E-Elahi (2012)*** said that the maqasid framework can play an important role in enhancing the Ummah's abilities and qualities of intellectual reform and civilizational renewal. It could become and approach for the orientation of the different activities pertaining to the civilization reawakening of the Ummah. It could form the epistemological and philosophical scaffold for directing the theories, source and objectives of civilizational renewal. It could also constitute the ethical and educational reference for guiding the activities of social and civilizational transformation of the Ummah. Moreover, it could assist in discovering the laws and pattern of civilizational transformation. In all these activities the Maqasidi framework can provide principles, guidelines and methods of discovering and implementation of the objectives of Islam in a real practical context.

Coming back to the Maqasid al shariah in Islamic finance that is not only to prohibit of Riba rather it includes circulation of wealth in the society, the continuity of investment of the wealth, achieving the economic prosperity for the whole society by satisfying the basic needs of the people, transparency in financial activities to eliminate disputes and permissibility of private and public ownership of the wealth. ***Manzur E Elahi (2012).*** Similarly, it also includes realizing how to make people free from any kinds of debt while they have been financed by the bank.

Scholars from previous to present mentioned the general maqasid al islamih such as ***Imam Gazalai, Ibn Taimiah*** and others. Only few of them mentioned Maqasid al shairah related to Islamic financial institutions. But obviously, it is very basic and fundamental. Many of the current scholars discussed about the Maqaqsid al shariah in depth and analyzed the details of the problems. ***Hashim kamali*** and ***Taher al Ashur*** are the key persons in this field. However, no one evaluated any banks or any other financial institutions by mentioning their names and examining their turn over the year. This is the time to select a bank or a group of institutions to examine what exactly was the Maqasid Shariah and what they did over the last period of time. In my study, I found there is no specific research done on any specific bank in Bangladesh. So, I believe this is a new study to find out the implication of Maqasid al Shaiah in Islami Bank Bangladesh Limited and finally, this paper significantly contributes in the literature and creates an opportunity for future researchers.

Hence, in this paper, we attempt to describe the basic understanding of Maqasid al Shairah with relation of Islamic financial institutions. We will also evaluate the function of Islami Bank Bangladesh Limited to find out the Maqasid al shariah in its operations. To discuss our analysis of the literature, the paper is organized as follows: section 2 presents the literature review. Section 3 states the objectives of the study. Maqasid al Shariah and its meaning in financial institutions outlined in section 4. Section 5 evaluates Islami Bank Bangladesh

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Limited. Sections 6 mentioned Finding of the research. Section 7 provides directions to further study and finally section describe conclusion.

II. Maqasid al Shariah

Al Maqasid al-Shari`ah, or the goals and objectives of Islamic law, is evidently an integral aspect of Shariah and the key point of Shariah supervisory board of Islamic Financial Institutions. Generally, the *Shariah is* predicated on the benefits of the individual and that of the community, and its laws are designed to protect these benefits and facilitate improvement and perfection of the conditions of human life on earth. The Qur'an is expressive of this when it mentions the most important purpose of the Prophet hood of Muhammad (peace be on him) in such terms as: "We have not sent you but a mercy to the world" (21: 107). This can also be seen in the Qur'an's characterization of itself in that it is "a healing to the (spiritual) ailment of the hearts, guidance and mercy for the believers" (and mankind) (10: 57) Another example, when Quran prescribes Qasas (retaliation), it speaks of the rationale of it, that applying retaliation prevents further killing *"There is life for you in Qasas*" (2: 179) Similarly, when Quran prohibits wine it says that wine is the works of devil as it causes quarrel and instills hatred and enmity among Muslims "*The devil only wants to excite enmity and hatred between you in intoxicants and gambling and hinder you from remembrance of Allah and from prayer*" (6:91)

Abozaid and asyraf wajdi dusuki mentioned:

Abdulazeem and Dusuki (2007) mentioned Maqasid Al-Shari'ah is the objectives and the rationale of the *Shari'ah*. A comprehensive and careful examination of the *Shari'ah* rulings entails an understanding that *Shari'ah* aims at protecting and preserving public interests (*maslahah*) in all aspects and segments of life.6 Many Shari'ah texts state clearly the reasoning behind certain Shari'ah rulings, suggesting that every ruling in Shari`ah comes with a purpose, which is to benefit the Mukallaf In depth comprehension of the objectives of Shari`ah is important for analogical deduction and other human reasoning and its methodology ***(Kamali 1999)***. Indeed, *Maqasid al-Sharī'ah* allows flexibility, dynamism and creativity in social policy**.** According to Imam Al-Ghazāli (d.1111)

> "*The objective of the Sharī'ah is to promote the well-being of all mankind, which lies in safeguarding their faith (dīn), their human self (nafs), their intellect ('aql), their posterity (nasl) and their wealth (mā). Whatever ensures the safeguard of these five serves public interest and is desirable.*"

Al-Shatibi approves ***al-Ghazali's*** list and sequence, thereby indicating that they are the most preferable in terms of their harmony with the essence of Shari`ah. Generally, Shari'ah is predicated on benefits of the individual and that of the community, and its laws are designed so as to protect these benefits, and facilitate improvement and perfection of human lives' conditions on earth. This perfection corresponds to the purposes of the Hereafter. In other words, each of the worldly purposes (preservation of faith, life, posterity, intellect and wealth) is meant to serve the single religious purpose of the Hereafter.

The uppermost objectives of *Shari`ah* rest within the concept of compassion and guidance that seeks to establish justice, eliminate prejudice and alleviate hardship. It promotes cooperation and mutual supports within the family and society at large. This is manifested in the realisation of *maslahah* (public interest) which the Islamic scholars have generally considered to be the all-pervasive value and objective of the *Shari`ah* and is to all intents and purposes synonymous with compassion. *Maslahah* sometimes connotes the same meaning [i] as *maqasid* and the scholars have used the two terms almost interchangeably.

Accordingly, ***Jasser Auda (2008)*** mentioned that the question of 'why' is equivalent to the question of 'what is maqasid?' and 'levels of why', as philosophers has put it, are the 'levels of maqasid', as Islamic jurists has put it. These levels of why and the exploration of maqasid will take us from the details of simple actions, such as stopping at a red traffic light, to the level of the overall principles and basic beliefs, such as justice, compassion, and the attributes of God. Therefore, maqasid al shariah is the branch of Islamic knowledge that answers all questions of 'why' on various levels, such as following question:

Why is giving zakah one of islam's principle 'pillar?

Why is drinking any amount of alcohol a major sin in Islam?

Why do Muslims greet people with Sallam (peach)?

Maqāid al-sharīah explain the 'wisdoms behind rulings,' such as 'enhancing social cohesion,' which is one of the wisdoms behind charity, being good to one's neighbors, and greeting people with peace. Wisdoms behind rulings also include 'developing consciousness of God,' which is one of the rationales behind regular prayers, fasting, and supplications.

Maqāid are also good ends that the laws aim to achieve by blocking, or opening, certain means. Thus, the maqāid of 'preserving people's minds and souls' explain the total and strict Islamic ban on alcohol and intoxicants, and the maqāid of 'protecting people's property and honour' explain the Quran's mention of a 'death penalty' as a (possible) punishment for rape or armed robbery.

Maqāid are also the group of divine intents and moral concepts upon which the Islamic law is based, such as, justice, human dignity, free will, magnanimity,

facilitation, and social cooperation. Thus, they represent the link between the Islamic law and today's notions of human rights, development, and civility, and could answer some other type of questions, such as:

- What is the best methodology for re-reading the Islamic scripts in light of today's realities?
- What is the Islamic concept of 'freedom' and 'justice'?
- What is the link between today's notions of human rights and Islamic law?
- How can the Islamic law contribute to 'development' and 'civility'?[2]

The scholars have classified the entire range of *masalih*-cum-*maqasid into* three categories in a descending order of importance, beginning with the essential *masâlih,* or *daruriyyat,* followed by the complementary benefits, or *hajiyyat,* and then the embellishment or *tahsiniyyat.* The essential interests are enumerated at five, namely: Faith, Life, Lineage, Intellect and Property.

The second class of the interests, known as *hajiyyat,* or complementary interests, are not an independent category as they also seek the same objective, i.e. to protect and promote the essential interests, albeit in a secondary capacity. These are defined as benefits, which seek to remove severity and hardship that do not pose a threat to the very survival of order and peace.

The third class of *masâlih,* known as *tahsîniyyât,* are in the nature of desirability as they seek to attain refinement and perfection in the customs and conduct of people at all levels of achievement. The *Shariah* thus encourages cleanliness of body and attire for purposes of prayer and recommends, for instance, the wearing of perfume when attending the congregational Friday prayer; contrariwise, it discourages the consumption of raw garlic on that occasion.

III. Maqasid al Shariah in Islamic Finance

What is the main reason (Maqsad) of bringing Islam in financial sector? The answer is to establish Maslaha (Public benefit) in economic activities. 'Islam' in economics means the economy is more developed and enhanced and consequently it establishes justice and protects pubic rights.

Monjur E Elahi (2000) noted that the objectives of the Shari'ah in financial transactions refer to the overall goals and meaning that the Shari'ah aims at achieving from its rulings. These objectives are not confined to one type of financial transaction, but include all aspects of financial activities and human life in general. Though these objectives seem specific as they deal with finance, they can be considered as integral objectives when their universal goals are considered. This is because such objectives do not deal with specific types of rulings, but they are related to almost all types of financial transactions and involve all activities of trading, profit making, spending and consumption. Allah says: *"There is not a moving (living) creature on earth, nor a bird that flies with its two wings, but are communities like you. We have neglected nothing in the Book, then to their Lord they (all) shall be gathered".[Al-Quran, al-An'am 6 : 38]*

Looking deeply and constantly into several texts or verses of the Qur'an and the Sunnah of the Prophet (PBUH) on financial activities, it can be stated that the Shari'ah has observed specific objectives in the enactment of financial laws and principles. These objectives include the circulation of wealth in the society, the continuity of the investment of the wealth, achieving the economic prosperity for the whole society by satisfying the basic needs of the people, transparency in financial activities to eliminate disputes and permissibility of private and public ownership of the wealth. These are the main objectives of Shari'ah in financial transactions and contracts. All the above objectives falls under the general meaning of the following verses of al-Qur'an:

"Allah does not want to place you in difficulty, but He wants to purify you, and to complete His Favour to you that you may be thankful". [Al-Quran, al-Maidah 5 : 6]

Allah also says in another ayah:

"…Allah intends for you ease, and He does not want to make things difficult for you....".[Al-Quran, al-Baqarah 2 : 185]

It is observed that, unfortunately, no serious effort has been made to fix the clear objectives of Islamic banking. What can be seen in many literatures are scanty and disjointed discussions about the objectives of Islamic Banks. It has been taken for granted that Islamic Banks are only about avoiding *riba* (interest). Rather there must be many basic important objectives of Islamic Banking which should be identified and from the theory of *Maqasid al-Shari'ah*, the ideal objectives of Islamic Banking can be identified. And based on those objectives a model of Islamic Banking performance can be developed.

a) Macro and Micro Maqasid-Al-Shari`ah

*Maqsid-al-Shari`ah* can be classified into two which are macro and micro Maqasid-Al-Shari`ah. Though both classes of *Maqasid* are important and needs achieving, but depending on situation one gets priority over another. Macro and Micro *Maqasid-Al-Shari`ah* are described as below:

3. (a) Macro Maqasid: Macro *Maqasid* is the interest or benefits related to the overall well-being and benefit of the economic system, which has always been the prime objective of Islamic economics for long (Al-Mubarak & Osmani, 2010).

3. (b) Micro Maqasid: On the other hand, micro *Maqasid* only relates to specific small cases relating to certain individual financial transactions (Al-Mubarak & Osmani, 2010).

Since, group interest and majority priority over minority and individual interest, certainly, macro *Maqasid* is more important to be concerned and observed than any micro *Maqasid* (Al-Mubarak & Osmani, 2010).

IV. Literature Review

The objectives of the Islamic economic system are derived from the economic objectives of Islam which currently depend on Maqasid al Shari'ah (Sechafia, Kayadibi, Yumusak, and Ates, 2013). *Maqasid al-Shariah* reflects the holistic view of Islam which has to be looked at as a whole not in parts as Islam is a complete and integrated code of life and its goal encompasses the whole life, individual and society; in this world and the hereafter (Dusuki & Abozaid, 2007). Whether we take *maqasid* as referring to the Al-Ghazali's five objectives or Al-Qarafi's six or ibn Taymiyyah's open-ended list or with a further edition by Qaradawi or the latest two edition, as far I know, by Kamali, I say that every Islamic banking product, at the very least satisfies one *maqasid*, may be more (Mohamad, 2014).

Broadly speaking, *Maqasid al-Shari'ah* ensure that Islamic banks (or any financial institution and/or manufacturing/industrial firm) could contribute to the promotion of human welfare, prevent corruption, enhance the social and economic stability (Ibn Ashur, 1945[2006]). Hence, for a proper realization of *Maqasid* al-Shari`ah , Islamic banking and finance must ensure that all transactions comply with Shari`ah; not only in terms of legal technicalities and forms but more importantly in terms of the economic substance of these transactions which is premised on the objectives outline by Shari`ah (Abozaid, Abdulazeem, 2010). Objectives of Islamic Shari'ah not only as a tool for the development within the traditional framework of our legal thought and practice, but within a more extended spectrum of thought that brings the concept of the objectives of Islamic Shari'ah to the overall development as well as the reconstruction of the Muslim thought, personality, culture and civilization (Monzur E Elahi, 2010).

These challenges emerge from the improper understanding of *maqasid* al- Shariah and the *maslahah* and *darura* concepts (Abozaid, Abdulazeem, 2010). Moreover, failure to understand these concepts and their application to modern transactions has led to their abuse, such as using *maqasid* to justify certain contracts which are in fact contradictory to the Shariah texts and principles. Obviously, M*aqasid* al-Sharah have been abused to justify certain financial contracts which in fact contradict the Shariah texts and principles. Surprisingly enough, *maqasid* al-Shariah have been used as a justification for adoption of some *riba* - disguised banking products though observing M*aqasid* al-Shariah must be the first factor to determine their prohibition (Abozaid, Abdulazeem, 2010).

Abozaid, Abdulazeem, (2010) opined that Islamic banks maintain legal and contractual rules but breach Shari`ah objectives because of the following justifications: (a) Realization of *maqasid* al-sharah, which are basically structured on the basis of *maslaha* (public interest), (b) Being in a state of *darura* (necessity), and *darura* may render prohibited things permissible, (c) The flexible stand attributed to some schools of *fiqh* towards transactions such as *bay [al-eina* and *tawarruq]*, which constitutes the basis of some contemporary modes of finance.

V. Maqasid al Shariah in Islami Bank Bangladesh Limited

As we said earlier Maqasid al Shariah is the objective of shariah ruling and in finance it is not only the prohibition of Riba rather it includes circulation of wealth in the society, the continuity of investment of the wealth, achieving the economic prosperity for the whole society by satisfying the basic needs of the people, transparency in financial activities to eliminate disputes and permissibility of private and public ownership of the wealth. In addition to that to have an extra cares to few customers and clients is considered Maqasid al Shariah. Most of the Islami Bank's product designed to comply this last Maqasid and successfully it has been practices over the period of time. Here, we figure out few products to find out how it comply with Maqasid al shariah.

a) Maqasid al Shariah No 01: Maslaha

Maslaha (Arabic مصلحة, 'public interest') is a technical word refers to the general benefit of mass people in Islamic Law. It is invoked to prohibit or permit something on the basis of whether or not it serves the public's benefit or welfare. The concept has a greater meaning while it is related to ' Istislah'. While the meaning of maslaha is 'public interest', the meaning of istislah is 'to seek the best public interest'. *Al Shatibi* is the key person to introduce the concept and generalize the idea in all part of Shariah ruling. Simultaneously, Islami Bank Bangladesh Limited has taken the banking business to provide the financial benefits for all people regardless Muslim or non Muslim. These benefits neither contradict with any other verdict of Shariah nor conflict with public interest. Therefore, the Bank is running its business on the basis of Maqasid al Shariah and rapidly growing its services to provide the maslaha for all.

b) Maqasid al Shariah No 02: Prohibition of Riba

The word "Riba", in Arabic language, literally means an "increment' or addition". In Islamic Fiqh the

term riba has a special meaning. Ahmad mentioned Riba is an unjustified increment in borrowing or lending money, paid in kind or in money above the amount of loan, as a condition imposed by the lender or voluntarily by the borrower. Riba defined in this way is called in Fiqh riba al-duyun (debt usury). Riba also is an unjustified increment gained by the seller or the buyer if they exchanged goods of the same kind in different quantities. This is called "riba al-fadl" or "riba-al-buyu" (trade usury).*Muslim* reported that Abdullah bin Mas`ud (May Allah be pleased with him) narrated: The Messenger of Allah (ﷺ) cursed the one who accepts Ar-Riba (the usury) and the one who pays it.

Prohibition of Riba (interest) is one of the main Maqsad al Shariah of Isami Bank Bangladesh Limited that has been clearly mentioned in its own publication. The special features of IBBL at a glance reported that: 'all activities are conducted on interest fee system in accordance with Islamic shariah principles and investment is made through different modes as per Islamic shariah.' By avoiding all sort of Riba, *IBBL* successfully kept them away from any kind of interest and they completely implemented the Main and major Maqasid al Shariah. It's one of the observations that I have made throughout my Shariah inspections in different branches of the bank.

c) Maqasid al shariah in deposit schemes

Since savings play an important role in capital formation, income-generation and creation of employment opportunities and contribute towards the increase in wealth of the individual and nation through profitable investment, Islami Bank Bangladesh Limited, has therefore, introduced the savings deposit accounts namely Mudaraba Account. According to the IBBL's website, the bank has currently 14 products on deposit scheme. All of their accounts have been achieved maqasid al shariah especially, few of them that exclusively designed to meet the criteria of Maqasid al shariah. Mudaraba Waqf Cash Deposit Account (MWCDA), Mudaraba Hajj Saving Account (MHSA), Mudaraba Muhor Saving Account (MMSA), The details are as follows:

i. *Mudaraba WAQF Cash Deposit Account (MWCDA)*

The core intention to introduce this product is Maslaha (Public Benefit). IBBL from its very beginning launched this Khidmah for the mass people of the country. The inspiration from the hadith that The Messenger of Allah (ﷺ) said, "When a man dies, his deeds come to an end, except for three: A continuous charity, knowledge by which people derive benefit, pious son who prays for him. The idea of Cash waqf is to provide a unique opportunity for making investment in different religious, educational and social services. Savings made from earnings for the purpose of Waqf by the well-off and the rich people of the society can be mobilized through this scheme and the income generated can be spent for different benevolent purposes. Through this scheme people may contribute to popularize the role of Waqf in the country including cash Waqf which can be instrumental in transferring savings from the rich to the members of the public by way of financing in Bangladesh.

In my observation, I found the main and ultimate Maqsad of Islamic Banking is Maslaha or public benefit that has been implemented in this product. Even though it's not a popular product, IBBL is paying the highest rate (10.00%) of profit in this account.

ii. *Mudarabah Hajj Saving Account*

The main purpose of creating this product is not to make money rather to help the people who wish to perform Hajj. Hajj is one of the fundamental worship (Ibadah) of Islam and because of the prevailing socio-economic situation in the country, many people interested to perform Hajj cannot arrange the required amount of money to perform this great Ibadah. Financial solvency and physical fitness are the pre-requisites of performing Hajj. Majority of the people, however, reach the fag end of their life in arranging the required amount of money for Hajj. Islami Bank Bangladesh Limited has, therefore, introduced 'Hajj Savings Scheme' so that people eager to perform holy Hajj may build-up savings through 'Mudaraba Hajj Savings Account'. Moreover, due to the pure intention of helping Hajj going people, IBBL provides second highest rate (9.50% from 11 to 25 years Terms and 9.10% from 1 year to 10 years Term) of profit in this account. Personally, I believe it is nothing but to fulfill the Maqasid al Shariah.

iii. *Mudaraba Muhor Saving Account*

Muhor is wealth, which a husband has to pay his wife, upon marriage. As per Islamic Shariah, it is compulsory for husband to pay this to his wife. But there are a good number of married men from all walks of life in our society who did not pay the total Muhor promised to their wives. Many of them are not aware about the necessity of payment of the deferred amount of Muhor, hence the wives have been remaining deprived of their fundamental right of Muhor. The wives are to forgive even the claim of the same. Although some of them are aware about the importance they are not able to attain the said amount as they don't get the opportunity to do so. This scheme, 'Mudaraba Muhor' has been designed for all classes of married people particularly the professionals & service holders, creating an opportunity for them to save in monthly installments according to their capability for rectifying their marriage life and to protect the human right of the women. The main objective of this product is to help the people understand and provide the awareness about Muhor, a basic Islamic principle and to help the women to protect their basic rights determined by Allah swt. According to

the latest Head Office Circular, the fourth highest rate (9.10% for 10 years Term and 8.00% for 5 years Term) has been given to this account after Mudaraba Special Savings (Pension) (9.10% for 10 years Term and 8.00% for 5 Years Term)

iv. *Maqasid al shariah in Investment*

Two other products in investment scheme that have been introduced due to meet the Maqasid al Shariah. Firstly, Rural Development Scheme (RDS) and Micro Enterprise (SME).

Firstly, Islami Bank Bangladesh Limited was founded with the major objective of establishing Islamic economy for balanced economic growth by ensuring reduction of rural-urban disparity and equitable distribution of income. In view of the above, Branches of the Bank have been encouraged to invest their deposits in their respective areas and in particular for the economic uplift of the rural people. Accordingly, a scheme in the name and style of 'Rural Development Scheme' (RDS) has been introduced in 1995 to cater to the investment needs of the agricultural and rural sector , to create a opportunity for generating employment and raising income of the rural people with a view to alleviate poverty. To be honest, the main objective to offer this product and service is to meet the Maqasis al shariah of circulation of wealth in the society, the continuity of investment of the wealth, achieving the economic prosperity for the whole society by satisfying the basic needs of the people, transparency in financial activities to eliminate disputes and permissibility of private and public ownership of the wealth.

Secondly, Islami Bank Bangladesh Limited is a multi-product financial institution operating on Islamic Shariah offering a broad spectrum of financial assistance to institutional and individual client through all its branches. Since its inception, it has introduced several investment schemes to cater to the needs of SMEs keeping in view the needs of different sectors and various sections of people for their socio-economic uplift and to improve their quality of life.

d) Special features of IBBL to implement Maqasid al Shariah

Over the last few years I witnessed the special features of Islami Bank Bangladesh Limited for its long run profitability. It's true that the bank has a dedicated manpower and it's the main wealth of the company. Moreover, it has a strong group of employees who are solely dedicated for Islamic banking. They are very strict to follow the country rules and regulation along with Shariah laws. Meanwhile, the bank organizes the multiple programs for public and special shariah awareness course for its employees.

e) Dedicated manpower to implement Shariah

IBBL has a dedicated manpower to devote all their time to implement and build awareness of Islamic finance in Bangladesh. At IBBL, recruitments are not based on purely on merit or skill rather on Shariah leadership qualities and the hunger to achieve the possible Maqasid al Shariah in Islamic Finance throughout the country. It gives me great pleasure in informing people that many officials at IBBL are very dedicated and strive hard to achieve Maqasid al Shariah in their day to day activities. This enthusiasm has refrained them from joining other banks which are giving them better opportunities to grow with worldly pleasure or entertainment.

f) Special Shariah awareness programs

IBBL is the only bank in Bangladesh who is seriously committed to comply with Shariah rules in all its banking transactions. To ensure Shariah compliance in the entire business, the parties related to the bank need to be educated about Shariah transactions. To educate these investment clients, the bank randomly arranges gatherings and seminars to bring awareness among the people. These programs are conducted every year, either once or two times depending on the availability of Shariah experts. These events provide a platform for Shariah experts to give their views, ideas and share their knowledge and experience with crowd. It is also provides a meaningful platform for the crowd to discuss their issues and obstacles that they come across while implementing these rules and regulations.

g) Findings and conclusion

- People are in debt while they are buying any product from Islami Bank.
- Murabah products are popular compared to Musharaka products.
- Public are not interested to share their profits with bank.

It's good enough to mention that Islami Bank Bangladesh Limited (IBBL) is highly committed to Shariah Board and to follow exactly what Shariah Board advices time to time. With the interview of Shariah Board Members and officers of the bank, I found the management including all of its share holders, officers and all stake holders are also serious to ensure this commitment in every single point of its business operation. The reason of their seriousness is they came to this field to establish 'Islam' in this economic sector not to do business in the name of Islam. Over the last two decades, IBBL is sincerely resolved the quality of Shariah compliance and at a time Islami Bank Bangladesh Limited has shown its interest to implement Maqasid al Shariah in its banking operation. In fact, there are various local problems to achieve Maqasid al Shariah in its all business transaction due to the long time conventional practice has an effective effort on mass people, lack of legal support, Islam phobia in Bangladesh and dishonesty of people. Ironically, Islami

Bank has succeed to comply Maqasid al Shariah comparing with other Shariah based Islamic banks in Bangladesh and in near future they will be able to comply Maqasid al Shariah successfully insa Allah.

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A New View at Usability Test Methods of Interfaces for Human Computer Interaction

By Najmeh Ghasemifard, Mahboubeh Shamsi, Abol Reza Rasouli Kenar & Vahid Ahmadi
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Abstract- As a basic and important term in the interaction design, usability is an overall rating of the degree of use in the human computer interaction, which guarantees the realization of interaction. Usability test is a necessary process in the human computer interface design. It is a process of through systematically collecting the usability data of interface and assessing and improving the data. Designers can enhance the usability through testing and improving the present interface; designers can also evaluate the usability of the present interface, borrowing its strongpoint, improving its shortcomings, and applying in the new design.Conducting sufficient usability test requires planning and attention to the evaluation details.In common, usability test methods for software take into considerations, planning usability questions, selecting a representative sample and recruiting participant s, and preparing the test materials and actualtest environment.In order to make a way to select an appropriate method to perform a usability test, this paper has introduced the usability test methods in the human computer interface design, then analyzed and summarized the methods and finally state of the art taxonomy is presented.

Keywords: *human computer interaction, usability, test, method, user experience, user interface.*

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I. Introduction

Usability test is a necessary process in the human computer interface design. It is a process of through systematically collecting the usability data of interface and assessing and improving the data. Designers can enhance the usability through testing and improving the present interface; designers can also evaluate the usability of the present interface, borrowing its strongpoint, improving its shortcomings, and applying in the new design. By doing this, the design of the interface can achieve its usability goal more effectively, reduce the learning time of users, and improve the using efficiency and satisfaction. On the other hand, usability test can also help designers highlight the interface characteristics of the product, reduce the expenditure of development and support, and boost its market competitiveness [1].One of the factors that affect the acceptability of software is its usability. Smith & Mayes [2] state that "usability is now recognized as a vital determining factor in the success of any new computer system or computer-based service."

Human computer interface is a medium in the communication, a platform in the flow of information and feedbacks, and a way to interact between human and computer. Human computer interface is also called user interface. A good design of user interface can make the communication more effective, more easily and less mistaking guidance for users. User interface should meet different kinds of proper needs of various users, so the usability research of interface design has become particularly important. As a basic and important term in the interaction design, usability is an overall rating of the degree of use in the human computer interaction, which guarantees the realization of interaction. It is also a quality term from the point of users to evaluate whether the product is effective, easy to learn, safe, efficient, easy to remember and few mistakes or not. Besides, it also needs to consider the expectation and experience of users, which should bring some larruping and unexpected feelings to users [4].

The primary goal of usability is to have products developed to maximize the users' ease of use.International Standards Organization in the ISO 9241-11 Guidance of Usability defined usability as "[t]he extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use." Jakob Nielsen, in his online column of August 2003, further defined usability by five quality components.

The first problem that should be solved is the cognition of users in the usability design of human computer interface. First of all, users must know and understand the interface, and then they can use it. However, how to know the interface depends on how the interface expresses its functions to users. Designers should solve the express of functions by adding less formats and actions, and intentionally design the interface on the basis of goal. Users must clearly understand what the input language needs, which requires approaches to realize functions concisely, and what the output language expresses, which needs understandable and proper feedback channels[5].

This paper first look into the give an introduction to usability, then usability testing is discussed in detail. The various methods of usability testing is examined in order to investigate the usability of human-computer interaction interfaces. Evaluation of methods and finally identifying the strengths and weaknesses of the methods is the objectives of this research.

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II. Usability

Human-Computer-Interaction (HCI) is the area where usability emerged. Several books or papers about HCI present a definition or characterization of usability. For instance, Hix&Hartson[6] consider that usability is related to the interface efficacy and efficiency and to user reaction to the interface. Nielsen [7] [8] integrates usability as one of the parameters associated with system acceptability. He associates five attributes to usability: easy to learn, efficient to use, easy to remember, few errors (the prevention of catastrophic errors is relevant for applications such as process control or medical applications), and pleasant to use.

Shackel [9] refers to four aspects of interest in usability testing: learnability (easy of learn), throughout, flexibility, and attitude. Rubin [10]accepts that usability includes one or more of the four factors outlined by Booth [11]: usefulness, effectiveness (ease of use), learnability, and attitude (likeability). For Smith and Mayes [2] usability focuses on three aspects: easy to learn, easy to use and user satisfaction in using the system.In international standards, usability refers to effectiveness and efficiency to achieve specified goals and users satisfaction. "Usability:the extent to which a product can be used by specified users to achieve a specified goals with effectiveness, efficiency and satisfaction in a specified context of use" (ISO/DIS 9241-11; European Usability Support Centres).Based on these opinions about usability we may conclude that there are two broad areas to collect relevant data: system and user performance (efficacy, efficiency, easiness to learn and easiness to use) and user satisfaction in using it.

The primary goal of usability is to have products developed to maximize the users' ease of use. International Standards Organization in the ISO 9241-11 Guidance of Usability defined usability as "[t]he extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use."Jakob Nielsen, in his online column of August 2003, further defined usability by five quality components:

1. Learnability: How easy is it for a user to complete a basic task at their first use of a system?
2. Efficiency: How quickly can a user familiar with the system perform tasks?
3. Memorability: How easy is it for a returned user to reestablish proficiency regarding the system?
4. Errors: How many errors does a user make using the system? How severe are the mistakes, and how difficult or easy is it to recover from the mistakes?
5. Satisfaction: How satisfactory is it to use the product?

III. Usability Test

Usability testing, the process by which products are tested by those who will use them, is intended to help product developers – including information product developers – create, modify, or improve products to better meet the needs of actual or intended users to make those products user-friendly [12].According to Dumas &Redish [13], authors of A Practical Guide to Usability Testing, usability testing helps product developers determine whether "the people who use the product can do so quickly and easily to accomplish their own tasks".

Usability tests identify areas where people struggle with a product and help you make recommendations for improvement. The goal is to better understand how real users interact with your product and to improve the product based on the results. The primary purpose of a usability test is to improve a design. In a typical usability test, real users try to accomplish typical goals, or tasks, with a product under controlled conditions. Researchers, stakeholders, and development team members watch, listen, collect data, and take notes.Since usability testing employs real customers accomplishing real tasks, it can provide objective performance data, such as time on task, error-rate, and task success. There is also no substitute for watching users struggle with or have great success in completing a task when using a product. This observation helps designers and developers gain empathy with users, and help them think of alternative designs that better support tasks and workflow [14].

Usability evaluations (UE) consist of methodologies for measuring the usability aspects of a system's user interface (UI) and identifying specific problems.They are an important part of the overall user interface design process, which consists of iterative cycles of designing, prototyping, and evaluating. According to Preece [15], evaluation is concerned with gathering data about the usability of a design or product by a specified group of users for a particular activity within a specified environment or work context. Ivory and Hearst [17] suggested that the main activities involved in an evaluation include:

- Capture: Collecting usability data, such as task completion time, errors, guideline violations and subjective ratings;
- Analysis: interpreting usability data to identify usability problems in the interface;
- Critique: suggest solutions or improvements to mitigate problems.

Usability test is a necessary process in the human computer interface design. It is a process of through systematically collecting the usability data of interface and assessing and improving the data. Designers can enhance the usability through testing and

improving the present interface; designers can also evaluate the usability of the present interface, borrowing its strongpoint, improving its shortcomings, and applying in the new design. By doing this, the design of the interface can achieve its usability goal more effectively, reduce the learning time of users, and improve the using efficiency and satisfaction. On the other hand, usability test can also help designers highlight the interface characteristics of the product, reduce the expenditure of development and support, and boost its market competitiveness [1].

IV. Usability Test Methods

In this section, we present countermeasure methods that have been proposed for Usability testing. A comparison and critical discussion on the proposed ideas will be detailed in section 6.

a) Heuristic evaluation Method

Heuristic evaluation is an informal system inspection method where a small group of evaluators are presented with an interface design and asked to judge whether each of its elements follows a set of established usability principles [18]. The method is intended to be a "discount usability engineering" method [18] that provides a way to do a usability evaluation more quickly, and with less cost. Because of its "discount" nature, heuristic evaluation was found to be the most commonly used UEM in a survey to the practitioners [19].Heuristic evaluation can be performed by experts and non-experts. It is difficult to do a heuristic evaluation with a single evaluator; it is near impossible for one person to find all usability problems. Yet it has been shown that when there are multiple evaluators, each were able to find different usability problems, thus the effectiveness of the problem can be improved by having a group of evaluators. Usually, 4 or 5 evaluators are able to report near 70% of the usability problems; additional evaluators often are not able find much more additional problems [20] [18].The main advantage of heuristic evaluation is its ability to be done in a short period of time with limited resources. The method is also very flexible and does not require advanced planning; it could be carried out as soon as the group of evaluators is assembled and that there is a product or a prototype to evaluate. Heuristic evaluation has also proved to be highly effective in finding usability problems[21] [22]. However, there are also several drawbacks. The effectiveness depends largely on the evaluators' skill and experience. Though non-experts are able to perform the evaluation as well as experts, it is very likely that they would not be able to find as many usability problems as the experts. A "bad" evaluator is also more likely to miss the problems that a better evaluator did not pick up, thus lowering the aggregated count of problems found [18].The flexibility given to the evaluators, allowing them to inspect the system anyway they want also means a lack of support and structure to the inspection process [23]. When the evaluators are not well informed about the product domain, the inspection may be not as effective.

b) Cognitive walkthrough Method

Cognitive walkthrough [24] [25] [26] is a theoretically structured usability evaluation process that focuses on a user's cognitive activities, especially while performing a task. It can be carried out by individuals or groups, software developers or usability specialists, and on finished products or paper prototypes. Based on a theory of exploratory learning and corresponding interface design guidelines, cognitive walkthrough is a task-based methodology that centers an evaluator's attention on the user's goals and actions during a task, and on whether the system design supportsor hinders the effective accomplishment of those goals. Moreover, it is a form-based evaluation methodology in which relies on a set of forms to guide the evaluation process. The theory behind the method describes human-computer interaction in four steps: the user sets a goal to be accomplished with the system, the user searches the interface for action options, the user selects the action that seems to make progress towards the goal, and finally the user performs the action and evaluates the system feedback [27].

Cognitive walkthrough has shown to be an effective UEM [24].It also provided an option for evaluating a system in early development with relatively lower cost. But the details of the procedure created difficulties in its execution. The walkthrough methodology presupposes knowledge of cognitive science terms, concepts, and skills from the evaluators [25]. A lack of familiarity with the terminologies in the form, such as the definitions of goal and action, could lead to misunderstandings and affect the outcome. At least one evaluator needs to be familiar with the concepts of the cognitive walkthrough theory, and the cognitive science terminologies used during the process in order for the walkthrough to be effective. Lewis et al. [24] conducted cognitive walkthrough with four evaluators, three of which have deep understandings of the core principles of the theory. Throughout the walkthrough, there was a high level of agreement among the three evaluators, but less with the fourth. The fourth evaluator also found fewer errors that the other evaluators [27].

c) Scenario-based Method

Scenario-based methods is the description of people using technology and it is essential in discussing and analyzing how the technology is (or could be) used to reshape their activities. A scenario describes a sequence of events when interacting with a system from the users' perspective and the scenario descriptions can be created before a system is built and its impacts felt. 'Scenarios' are similar to 'Use Cases', which describe

interactions at a technical level, but scenarios can be easily understood by anyone regardless of the level of their technical knowledge. Scenarios are especially useful when you need to remove the focus from the technology in order to consider other design possibilities. Scenarios focus in terms of tasks rather than the technology used to support them. E.g. "User enters his pin" is incorrect because it mentions the technology used, whereas "User identifies himself" is okay because it keeps open other alternatives [28].

d) Remote Testing Usability Method

Most of the time, usability evaluations are conduct dinausability laboratory. People that were recruited are invited to come to the test facilities consisting of a test room, where the participants will accomplish specific tasks, an observation room and the "recording" room. A usability laboratory may contain complex and sophisticated audio/visual recordings and analysis facilities. In this context, test sessions are conducted individually. Although this situation has advantages it also has drawbacks, as we will see. Remote usability evaluation refers to a situation in which the evaluators and the test participants are not in the same roomor location. Two approaches to remote usability evaluation have been developed: synchronous and asynchronous. Each approach uses specific tools. In the synchronous approach, a facilitator and the evaluators collect the data and manage the evaluation session in real time with a participant who is remote (the participant may be at home, at work or in another room). The evaluation may require video conferencing applications or remote applications sharing tools that allow to share computer screens so as to allow the evaluator to see what is happening on the user's screen. Incontrast, with a synchronous methods, observers do not have access to the data in real time, and there is no facilitator interacting with the user during data collection. Asynchronous methods also include auto mated approaches, where by users' click streams are collected automatically (e.g., Web Quilt). The key advantage this technique offers is that many more test users can participate (in parallel), with little or no incremental cost per participant. For conducting these asynchronous tests, different strategies have been proposed. One strategy is to ask test participants to download and use an instrumented browser that will capture the users' click streams as well as screen shots, and transmit those data to the evaluator's host site for analysis (an example of this kind of browser is Ergo Browser, http://www.ergolabs.com/resources.htm).Anotherapproa ch consists in using a proxy. The test participants are invited to go to a specific Website and then to follow instructions. They are then brought to the Website under evaluation. The users' behaviors are captured, aggregated and visualized to show the web pages people explored. The visualization also shows the most common paths taken through the website for a given task, as well as the optimal path for that task as implemented by the designer [29].An example of this kind of approach is Web Quilt[30] and the work by Atterer, Wnukand Schmidt [31].

The asynchronous approach does not allow for observational data and recordings of spontaneous verbalizations during the remote test sessions. The qualitative data can only be recorded through post-test questionnaires or self-report forms. However, the asynchronous approach allows the recording of large groups of users as we said. The synchronous approach is favored by some authors [32] because it is analogous to laboratory testing and because it allows the capture of qualitative data. Incomparison to the laboratory user test, the synchronous remote testing is cost effective, especially for travel expenses when participants are recruited in different region in a given country. However, the costs associated with this approach may in some cases be quite similar to those of the laboratory testing (for the recruitment for instance). Two other reasons for preferring the remote synchronous approach to traditional user testing is the freedom from facilities (especially when the product or software can be distributed electronically or when testing a Website) and time saving. However synchronous remote testing can be perceived as more intrusive than traditional laboratory user testing [29].

e) User-based Testing Method

User-based evaluations are usability evaluation methods in which users directly participate. Users are invited to do typical tasks with a product, or simply asked to explore it freely, while their behaviors are observed and recorded in order to identify design flaws that cause user errors or difficulties. During these observations, the time required to complete a task, task-completion rates, and number and types of errors, are recorded. Once design flaws have been identified, design recommendations are proposed to improve the ergonomic quality of the product [29]. User testing is centered on the feedback of users interacting with a particular interface and is "usually conducted in a scenario-based environment" [33]. User testing is good at "assessing the system in action, at identifying problems users experience while performing real tasks" [34]. Also, internal issues can be detected quickly and potential problems can be fixed before the product ever reaches the market. User testing on the other hand is not 100% representative of the target population. The method is qualitative and therefore does not provide large samples of feedback. User testing on the other hand revealed more detail level problems of the interface because it required the users to enact the system at the task level. Despite the fact that user testing identified fewer problems,most were directly related to the true performance and/or user acceptance

of the interface. In addition, it is assumed that user testing is time consuming [35].

f) Focus group method

A focus group is a meeting of about six to nine users wherein users discuss issues relating to the system. The evaluator plays the role of the moderator (i.e., asks about pre-determined issues) and gathers the needed information from the discussion. This is valuable for improving the usability of future releases. This method is a technique used to study human-computer interaction and human factors [36]. A traditional focus group is done by inviting a small group of end users in to talk about a product. The discussion is presided over by an experienced moderator, and held in a room with a one-way observation mirror. The moderator takes notes of the happenings, leads the conversation into interesting tangents, encourages comments, prevents the discussion to be dominated by few of the participants, and all the while avoid having any effects on the session's outcome. Some practitioners believe that with well planning, proper guidelines and a good moderator, focus groups can gather valuable usability data.They believe that though it is not suited for comparative, competitive, or bench-marking studies, focus groups can be used to generate ideas, capture and validate user roles as well as tasks and workflows, and validate high level strategy. However, there are also some major drawbacks that led many practitioners to question its validity in gathering useful user data[27].Rauch [37] stated that "… the quality of the data obtained from usability focus groups is only as good as the quality of the participant selection and the questions asked."

g) Contextual inquiry method

Raven and Flanders [38] defines contextual inquiry as "a qualitative data-gathering and data-analysis methodology adapted from the fields of psychology, anthropology, and sociology." It is a field research method wherein usability evaluators go to the users' workplaces, observes them at work, and asks questions regarding to the work content, process, or product usage. Several evaluators may observe different users at the same time. The data is gathered, compared and shared among product development team members after the observation [27]. It provides product designers an understanding of user work and usability; and further suggests generic principles of usability and work concepts that might become the initial frame work of new products [39].It is a structured field interviewing method, Contextual inquiry is based on three core principles: 1) understanding the context in which a product is used (the work being performed) is essential for elegant design, 2) that the user is a partner in the design process, 3) that the usability design processes, including assessment methods like contextual inquiry and usability testing, must have a focus. Contextual inquiry may take hours to months or even years to complete; it is a significant time investment to ask for and it is best used in the early stages of development to help develop product design guidelines [40].

h) Model-based evaluation method

Model-based evaluation methods can predict measures such as the time to complete a task or the difficulty of learning to use an interface. Some models have the potential advantage that they can be used without the need for any prototype to be developed. Models and simulations uses to evaluation when models can be constructed economically and user testing is not practical. However, setting up a model currently usually requires considerable effort, so model-based methods are cost effective in situations where other methods are impracticable, or the information provided by the model is a cost-effective means of managing particular risks [41].

V. Evaluation Criteria for Usability Testing Methods

Usability testing evaluation criteria will be described in this section. The criteria listed below are most common criteria that discussed in articles and researches with considering all usability test aspect.

High Velocity: The time which takes to complete a task done.

Low Cost: Costs required for testing (Building and maintenance of laboratory, equipment, the cost of users, costs related to the location and time that employees spend for meetings).

Flexibility: The ability of the method to handle the limitation in the use of a special tool or framework and change in it.

Resource Requirements: In usability test terminology, resources are required to carry out the test tasks. They can be people, equipment, facilities, funding, or anything else capable of definition required for the completion of test activities.

How Many to Test: The number of participants who work with products. Each test methods requires different numbers of users, managers, observers, evaluator or scenario that the exact number of people required to perform each test is still not completely understood.

Test Type: Two main approaches to consider the usability of the system are: Experimental and Analytical. The experimental procedure consists of testing systems with users while the analytical method includes the systems evaluation by using the created theories and methods.

Impact of evaluators experience on test results: In the some methods for usability testing groupthink, evaluators experience and expertise, view of observers and other people involved in the testing process will affect the test results.

Level of found problems: A usability problem is an aspect of the system and/ or a demand on the user which makes it unpleasant, inefficient, onerous or impossible for the user to achieve their goals in typical usage situations. In this paper usability problems categorize to two level: major and minor.

Method purpose: The method purpose parameter specifies the basic building blocks of the discussed methods for usability test. The method purpose parameter is included to identify the evaluation requirements of the discussed us ability test methods.

VI. Evaluation and Discussion

All the methods discussed under the category of usability testing methods have been presented in Table 1 chronologically. Each method has been evaluated with reference to evaluation criteria discussed in Section 5.

Table 1 : Comparison of evaluated Usability testing methods.

	High Velocity	Low Cost	Flexibility	Resource Requirements	How Many to Test	Test Type	Impact of evaluators experience on test results	Level of found problems	Method purpose
Heuristic evaluation Method	Yes	Yes	Yes	Low	3-5 Evaluator	Experimental	The more experienced evaluators, find problems more and better	Major	Provide expert feedback on user interfaces
Cognitive walkthrough Method	No	Yes	No	Medium	4 Evaluator	Analytical	If the evaluators are not familiar with specific concepts and principles of method, test is not conducted well	Minor	Check structure and countercurrent flow of user goals
Scenario-based Method	Yes	Yes	No	Medium	3-4 Scenario	Analytical	-	Minor	Requirements description and conceptual design support
Remote Testing Usability Method	Yes	Yes	Yes	Medium	-	Experimental	-	-	-
User-based Testing Method	No	No	Yes	High	8 User	Experimental		Minor	Measuring usability and interaction problems
Focus group method	Yes	Yes	Yes	Low	1 Manager, 6-4 User	Experimental	Sometimes groupthink prevents proper testing	Minor	Extraction requirements / user views through discussion
Contextual inquiry method	No	No	Yes	Medium	-	Experimental	High	Minor	Provide information about the user's field
Model-based evaluation method	Yes	No	No	-	-	Analytical	-	-	Find learning problems in using the interface

VII. Conclusion

The usability design of human computer interface determines the market prospect of the product. Designers should be guided by the natural and human idea, also designers should optimize the use and operation of interface from many different areas, such as design, ergonomics, cognitive psychology, linguistics and semiotic, ultimately achieve the ideal goal of improving the usability of products.Usability evaluation is occupying a central part of software development based on the results extracted from quantitative and qualitative evaluations.This paper introduced and compared the some methods for conducting usability testing which most widely used in human-computer interaction user interfaces.The slandered evaluation criteria related with usability was addressed in this paper based on the previous researches. Based on the data collected, it was found that each method has unique advantages and limitations.According to the investigated research in this paper, none of these methods none of these methods is superior over others. In fact, the degree to which each of usability testing methods identify problems in the system depends on a number of factors and levels of complexity.

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(d) An Introduction, giving necessary background excluding subheadings; objectives must be clearly declared.

(e) Resources and techniques with sufficient complete experimental details (wherever possible by reference) to permit repetition; sources of information must be given and numerical methods must be specified by reference, unless non-standard.

(f) Results should be presented concisely, by well-designed tables and/or figures; the same data may not be used in both; suitable statistical data should be given. All data must be obtained with attention to numerical detail in the planning stage. As reproduced design has been recognized to be important to experiments for a considerable time, the Editor has decided that any paper that appears not to have adequate numerical treatments of the data will be returned un-refereed;

(g) Discussion should cover the implications and consequences, not just recapitulating the results; conclusions should be summarizing.

(h) Brief Acknowledgements.

(i) References in the proper form.

Authors should very cautiously consider the preparation of papers to ensure that they communicate efficiently. Papers are much more likely to be accepted, if they are cautiously designed and laid out, contain few or no errors, are summarizing, and be conventional to the approach and instructions. They will in addition, be published with much less delays than those that require much technical and editorial correction.

The Editorial Board reserves the right to make literary corrections and to make suggestions to improve briefness.

It is vital, that authors take care in submitting a manuscript that is written in simple language and adheres to published guidelines.

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Language: The language of publication is UK English. Authors, for whom English is a second language, must have their manuscript efficiently edited by an English-speaking person before submission to make sure that, the English is of high excellence. It is preferable, that manuscripts should be professionally edited.

Standard Usage, Abbreviations, and Units: Spelling and hyphenation should be conventional to The Concise Oxford English Dictionary. Statistics and measurements should at all times be given in figures, e.g. 16 min, except for when the number begins a sentence. When the number does not refer to a unit of measurement it should be spelt in full unless, it is 160 or greater.

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Key Words

A major linchpin in research work for the writing research paper is the keyword search, which one will employ to find both library and Internet resources.

One must be persistent and creative in using keywords. An effective keyword search requires a strategy and planning a list of possible keywords and phrases to try.

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- One should start brainstorming lists of possible keywords before even begin searching. Think about the most important concepts related to research work. Ask, "What words would a source have to include to be truly valuable in research paper?" Then consider synonyms for the important words.
- It may take the discovery of only one relevant paper to let steer in the right keyword direction because in most databases, the keywords under which a research paper is abstracted are listed with the paper.
- One should avoid outdated words.

Keywords are the key that opens a door to research work sources. Keyword searching is an art in which researcher's skills are bound to improve with experience and time.

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References

References follow the Harvard scheme of referencing. References in the text should cite the authors' names followed by the time of their publication, unless there are three or more authors when simply the first author's name is quoted followed by et al. unpublished work has to only be cited where necessary, and only in the text. Copies of references in press in other journals have to be supplied with submitted typescripts. It is necessary that all citations and references be carefully checked before submission, as mistakes or omissions will cause delays.

References to information on the World Wide Web can be given, but only if the information is available without charge to readers on an official site. Wikipedia and Similar websites are not allowed where anyone can change the information. Authors will be asked to make available electronic copies of the cited information for inclusion on the Global Journals Inc. (US) homepage at the judgment of the Editorial Board.

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21. Arrangement of information: Each section of the main body should start with an opening sentence and there should be a changeover at the end of the section. Give only valid and powerful arguments to your topic. You may also maintain your arguments with records.

22. Never start in last minute: Always start at right time and give enough time to research work. Leaving everything to the last minute will degrade your paper and spoil your work.

23. Multitasking in research is not good: Doing several things at the same time proves bad habit in case of research activity. Research is an area, where everything has a particular time slot. Divide your research work in parts and do particular part in particular time slot.

24. Never copy others' work: Never copy others' work and give it your name because if evaluator has seen it anywhere you will be in trouble.

25. Take proper rest and food: No matter how many hours you spend for your research activity, if you are not taking care of your health then all your efforts will be in vain. For a quality research, study is must, and this can be done by taking proper rest and food.

26. Go for seminars: Attend seminars if the topic is relevant to your research area. Utilize all your resources.

27. Refresh your mind after intervals: Try to give rest to your mind by listening to soft music or by sleeping in intervals. This will also improve your memory.

28. Make colleagues: Always try to make colleagues. No matter how sharper or intelligent you are, if you make colleagues you can have several ideas, which will be helpful for your research.

29. Think technically: Always think technically. If anything happens, then search its reasons, its benefits, and demerits.

30. Think and then print: When you will go to print your paper, notice that tables are not be split, headings are not detached from their descriptions, and page sequence is maintained.

31. Adding unnecessary information: Do not add unnecessary information, like, I have used MS Excel to draw graph. Do not add irrelevant and inappropriate material. These all will create superfluous. Foreign terminology and phrases are not apropos. One should NEVER take a broad view. Analogy in script is like feathers on a snake. Not at all use a large word when a very small one would be sufficient. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Amplification is a billion times of inferior quality than sarcasm.

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33. Report concluded results: Use concluded results. From raw data, filter the results and then conclude your studies based on measurements and observations taken. Significant figures and appropriate number of decimal places should be used. Parenthetical remarks are prohibitive. Proofread carefully at final stage. In the end give outline to your arguments. Spot out perspectives of further study of this subject. Justify your conclusion by at the bottom of them with sufficient justifications and examples.

34. After conclusion: Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium though which your research is going to be in print to the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects in your research.

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Key points to remember:

- Submit all work in its final form.
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Final Points:

A purpose of organizing a research paper is to let people to interpret your effort selectively. The journal requires the following sections, submitted in the order listed, each section to start on a new page.

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- Separating a table/chart or figure - impound each figure/table to a single page
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· Use paragraphs to split each significant point (excluding for the abstract)

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· Present your points in sound order

· Use present tense to report well accepted

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- Significant conclusions or questions that track from the research(es)

Approach:

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The page length of this segment is set by the sum and types of data to be reported. Carry on to be to the point, by means of statistics and tables, if suitable, to present consequences most efficiently.You must obviously differentiate material that would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matter should not be submitted at all except requested by the instructor.

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- Sum up your conclusion in text and demonstrate them, if suitable, with figures and tables.
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- Present a background, such as by describing the question that was addressed by creation an exacting study.
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- As forever, use past tense when you submit to your results, and put the whole thing in a reasonable order.
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- Give details all of your remarks as much as possible, focus on mechanisms.
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- One research will not counter an overall question, so maintain the large picture in mind, where do you go next? The best studies unlock new avenues of study. What questions remain?
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Abstract	Clear and concise with appropriate content, Correct format. 200 words or below	Unclear summary and no specific data, Incorrect form Above 200 words	No specific data with ambiguous information Above 250 words
Introduction	Containing all background details with clear goal and appropriate details, flow specification, no grammar and spelling mistake, well organized sentence and paragraph, reference cited	Unclear and confusing data, appropriate format, grammar and spelling errors with unorganized matter	Out of place depth and content, hazy format
Methods and Procedures	Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads	Difficult to comprehend with embarrassed text, too much explanation but completed	Incorrect and unorganized structure with hazy meaning
Result	Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake	Complete and embarrassed text, difficult to comprehend	Irregular format with wrong facts and figures
Discussion	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

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